PHYSIK DER HADRONEN UND KERNE (HK)

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Zusammen mit dem Fachverband Teilchenphysik veranstalten wir das Symposium 'Dark Matter and Dark Energy' am Samstag um 10:30 im Hörsaal TU H105

Zusammen mit den Fachveränden Atomphysik und Massenspektrometrie veranstalten wir das Symposium 'Atomare Präzisionsmassenspektrometrie' am Montag um 10:00 im HUB Senatssaal

ÜBERSICHT DER HAUPTVORTRÄGE UND FACHSITZUNGEN

(Hörsäle TU MA001, MA004, MA005, MA041, MA042, MA144)

Begrüßung

HK 1.1	Fr	10:15	(TU MA001)	Kay Königsmann

Hauptvorträge

HK 1.2	Fr	10:25	(TU MA001)	**CP-Verletzung im B-System**, Helmut Marsiske
HK 1.3	Fr	10:55	(TU MA001)	**The COMPASS Experiment at CERN**, Joerg Pretz, COMPASS - Kollaboration
HK 1.4	Fr	11:25	(TU MA001)	**Messungen der elektromagnetischen Formfaktoren der Nukleonen am Jefferson Lab**, Bodo Reitz
HK 1.5	Fr	11:55	(TU MA001)	**Laserspektroskopische Bestimmung der Ladungsradien leichter Kerne**, Wilfried Nörtershäuser
HK 14.1	Sa	08:30	(TU MA001)	**Hyperkerne: Gestern und Morgen**, Bogdan Povh
HK 14.2	Sa	09:00	(TU MA001)	**Heavy-Ion Atom Collisions – Atomic Physics under Extreme Condidtions**, Andrzej Warczak
HK 14.3	Sa	09:30	(TU MA001)	**Upcoming Hadron Physics Projects with Internal Targets - from WASA at COSY to PANDA at FAIR**, James Ritman
HK 15.1	Mo	10:15	(TU MA001)	**Meson Production and Decay Studies at CELSIUS-WASA***, H. Clement, CELSIUS-WASA - Kollaboration
HK 15.2	Mo	10:45	(TU MA001)	**First Results from the CERN Axion Solar Telescope**, F. H. Heinsius, CAST - Kollaboration
HK 15.3	Mo	11:15	(TU MA001)	**Exploring the QCD phase diagram**, Christoph Blume, NA49 - Kollaboration
HK 15.4	Mo	11:45	(TU MA001)	**Exploring the *"Island of Inversion"*: Coulomb excitation of ^{30}Mg and ^{32}Mg with MINIBALL at REX-ISOLDE**, Heiko Scheit, REX-MINIBALL - Kollaboration
HK 23.1	Di	10:15	(TU MA001)	**Investigation of triple shape coexistence in ^{188,186}Pb using transition probabilities**, A. Dewald, O. Möller, B. Melon, B. Saha, K.O. Zell, T. Pissulla, S. Christen, J. Jolie, T. Grahn, P. Greenlees, S. Eeckhaudt, P. Jones, R. Julin, M. Leino, J. Pakarinen, P. Rahkila, C. Scholey, J. Uusitalo, P. Petkov, R. Krücken, T. Kröll, P. Maierbeck, C.W. Beausang, D.A. Meyer, W. Korten, A. Görgen, Y.Le Coz
HK 23.2	Di	10:45	(TU MA001)	**Exploring the Driplines: First Observation of ^{60}Ge and ^{64}Se**, Andreas Stolz
HK 23.3	Di	11:15	(TU MA001)	**Feinstruktur von Riesenresonanzen, Waveletanalyse und Skalen***, A. Shevchenko, T. Adachi, J. Carter, R.W. Fearick, S.V. Förtsch, H. Fujita, Y. Fujita, Y. Kalmykov, K. Langanke, G. Martínez-Pinedo, P. von Neumann-Cosel, V.Yu. Ponomarev, A. Richter, Y. Shimbara, F.D. Smit, J. Wambach
HK 23.4	Di	11:45	(TU MA001)	**Präzisions-Studien von relativistischen nuklearen Stößen**, Karl-Heinz Schmidt, CHARMS - Kollaboration

HK 36.1	Mi	10:15	(TU MA001)	**Recent progress in effective field theory** , Stefan Scherer
HK 36.2	Mi	10:45	(TU MA001)	**Effektive Feldtheorie und die Schnittstelle zur Gitter QCD**, Thomas Hemmert
HK 36.3	Mi	11:15	(TU MA001)	**Present understanding of single spin asymmetries**, Andreas Metz
HK 36.4	Mi	11:45	(TU MA001)	**Kovariante ab initio Theorie für Kerne und Hyperkerne**, Horst Lenske, Christoph Keil, Patrick Konrad, Nadia Tsoneva

Fachsitzungen

HK 1	**Hauptvorträge**	Fr	10:15–12:25	TU MA001	HK 1.1–1.5
HK 2	**Elektromagnetische und Hadronische Proben**	Fr	14:00–16:00	TU MA001	HK 2.1–2.7
HK 3	**Kernphysik/Spektroskopie**	Fr	14:00–16:00	TU MA004	HK 3.1–3.7
HK 4	**Physik mit schweren Ionen**	Fr	14:00–16:00	TU MA041	HK 4.1–4.5
HK 5	**Theorie**	Fr	14:00–16:00	TU MA005	HK 5.1–5.8
HK 6	**Kern- und Teilchen-Astrophysik**	Fr	14:00–16:00	TU MA144	HK 6.1–6.7
HK 7	**Instrumentation und Anwendungen**	Fr	14:00–16:00	TU MA042	HK 7.1–7.6
HK 8	**Elektromagnetische und Hadronische Proben**	Fr	16:30–19:00	TU MA001	HK 8.1–8.10
HK 9	**Elektromagnetische und Hadronische Proben**	Fr	16:30–19:00	TU MA004	HK 9.1–9.9
HK 10	**Kernphysik/Spektroskopie**	Fr	16:30–19:00	TU MA005	HK 10.1–10.8
HK 11	**Physik mit schweren Ionen**	Fr	16:30–19:00	TU MA042	HK 11.1–11.7
HK 12	**Theorie**	Fr	16:30–19:00	TU MA041	HK 12.1–12.9
HK 13	**Kern- und Teilchen-Astrophysik**	Fr	16:30–19:00	TU MA144	HK 13.1–13.8
HK 14	**Hauptvorträge**	Sa	08:30–10:00	TU MA001	HK 14.1–14.3
HK 15	**Hauptvorträge**	Mo	10:15–12:15	TU MA001	HK 15.1–15.4
HK 16	**Elektromagnetische und Hadronische Proben**	Mo	14:00–16:00	TU MA001	HK 16.1–16.8
HK 17	**Kernphysik/Spektroskopie**	Mo	14:00–16:00	TU MA004	HK 17.1–17.7
HK 18	**Physik mit schweren Ionen**	Mo	14:00–16:00	TU MA041	HK 18.1–18.5
HK 19	**Theorie**	Mo	14:00–16:00	TU MA005	HK 19.1–19.6
HK 20	**Kern- und Teilchen-Astrophysik**	Mo	14:00–16:00	TU MA144	HK 20.1–20.8
HK 21	**Instrumentation und Anwendungen**	Mo	14:00–16:00	TU MA042	HK 21.1–21.7
HK 22	**Postersitzung**	Mo	16:30–18:00	TU MA141	HK 22.1–22.99
HK 23	**Hauptvorträge**	Di	10:15–12:15	TU MA001	HK 23.1–23.4
HK 24	**Elektromagnetische und Hadronische Proben**	Di	14:00–16:00	TU MA001	HK 24.1–24.7
HK 25	**Physik mit schweren Ionen**	Di	14:00–16:00	TU MA144	HK 25.1–25.7
HK 26	**Theorie**	Di	14:00–16:00	TU MA004	HK 26.1–26.6
HK 27	**Theorie**	Di	14:00–16:00	TU MA005	HK 27.1–27.8
HK 28	**Instrumentation und Anwendungen**	Di	14:00–16:00	TU MA041	HK 28.1–28.6
HK 29	**Instrumentation und Anwendungen**	Di	14:00–16:00	TU MA042	HK 29.1–29.8
HK 30	**Elektromagnetische und Hadronische Proben**	Di	16:30–19:00	TU MA001	HK 30.1–30.9
HK 31	**Elektromagnetische und Hadronische Proben**	Di	16:30–19:00	TU MA004	HK 31.1–31.10
HK 32	**Kernphysik/Spektroskopie**	Di	16:30–19:00	TU MA005	HK 32.1–32.8
HK 33	**Kernphysik/Spektroskopie**	Di	16:30–18:45	TU MA041	HK 33.1–33.7
HK 34	**Theorie**	Di	16:30–19:00	TU MA042	HK 34.1–34.10
HK 35	**Instrumentation und Anwendungen**	Di	16:30–19:00	TU MA144	HK 35.1–35.7
HK 36	**Hauptvorträge**	Mi	10:15–12:15	TU MA001	HK 36.1–36.4
HK 37	**Elektromagnetische und Hadronische Proben**	Mi	14:00–16:00	TU MA001	HK 37.1–37.8
HK 38	**Kernphysik/Spektroskopie**	Mi	14:00–16:00	TU MA004	HK 38.1–38.7
HK 39	**Physik mit schweren Ionen**	Mi	14:00–16:00	TU MA144	HK 39.1–39.7
HK 40	**Theorie**	Mi	14:00–16:00	TU MA005	HK 40.1–40.7
HK 41	**Instrumentation und Anwendungen**	Mi	14:00–16:00	TU MA041	HK 41.1–41.8
HK 42	**Instrumentation und Anwendungen**	Mi	14:00–16:00	TU MA042	HK 42.1–42.7

Mitgliederversammlung des Fachverbands Physik der Hadronen und Kerne

Sa 14:30–16:30 TU MA001

Öffentliche Sitzung des Komitees für Hadronen und Kerne
anschliessend
Öffentliche Sitzung des DPG-Fachverbandes Hadronen und Kerne

Fachsitzungen

– Hauptvorträge, Gruppenberichte, Kurzvorträge und Posterbeiträge –

HK 1 Hauptvorträge

Zeit: Freitag 10:15–12:25 Raum: TU MA001

Begrüßung HK 1.1 Fr 10:15 TU MA001

Begrüßung — •Kay Königsmann — Physikalisches Institut Freiburg

Hauptvortrag HK 1.2 Fr 10:25 TU MA001

CP-Verletzung im B-System — •Helmut Marsiske — Stanford Linear Accelerator Center, MS 95, 2575 Sand Hill Road, Menlo Park, CA 94025

Die praezise Messung einer Vielzahl von CP-verletzenden Effekten im B-System ist das Hauptprogramm der BABAR und Belle Experimente an den B-Fabriken PEP-II und KEK-B. Ziel ist ein umfassender Test des Kobayashi-Maskawa Mechanismus' der CP-Verletzung im Standard Model (SM). Ein wichtiger Teil dieses Programms ist die Messung der Winkel alpha, beta und gamma im Unitaritaets-Dreieck. Diese Winkel sind Funktionen der CP-verletzenden Phase in der Cabibbo-Kobayashi- Maskawa Matrix; sie lassen sich u.a. bestimmen aus zeitabhaengigen Asymmetrie-Messungen in der Interferenz von neutralen B-Meson Zerfaellen mit und ohne vorhergehende Teilchen-Antiteilchen Oszillation. Mit dieser Methode gelang BABAR und Belle mit der Messung des Winkels beta im Jahr 2001 erstmals der Nachweis der CP-Verletzung ausserhalb des Kaon-Systems. Der in Endzustaenden mit charmonium gemessene Wert von beta war und ist, auch mit jetzt stark verbesserter Praezision, in sehr guter Uebereinstimmung mit der SM-Erwartung abgeleitet aus einer Vielzahl von anderen Messungen. Dank der enorm angestiegenen Datenmengen ist das Programm der Experimente jetzt dahingehend fortgeschritten, beta sowohl in tree- als auch in seltenen penguin-Prozessen zu messen. Dabei finden sich Hinweise auf moeglichen Diskrepanzen. Desweiteren werden die ersten Messungen des Winkels alpha moeglich, und es lassen sich Strategien fuer eine gamma-Messung entwickeln.

Hauptvortrag HK 1.3 Fr 10:55 TU MA001

The COMPASS Experiment at CERN — •Joerg Pretz for the COMPASS collaboration — CERN/PH, CH 1211 Genf 23

COMPASS is a fixed target experiment at CERN studying the spin structure of the nucleon using a polarized muon beam. Hadron spectroscopy and structure is investigated using hadron beams. The main goal of the muon program is the determination of the gluon helicity contribution, $\Delta G/G$, to the nucleon spin. Previous measurements showed that only a surprisingly small fraction (20-30%) of the nucleon spin originates from the quark helicity contribution. The measurement of $\Delta G/G$ will thus help to resolve this so called spin puzzle.

$\Delta G/G$ can be accessed by measuring double spin asymmetries of various hadronic final states produced in deep inelastic reactions on a longitudinally polarized nucleon target. COMPASS measures asymmetries of hadrons with large transverse momentum and of charmed mesons. In parallel other physics topics like the measurement of polarized quark distributions and the spin transfer of Λs are studied. Part of the running time was dedicated to the measurement of transverse quark distributions which demands a transversely polarized target.

COMPASS is taking data since 2002 with a muon beam. At the end of the 2004 data taking period a first hadron beam pilot run was performed. Recent results will be presented.

Hauptvortrag HK 1.4 Fr 11:25 TU MA001

Messungen der elektromagnetischen Formfaktoren der Nukleonen am Jefferson Lab — •Bodo Reitz — Jefferson Lab, 12000 Jefferson Avenue, Newport News NA 23606, USA

Die Messung der elektromagnetischen Formfaktoren von Protonen und Neutronen erlaubt einen grundlegenden Einblick in die interne Struktur der Nukleonen. Das Verhältnis von elektrischem zu magnetischem Formfaktor des Protons, G_{Ep}/G_{Mp}, wurde in zwei Experimenten am JLab für Impulsüberträge von 0.5 bis 5.6 GeV/c^2 mittels Messung der Rückstoßpolarisation der Protonen in der Reaktion $\mathrm{H}(\vec{e}, e'\vec{p})$ bestimmt. In einem weiteren Experiment wurde G_{Ep} direkt in der Reaktion $\mathrm{H}(e, p)$ mit einer Variante der Rosenbluth Methode untersucht. Der elektrische Formfaktor des Neutrons G_{En} wurde in den Reaktionen $^2\mathrm{H}(\vec{e}, e'\vec{n})$ und $^2\vec{\mathrm{H}}(\vec{e}, e'n)$ fuer Impulsübertrage zwischen 0.5 und 1.5 GeV/c^2 gemessen. In diesem Vortrag sollen die Ergebnisse dieser Experimente zusammengefasst und mit aktuellen Modellrechnungen verglichen werden. Weiter werden drei sich im Aufbau befindende JLab Experimente vorgestellt, die G_{Ep} und G_{En} in kinematischen Regionen messen, die bisher fuer präzise Experiement unzugänglich waren. Die Möglichkeiten, die der geplante Ausbau des JLabs in Hinblick auf diese Experimente bietet, werden diskutiert.

Hauptvortrag HK 1.5 Fr 11:55 TU MA001

Laserspektroskopische Bestimmung der Ladungsradien leichter Kerne — •Wilfried Nörtershäuser — GSI Darmstadt — Universität Tübingen

Die laserspektroskopische Messung der Isotopieverschiebung bietet einen kernmodellunabhängigen Zugang zu den mittleren quadratischen Ladungsradien der Atomkerne. Dies wurde seit Jahrzehnten genutzt um die Ladungsradien stabiler und kurzlebiger Kerne zu bestimmen. Der für den Ladungsradius relevante Teil der Isotopieverschiebung wird mit abnehmender Kernladung immer kleiner, der Masseneffekt jedoch immer größer, und somit wird eine Extraktion der Ladungsradien bei den leichten Elementen sehr schwierig. Ermöglicht wird er nur durch die Kombination einer präzisen Messung der Isotopieverschiebung und genauen atomphysikalischen Berechnungen des Masseneffektes. Nach einem Überblick wird auf die jüngsten Entwicklungen auf diesem Gebiet eingegangen, mit denen erstmalig eine Bestimmung der Ladungsradien kurzlebiger leichter Isotope ($Z \leq 3$, $A \leq 11$) gelang. Der Schwerpunkt liegt dabei auf der Bestimmung der Isotopieverschiebung aller Lithiumisotope. Hier ist die Änderung des Ladungsradius zwischen ^{9}Li und dem Halokern ^{11}Li von besonderem Interesse, denn diese Messung erlaubt Rückschlüsse auf die Wechselwirkung zwischen den Halo-Neutronen und dem Core.

HK 2 Elektromagnetische und Hadronische Proben

Zeit: Freitag 14:00–16:00 Raum: TU MA001

Gruppenbericht HK 2.1 Fr 14:00 TU MA001

Messung des Wirkungsquerschnitts $\sigma(e^+e^- \to \pi^+\pi^-)$ mit dem KLOE-Detektor in Frascati — •Stefan E. Müller für die KLOE-Kollaboration — Institut für Exp. Kernphysik, Universität Karlsruhe, Postfach 3640, 76021 Karlsruhe

Das KLOE-Experiment am DAΦNE-Speicherring in Frascati ist seit 1999 in Betrieb. Obwohl in erster Linie für Physik mit neutralen und geladenen Kaonen konzipiert, eignet sich der KLOE-Detektor auch zur Untersuchung von Fragen außerhalb der Kaonphysik. Von besonderem Interesse ist hierbei die präzise Vermessung des Wirkungsquerschnitts für den Prozess $e^+e^- \to \pi^+\pi^-$ im Energiebereich unterhalb von 1 GeV. Die Bestimmung dieses Wirkungsquerschnitts trägt zur Verringerung der Unsicherheit in der theoretischen Berechnung des hadronischen Beitrags zur Anomalie des magnetischen Moments des Myons bei. Da DAΦNE bei einer festen Schwerpunktsenergie von 1.02 GeV arbeitet, werden Ereignisse selektiert, bei denen entweder vom e^+ oder vom e^- ein hartes Photon abgestrahlt wird, wodurch die Kollisionsenergie herabgesetzt wird. In Abhängigkeit von der Energie des abgestrahlten Photons kann so der gesamte Bereich unterhalb von 1 GeV überdeckt werden.

Es werden die Meßmethode und das Resultat für die Bestimmung des

Wirkungsquerschnitts im Energiebereich von $0.35 - 0.95$ GeV^2 gezeigt sowie laufende und zukünftige Analysen vorgestellt, die einer weiteren Verringerung des systematischen Fehlers und der Vermessung des Energiebereichs unterhalb von 0.35 GeV^2 dienen.

HK 2.2 Fr 14:30 TU MA001

Kaonic hydrogen and K^-p scattering — •B. Borasoy[1], R. Nissler[1], and W. Weise[2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn, Germany — [2]Physik Department, Technische Universität München, Germany

We present a novel analysis of K^-p scattering data and the strong interaction shift and width in kaonic hydrogen in view of the new accurate DEAR measurements [1] by employing a relativistic chiral SU(3) approach of effective field theory with coupled channels [2]. Questions of consistency between the various data sets are examined and the importance of the constraints set by the precise DEAR experiment is emphasized. Coulomb and isospin breaking effects turn out to be important and are both taken into account.

Financial support of the DFG and BMBF is gratefully acknowledged.

[1] M. Cargnelli et al. (DEAR collaboration), Proceedings of "8th International Workshop on Meson Production, Properties and Interaction (MESON 2004)", Kraków, Poland, June 2004.

[2] B. Borasoy, R. Nißler and W. Weise, hep-ph/0410305.

HK 2.3 Fr 14:45 TU MA001

Pentaquarksuche und D_{sJ}–Studien bei BABAR — •Klaus Götzen für die BABAR-Kollaboration — Ruhr–Universität Bochum, Institut für Experimentalphysik I, Universitätsstr. 150, 44780 Bochum

Der am asymmetrischen e^+e^-–Speicherring des Stanford Linear Accelerator Center befindliche BaBar–Detektor hat seit Beginn des Experiments eine der integrierten Luminosität von 240/fb entsprechenden Datenmenge aufgezeichnet. Diese sehr große Zahl von hadronischen Ereignissen ist hervorragend dazu geeignet, dem Puzzle der kontrovers diskutierten möglichen Existenz von exotischen Pentaquarkzuständen ein weiteres Stück hinzuzufügen. Präsentiert werden die Ergebnisse der inklusiven Suche nach Strange–haltigen Pentaquark–Kandidaten wie dem $\Theta(1540)^+$, dem $\Phi(1860)$ und weiteren. Darüberhinaus werden die Ergebnisse aktueller Studien zu den erstmalig bei BaBar beobachteten mesonischen Zuständen $D^*_{sJ}(2317)^\pm$ und $D_{sJ}(2460)^\pm$ vorgestellt.

Gefördert durch das bmb+f (Förderkennzeichen 06BO9041).

HK 2.4 Fr 15:00 TU MA001

Untersuchung des $D_{s1}(2536)^\pm$ — •Torsten Schröder für die BABAR (Deutschland)-Kollaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum, Universitätsstr. 150, 44780 Bochum

Im Rahmen des BaBar-Experiments wurde seit der Inbetriebnahme im Jahre 1999 ein Datensatz entsprechend einer integrierten Luminosität von mehr als 242 fb^{-1} aufgenommen. Die hohe Luminosität in Verbindung mit den exzellenten Instrumenten des BaBar-Detektors zur Spurrekonstruktion und Teilchenidentifizierung bietet hervorragende Voraussetzungen für die Mesonenspektroskopie, besonders im Bereich der Charm-Physik.

Für ein umfassendes Verständnis des D_s-Sektors ist eine genaue Kenntnis der Parameter aller bekannten D_s-Zustände notwendig. Es wird die Untersuchung des Zerfalls $D_{s1}(2536)^\pm \to D^{*\pm}K^0_s$ präsentiert, anhand dessen die Bestimmung der Masse und der Zerfallsbreite des $D^\pm_{s1}$ mit geringen statistischen Fehlern möglich ist.

Gefördert durch das bmb+f (06BO9041).

HK 2.5 Fr 15:15 TU MA001

Existenz oder Nicht-Existenz von Exotica — •Johann Haidenbauer[1], Alexander Sibirtsev[1], Siegfried Krewald[1] und Ulf-G. Meissner[1,2] — [1]Forschungszentrum Jülich, IKP, 52425 Jülich — [2]ISK, Universität Bonn, 53115 Bonn

Wir untersuchen die Evidenz für das $\Theta^+(1540)$ Pentaquark anhand zweier Reaktionen und zwar $K^+d \to K^0pp$ und $K^+Xe \to K^0pX$. Ausgangspunkt der mikroskopischen Modellrechnung ist das Jülicher Mesonaustauschmodell der KN Wechselwirkung.

Für die Reaktion $K^+d \to K^0pp$ gibt es experimentelle Informationen über differentielle und integrierte Wirkungsquerschnitte im relevanten Energiebereich. Unsere Rechnungen zeigen, daß die existierenden Daten ein Pentaquark mit einer Breite von mehr als 1 MeV ausschließen [1].

Im Falle der Reaktion $K^+Xe \to K^0pX$ stellt sich heraus, daß die Daten der DIANA Kollaboration [2] mit einem $\Theta^+(1540)$ mit einer Breite von 1 MeV gut beschrieben werden können [3]. Eine vergleichbar gute Beschreibung liefert aber auch eine Modellrechnung ohne Berücksichtigung der $\Theta^+(1540)$ Resonanz.

Wir berichten auch über eine Modellrechnung zur Reaktion $J/\Psi \to \gamma p\bar{p}$, wo die BES Kollaboration im $p\bar{p}$ Massenspektrum Hinweise auf eine exotische schmale Resonanz in der Schwellennähe gefunden hat [4].

[1] A. Sibirtsev et al., Phys. Lett. **B 599**, 230 (2004).
[2] V.V. Barmin et al., Phys. Atom. Nucl. **66**, 1715 (2003).
[3] A. Sibirtsev et al., `hep-ph/0407011`; Eur. Phys. J. **A**, in print.
[4] J.Z. Bai et al., Phys. Rev. Lett. **91**, 022001 (2003).

HK 2.6 Fr 15:30 TU MA001

Der PANDA Detektor — •Bernd Lewandowski für die Panda-Kollaboration — Ruhr-Universität Bochum, Institut f. Experimentalphysik I

Eine wesentliche Komponente des FAIR (Facility for Antiproton and Ion Research) Projekts an der GSI in Darmstadt ist der High Energy Storage Ring (HESR) für hochintensive gekühlte Antiprotonen mit Impulsen bis zu 15 GeV/c. Für diese Anlage ist ein weitgefächertes Physikprogramm zur Untersuchung sowohl der Struktur der Hadronen im Massenbereich des Charmoniums als auch der Spektroskopie von Doppelhyperkernen geplant. Dieses Physikprogramm erfordert ein modulares Detektorkonzept. Zu diesem Zweck wird der PANDA (Antiproton Annihilations at Darmstadt) Detektor entwickelt. Konzept und Design, sowie der Status von Forschung und Entwicklung für die einzelnen Detektorsysteme, werden präsentiert. gefördert von bmb+f (06BO105)

HK 2.7 Fr 15:45 TU MA001

Spin Physics with Polarized Antiprotons at HESR (FAIR-GSI) — •Erhard Steffens[1], Paolo Lenisa[2], Frank Rathmann[3], Paola Ferretti-Dalpiaz[2], Marco Contalbrigo[2], Andro Kacharava[1,3], Davide Reggiani[1], and Sergey Yaschenko[1,3] for the PAX collaboration — [1]Physik. Inst., Univ. Erlangen-Nürnberg — [2]Univ. of Ferrara and INFN — [3]Inst. für Kernphysik, FZ Jülich

A proposal to add an antiproton polarizer ring (APR) to the FAIR facility is being prepared by the PAX Collaboration [1]. It consists of a low-energy storage ring with electron cooling and internal polarized hydrogen gas target with high electron polarization. Recent calculations have shown that by 'Spin Filtering' at energies of 40-100MeV surprisingly high polarization degrees for antiprotons in the order of 0.2-0.4 can be achieved [2] which surpasses by more than one order of magnitude the result of a previous test experiment with protons [3]. The new method is based on spin-exchange of the target electrons to the circulating antiprotons which is purely electro-magnetic and calculable [4]. The beam from the APR will be transfered to the high energy storage ring HESR and accelerated to the final energy of 15GeV or more. The physics case comprises the first direct measurement of the transversity h1 in Drell-Yan [5]. The present status of the lay-out of the experiment and the detector concept will be presented.

[1] http://www.fz-juelich.de/ikp/pax [2] F. Rathmann et al, submitted to PRL; eprint: physics/0410067 [3] F. Rathmann et al, PRL 71, 1379 (1993) [4] C.J. Horowitz and H.O. Meyer, PRL 72, 3981 (1994) [5] M. Anselmino et al, Phys. Lett. B594, 97 (2004), eprint: hep-ph/0403114

HK 3 Kernphysik/Spektroskopie

Zeit: Freitag 14:00–16:00 Raum: TU MA004

Gruppenbericht

HK 3.1 Fr 14:00 TU MA004

Observation of soft and giant dipole modes in ^{132}Sn and neighboring unstable nuclei — •Adam Klimkiewicz for the LAND-FRS collaboration — GSI, Darmstadt, Germany

Secondary beams of unstable neutron-rich $^{129-132}$Sn, $^{132-135}$Sb and ^{136,137}Te isotopes (∼500 MeV/u) were produced by in-flight fission of a primary ^{238}U beam at GSI, Darmstadt. Dipole strength distributions ranging from the neutron threshold up to 30 MeV excitation energy were derived from the measured electromagnetic excitation cross sections in a Pb target using the LAND setup at the fragment separator FRS.

The data reveal the giant dipole resonance structure. In addition, in some of the isotopes, clear evidence for a resonant-like, relatively narrow structure at lower excitation energy is obtained. In ^{132}Sn this low-lying resonance is centered at 10 MeV and comprises 4(2) % of the TRK sum rule. The systematics of the parameters of low-lying and giant dipole resonances will be presented. The low-lying resonance will be discussed with regard to soft dipole modes expected to arise from a neutron skin vibration against the nucleus core, see also earlier photoabsorption measurements on stable N=82 nuclei [1]. The data are compared to (Q)RPA calculations [2,3] and the impact on r-process nucleosynthesis calculations is briefly addressed [4].

Work supported by BMBF and GSI.

[1] A.Zilges et al., Phys. Lett. B**542** (2002) 43-48
[2] D.Sarchi et al., Phys. Lett. B**601** (2004) 27-33
[3] D.Vretenar et al., Nucl. Phys. A**692** (2001) 496-517
[4] S.Goriely, Phys. Lett. B**436** (1998) 10-18

HK 3.2 Fr 14:30 TU MA004

Test of the critical point symmetry X(5) in the A=180 mass region — •O. Möller[1], A. Dewald[1], B. Melon[1], P. Petkov[1,2], A. Fitzler[1], K. Jessen[1], J. Jolie[1], C. Ur[3], M. Axiotis[3], and C. Rusu[3] — [1]Institut für Kernphysik, Universität zu Köln, Deutschland — [2]Institute for Nuclear Research and Nuclear Energy, Sofia, Bulgaria — [3]INFN, Laboratori Nazionali di Legnaro, Legnaro, Italy

The investigation of nuclear phase transition phenomena is one of the new and very challenging topics in nuclear structure physics.
Recently N=90 nuclei became of special interest as testing ground for the new dynamic symmetry at the critical point of shape phase transition from axially deformed to spherical nuclei, called X(5) [1]. Based on the energy spectra and relative transition probabilities the even $^{176-180}$Os nuclei can be considered to be very promising X(5) candidates in a new mass region. In order to perform stringent tests for these Os nuclei, experimental data on absolute transition probabilities are needed. Therefore we performed different experiments: We measured lifetimes of the 2_1^+-states at the Köln FN-Tandem facility using the electronic timing technique. Lifetimes of higher lying states in ^{178}Os were measured in a RDDS coincidence experiment with the GASP spectrometer and the Köln plunger device. The excellent agreement of our present results with the X(5) predictions encouraged us to continue this project, further experiments on this topic are scheduled.

[1] F. Iachello, Phys. Rev. Lett. 87, 52502 (2001)

Supported by the BMBF project no. 06K-167 and under the EU Programme contract no.HPRI–CT-1999-00083.

HK 3.3 Fr 14:45 TU MA004

Untersuchung gemischtsymmetrischer Zustände in ^{94}Mo mit hochauflösender Elektronen- und Protonenstreuung* — •M. Kuhar[1], O. Burda[1], N. Botha[2], J. Carter[3], R.W. Fearick[2], S.V. Förtsch[4], C. Fransen[5], H. Fujita[3], A. Lenhardt[1], P. von Neumann-Cosel[1], R. Neveling[4], N. Pietralla[6], V.Yu. Ponomarev[1], A. Richter[1], E. Sideras-Haddad[3], R. Smit[4] und J. Wambach[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Physics Department, University of Cape Town — [3]School of Physics, University of the Witwatersrand — [4]iThemba LABS, Somerset West — [5]Institut für Kernphysik, Universität zu Köln — [6]Department of Physics and Astronomy, State University of New York, Stony Brook

Der Kern ^{94}Mo ist ein besonders gut untersuchtes Beispiel für die Existenz von Ein- und Zweiphononzuständen gemischter Symmetrie [1,2]. Als experimentelle Signaturen dienen Auswahlregeln für den Gammazerfall in symmetrische Zustände sowie zwischen Zuständen mit Ein- und Zweiphononcharakter. Komplementäre Experimente mit hochauflösender ($\Delta E \approx 30-35$ keV FWHM) Elektronenstreuung am S-DALINAC ($E_0 \simeq 70$ MeV, $\Theta = 93° - 165°$) und Protonenstreuung am iThemba LABS ($E_0 = 200$ MeV, $\Theta = 4.5° - 26°$) erlauben einen Test der Reinheit gemischtsysmmetrischer Zustände. Erste Resultate werden im Rahmen von QPM- und Schalenmodellrechnungen diskutiert.

[1] N. Pietralla et al., Phys. Rev. Lett. 83, 1303 (1999); 84, 3775 (2000)
[2] C. Fransen et al., Phys. Lett. B 508, 219 (2001); Phys. Rev. C 67, 024307 (2003)

*Gefördert durch die DFG unter SFB 634 und 445 SUA 113/6/0-1.

HK 3.4 Fr 15:00 TU MA004

Oktupol Korrelationen in der Region $N \sim 88$* — •M. Babilon[1,2], N. V. Zamfir[2], D. Kusnezov[3], E. A. McCutchan[2], L. Kern[1] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt — [2]Wright Nuclear Structure Laboratory, Yale University, New Haven, USA — [3]Sloane Physics Laboratory, Yale University, New Haven, USA

Mikroskopische Modelle sagen das Auftreten von starken Oktupol-Korrelationen in Kernen der Region $N \sim 88$ voraus. Experimentelle Daten der Isotope $^{148-154}$Sm erlauben die systematische Untersuchung möglicher Signaturen solcher Korrelationen im Rahmen des *spdf*-Interacting Boson Approximation Modells (IBA). Eigenschaften niedrig liegender Zustände können beschrieben werden, wenn man an einen einfachen Hamiltonian mit positiver Parität ein Boson mit negativer Parität koppelt [1,2]. Um Eigenschaften von Zuständen mit höherem Spin zu beschreiben, ist jedoch die Berücksichtigung mehrerer Bosonen negativer Parität nötig. Um die Studien zu erweitern, wurden am Tandem-Beschleuniger des WNSL der Yale University zwei Experimente zum Zerfallsverhalten des Kerns ^{152}Gd durchgeführt. Ergebnisse dieser Experimente werden vorgestellt und mit *spdf*-IBA Rechnungen verglichen.

*Gefördert durch die DFG (SFB 634) und das USDOE unter Fördernummer DE-FG02-91ER-40609.

[1] D. Kusnezov und F. Iachello, Phys. Lett. B **209**, 420 (1988).
[2] N. V. Zamfir und D. Kusnezov, Phys. Rev. C **67**,014305 (2003).

HK 3.5 Fr 15:15 TU MA004

Structure of the 2_1^+ state in radioactive ^{68}Ge from g factor and lifetime measurements$^+$ — •J. Leske[1], K.-H. Speidel[1], S. Schielke[1], O. Kenn[1], J. Gerber[2], P. Maier-Komor[3], S.J.Q. Robinson[4], Y.Y. Sharon[5], and L. Zamick[5] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Univ. Bonn, Germany — [2]Institut de Recherches Subatomiques, Strasbourg, France — [3]Physik-Dept. TU München, Garching, Germany — [4]Univ. of Southern Indiana, Evansville, Indiana, USA — [5]Rutgers Univ., Piscataway, NJ, USA

The g factor of the 2_1^+ state of radioactive ^{68}Ge ($T_{1/2} = 270$ d) has been measured for the first time. The technique used is based on α transfer from a ^{12}C target to 180 MeV ^{64}Zn projectiles that incorporates the favourable conditions of inverse kinematics as in projectile Coulomb excitation. It also includes the good features of the transient field technique applied to the nuclear spin precessions. In addition, we have remeasured the lifetimes of several excited states using the Doppler-Shift-Attenuation method. All measurements were carried out at the Munich tandem accelerator. The g factor value obtained, $g(2_1^+) = +0.55(14)$, is in good agreement with the collective value, g = Z/A = +0.47, and is also consistent with the precise data of the stable even-A Ge isotopes. The deduced $B(E2)$ values and the g factor have been interpreted in the framework of the spherical shell model assuming a closed ^{56}Ni core and neutron and proton orbitals in the fp shell model space. Among the various effective interactions used the FPD6 interaction without A–scaling yielded surprisingly the best overall agreement with the experimental data.

[+] supported by the BMBF

HK 3.6 Fr 15:30 TU MA004

First g factor measurements on the 2_1^+ states in $^{36,38}Ar$ and their shell model interpretations[+] — •S. Schielke[1], K.-H. Speidel[1], J. Leske[1], J. Gerber[2], P. Maier-Komor[3], S.J.Q. Robinson[4], Y.Y. Sharon[5], and L. Zamick[5] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Univ. Bonn, Germany — [2]Institut de Recherches Subatomiques, Strasbourg, France — [3]Physik-Dept. TU München, Garching, Germany — [4]Univ. of Southern Indiana, Evansville, Indiana, USA — [5]Rutgers Univ., Piscataway, NJ, USA

First measurements of g factors of the 2_1^+ states in $^{36,38}Ar$ have been performed via α transfer reactions in inverse kinematics combined with the technique of transient magnetic fields. In addition, $B(E2)$ values were deduced from newly measured lifetimes using the Doppler-Shift-Attenuation method. These investigations were mainly motivated by the specific features, that for ^{36}Ar with N=Z=18, isospin symmetry effects as well as neutron-proton pairing correlations, and for ^{38}Ar with 20 neutrons, the N=20 shell closure should dominate the nuclear structure. Hence, for these nuclei with the inclusion of similar data for ^{40}Ar, appropriate shell model calculations ought to explain subtle alterations of the structure with neutron number. In the measurements, ^{32}S and ^{34}S beams of the Cologne and Munich tandem accelerators were used as projectiles bombarding a multilayered target with natural carbon for the nuclear reaction. Excellent agreement was achieved between experiment and theory for all Ar isotopes.

[+] supported by the DFG

HK 3.7 Fr 15:45 TU MA004

Dominant neutron component in the $^{68}Zn(4_1^+)$ wave function from g factor measurements[+] — •J. Leske[1], K.-H. Speidel[1], S. Schielke[1], J. Gerber[2], and P. Maier-Komor[3] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Univ. Bonn, Germany — [2]Institut de Recherches Subatomiques, Strasbourg, France — [3]Physik-Dept. TU München, Garching, Germany

The g factor of the 4_1^+ state in ^{68}Zn has been measured for the first time employing projectile Coulomb excitation in inverse kinematics. A multilayered target consisting of thin layers of C/Gd/Ta/Cu was bombarded with a ^{68}Zn beam of 180 MeV provided by the Munich tandem accelerator. The γ rays emitted from the excited states were measured in coincidence with forward scattered carbon ions. Spin precessions occured in the transient field of the magnetized Gd layer. A Si detector was used for detection of the carbon ions whereas the γ rays were detected by pairs of NaI(Tl) scintillators and Ge detectors. The superior energy resolution of the Ge detectors was essential for separating the $(4_1^+ \rightarrow 2_1^+)$ γ line from neighbouring and Doppler-shifted $(2_3^+ \rightarrow 2_1^+)$ 1261 keV line in the forward hemisphere. The negative g factor deduced is a surprise as its sign contradicts large-scale shell model predictions. It can only be understood if $g_{9/2}$ neutrons are a strong component in the nuclear wave function. This result will be discussed in the context of similar measurements in ^{64}Zn for which the g factor of the 4_1^+ state was found to be positive in agreement with the collective as well as shell model predictions.

[+] supported by the DFG

HK 4 Physik mit schweren Ionen

Zeit: Freitag 14:00–16:00 Raum: TU MA041

Gruppenbericht

HK 4.1 Fr 14:00 TU MA041

Kaon and antikaon production at 1-2AGeV at SIS energies[*] — •Mateusz Płoskoń — GSI Darmstadt, Germany

A survey of experimental data on kaon and antikaon production in Au+Au and Ni+Ni collisions at beam energies between 1 and 2AGeV measured by the KaoS collaboration, will be discussed. Investigations featuring the production cross sections, the multiplicities, the inverse slope parameters and the angular distributions of the mesons in comparison with the transport calculations provide interesting information on their production mechanism and the in-medium potentials[1]. The anisotropy of the azimuthal emission pattern of K^+ has been regarded as an evidence for a repulsive kaon-nucleon potential in the nuclear medium[2]. The observation of different azimuthal emission patterns for K^+ and K^- obtained from Ni+Ni at 1.93AGeV[3] as well as the results on the elliptic flow of kaons and antikaons as a function of their transverse momenta obtained with the recent Au+Au at 1.5AGeV measurement will be presented.

[*] Supported by BMBF and GSI

[1] A.Förster, F. Uhlig et al., PRL 91 (2003) 152301
[2] Y.Shin et al., PRL 81 (1998) 1576
[3] F.Uhlig, A.Förster et al., submitted

Gruppenbericht

HK 4.2 Fr 14:30 TU MA041

Production and Flow of Strange Particles in FOPI — •Markus Merschmeyer for the FOPI collaboration — Physikalisches Institut der Universität Heidelberg, Philosophenweg 12, 69120 Heidelberg

Heavy-ion collisions at relativistic energies offer the possibility to study states of hot and compressed nuclear matter. Hadron properties are expected to change within this environment. Prodution yield and phase space distributions of strange particles are two independent tools to probe those in-medium effects. A high-statistics data sample was taken for Ni+Ni at 1.93 AGeV. The 4π production yields and the flow behaviour of reconstructed K^0 and Λ have been studied. Detailed comparisons to microscopic model calculations have been performed. The talk will present results of the analysis of neutral strange particles. Furthermore, the status of the search for double-strange baryons and kaonic clusters is reported.

Supported by BMBF (06HD154) and GSI (HD-HER).

HK 4.3 Fr 15:00 TU MA041

Strangeness production in π-induced reactions with the FOPI detector. — •Mohamed Lotfi Benabderrahmane for the FOPI collaboration — Physikalisches Institut der Universität Heidelberg, Philosophenweg 12, 69210 Heidelberg

Studies of strangeness production and in-medium modifications of hadrons are one of the major goals of modern nuclear physics. In-medium modifications at densities up to 2-3 ρ_0 have been studied in heavy-ion collisions. The concept of density dependent in-medium masses, can be cross-checked at normal nuclear matter density by using π-induced reactions. In August 2004, the FOPI collaboration performed an experiment bombarding targets of Carbon, Aluminum, Copper, Tin and Lead with π^- of 1.15 GeV/c momentum. First results are the inclusive K^0 and Λ production cross sections and their phase space distributions which will be reported.

Supported by BMBF(06HD154) and GSI (HD-HER).

Gruppenbericht

HK 4.4 Fr 15:15 TU MA041

Determination of the Isoscalar and Isovector Equation-of-State in Heavy Ion Collisions* — •H.H. Wolter[1], T. Gaitanos[2], Ch. Fuchs[3], M. Colonna[2], M. Di Toro[2], and R.A. Ionescu[1,4] — [1]Dept. Physik, Univ. of Munich — [2]LNS, INFN, Catania — [3]Inst. Theor. Physik, Univ. of Tübingen — [4]NIPNE, Bucharest

A primary goal of heavy ion collisions at Fermi to relativistic energies has been the determination of hadronic equation-of-state (Eos) as a function of density, temperature, isospin or other flavors. In particular the isovector part has been of much interest recently because of the relevance for the structure of exotic nuclei and astrophysical systems, in particular neutron stars. Rather than test phenomenological Eos's we have extensively investigated fields from relativistic, microscopic theories (Dirac-Brueckner) and recently also consistently the corresponding in-medium crosss sections. We find that generally flow data are reasonably well described, provided non-equilibrium effects in the effective interaction are taken into account. E.g. we are able to describe a recently proposed sensitive measure of the stopping (var_{tl}) as proposed by FOPI. With respect to the density dependence of the isovector part, a crucial question in a relativistic formulation is the existence and importance of an scalar-isovector field. This can be parametrized in terms of a δ-meson, and leads to a stiffer isovector eos. We investigate various differential flow and stopping variables for protons/neutrons as well as for $\pi^\pm$ to find sensitive quantities to the isovector eos.

*supported by the BMBF, grant 06LM189

HK 4.5 Fr 15:45 TU MA041

High resolution Runge-Kutta tracking for kaon reconstruction — •Alexander Sadovsky for the HADES collaboration — Research Center Rossendorf Institute of Nuclear and Hadron Physics PF 51 01 19 D-01314 Dresden Germany

The High Acceptance Di-Electron Spectrometer (HADES), installed at SIS/GSI, Darmstadt, can also be used for studies of hadron production in heavy ion collisions. The investigation of charge kaon production needs high resolution tracking and understanding of the detector performance. The Runge-Kutta tracking algorithm was used to improve the quality of K^+ identification. The status of our K^+ production analysis in C+C reactions at beam energy of 2 AGeV will be presented. A possible extention of the method is to study more complex resonances, where the large phase space coverage of HADES detector plays an important role.

This work is supported by EU, BMBF and GSI.

HK 5 Theorie

Zeit: Freitag 14:00–16:00 Raum: TU MA005

HK 5.1 Fr 14:00 TU MA005

Goldstone boson condensation in the color-flavor locked phase — •Michael Buballa — Institut für Kernphysik, TU Darmstadt

It is generally believed that strongly interacting matter at low temperatures and very high densities is a color superconductor in the color-flavor locked (CFL) phase. The situation is less clear at "moderate" densities which could be relevant, e.g., for the interiors of neutron stars. Based on low-energy effective theories it has been suggested that, as a consequence of the stress posed by the strange quark mass, the CFL phase should eventually become unstable to the formation of pion or kaon condensates. On the other hand, various so-called gapless color-superconducting phases have been found in recent NJL model studies, which, however, neglect the possibility of Goldstone condensates. In this talk we present an NJL-type model which has been extended to include this possibility by allowing for pseudoscalar diquark condensates in addition to the scalar ones which constitute the CFL phase. We show that the results obtained within this model, e.g., the dependence of the free energy in the Goldstone condensed phases on quark masses or charge chemical potentials are in good qualitative – in most cases even quantitative – agreement with the low-energy effective theory approach. The phase structure emerging from this model is discussed.

HK 5.2 Fr 14:15 TU MA005

Density perturbations in heavy ion collisions arround the critical point — •Kerstin Paech and Adrian Dumitru — Institut für Theoretische Physik, JWG Universität Frankfurt am Main

We introduce a model for the real-time evolution of a relativistic fluid of quarks coupled to non-equilibrium dynamics of the long wavelength (classical) modes of the chiral condensate. We solve the equations of motion numerically in 3+1 space-time dimensions. Starting the evolution at high temperature in the symmetric phase, we study dynamical trajectories that either cross the line of first order phase transitions or evolve through its critical endpoint. For those cases, we study the formation of density perturbations.

HK 5.3 Fr 14:30 TU MA005

Baryonische Resonanzen und das QCD-Phasendiagramm in einem chiralen SU(3) Modell — •Gebhard Zeeb, Detlef Zschiesche und Stefan Schramm — Institut für Theoretische Physik, J.W.Goethe-Universität, Robert-Mayer-Str. 10, 60054 Frankfurt am Main

Wir untersuchen das QCD Phasendiagramm eines hadronischen chiralen SU(3)×SU(3) Modells. Es wird der Einfluss unterschiedlicher skalarer bzw. vektorieller Ankopplung der baryonischen Resonanzen sowie verschiedener Varianten der Ankopplung des Dilaton-Feldes (Gluonen-Kondensat) auf das Phasenübergangsverhalten diskutiert. Den Ergebnissen werden auch Phasendiagramme aus Gitter-QCD-Rechnungen gegenübergestellt.

HK 5.4 Fr 14:45 TU MA005

Hadron Resonances on the Lattice — •Christian Hagen, Christof Gattringer, and Andreas Schäfer — Institut für Theoretische Physik, Universität Regensburg

We study baryons on the lattice with a special focus on excited states. For that purpose we construct several interpolators which differ in their Dirac structure. These interpolators are built from Jacobi smeared quarks with different widths to construct operators with different spatial wave functions. We then calculate all cross correlations and use the variational method to determine which combinations of operators have best overlap with ground and excited states. Our approach yields promising results for the nucleon, Ξ and Σ. Hopefully, first results for the Θ^+ channel (pentaquark) will be available at the time of the conference.(Supported by BMBF)

HK 5.5 Fr 15:00 TU MA005

$I = 2$ pion scattering length with chirally improved fermions — •Dieter Hierl, Christof Gattringer, and Andreas Schäfer — University of Regensburg

We report on a lattice calculation of the pion scattering length in the $I = 2$ channel using the chirally improved lattice Dirac operator. The scattering length is extracted by using the standard finite volume technique of Lüscher. We use different lattice sizes and discuss several extrapolations to the chiral limit. Finally we compare our results with the latest experimental data.

Supported by BMBF and DFG.

HK 5.6 Fr 15:15 TU MA005

Breite Quasiteilchen in heißer QCD — •André Peshier — Institut für Theoretische Physik, Universität Giessen, Germany

Betrachtet werden stark wechselwirkende Vielteilchensysteme oberhalb der Übergangstemperatur $T_c \sim 200\,\mathrm{MeV}$. Es wird argumentiert, daß aus bekannten thermodynamischen Eigenschaften Rückschlüsse auf spektrale Kenngrößen der Anregungen gezogen werden können. Dies erlaubt insbesondere eine Aussage über die Partonenbreiten nahe T_c, welche bislang nur parametrisch abgeschätzt werden konnten. Das resultierende neue physikalische Bild – 'Quasiteilchen' mit teilweise großen Breiten – liefert interessante Implikationen für eine Reihe experimentell relevanter Größen wie Wirkungsquerschnitte und Transportkoeffizienten.

Gefördert durch BMBF.

[1] A. Peshier, Phys. Rev. D70 (2004) 034016.

HK 5.7 Fr 15:30 TU MA005

In-medium four-quark condensates — •Stefan Leupold — Institut für Theoretische Physik, Universität Giessen, Germany

It is well-established for the vacuum case that in the large-N_c limit four-quark condensates factorize into products of the two-quark condensate. Here N_c denotes the number of colors. It is shown that in the combined large-N_c and linear density approximation four-quark condensates do not factorize in a medium of pions (finite temperature system) but do factorize in a medium of nucleons (nuclear system).

HK 5.8 Fr 15:45 TU MA005

Densitiy Dependence of Four-Quark Condensates: Evaluation of QCD Sum-Rules for the Nucleon and Light Vector Mesons — •Ronny Thomas[1,2], Sven Zschocke[1,2], and Burkhardt Kämpfer[1] — [1]Forschungszentrum Rossendorf, Dresden, Germany — [2]TU Dresden, Germany

QCD sum-rules for the nucleon and the light vector mesons are revisited with emphasis on the role of four-quark condensates. Often the factorization hypothesis is used to predict hadronic properties at finite baryon density. Distinct occurence of the four-quark condensates in sum-rules for the nucleon and light vector mesons imply further understanding of their density dependence. Prospects to constrain some four-quark condensates by di-electron measurements at HADES are discussed.

HK 6 Kern- und Teilchen-Astrophysik

Zeit: Freitag 14:00–16:00 Raum: TU MA144

Gruppenbericht

HK 6.1 Fr 14:00 TU MA144

LUNA: A Status Report — •Frank Strieder for the LUNA collaboration — Institut für Physik mit Ionenstrahlen, Ruhr-Universität Bochum

This talk will give an overview about the experiments in the framework of the LUNA project. In short, the LUNA collaboration (Laboratory Underground for Nuclear Astrophysics) studies at the Gran Sasso underground laboratory, Assergi, Italy, the low energy cross section of capture reactions of astrophysical interest close to the Gamow window. Therefore, a 400 kV high current, electrostatic accelerator was installed in the underground lab and is contiously running in long term experiments. Recently, the measurement of the reaction ^{14}N(p,γ)^{15}O was completed. The cross section was measured in the energy range below 400 keV complementary with a N_2 gas target in combination with a 4π BGO summing crystal as well as with a solid target station in combination with a high resolution germanium detector. The different approaches allowed on one side a high efficiency measurement down to very low energies and on the other hand a high resolution experiment, which was able to discriminate clearly all diffenrent contributions to the total cross section. The final results of these measurements will be discussed.

The experimental program of the LUNA collaboration will be continued with the measurement of the reactions ^{3}He$(\alpha,\gamma)^7$Be and ^{25}Mg(p,γ)^{26}Al, which will start in 2005. The experimental status and the prospects of these experiments will be presented.

The projects are supported by Bundesministerium für Bildung und Forschung (05CL1PC1/1).

HK 6.2 Fr 14:30 TU MA144

Electron screening in $d(d,p)t$ for deuterated metals: temperature dependence — •Francesco Raiola für die LUNA-Kollaboration — Inst. für Experimentalphysik III, Ruhr-Universität Bochum, Germany

The electron screening effect in the $d(d,p)t$ reaction has been studied at the Ruhr-Universität Bochum for most of the metals and some insulators/semiconductors by using deuterated targets [1]. The deuterated targets were produced via implantation of low-energy deuterons. As compared to measurements performed with a gaseous D_2 target, a large effect has been observed for all metals. In particular work has been done to investigate the high solubility for the metals of groups III and IV and the lanthanides, at a sample temperature $T = 200$°C. The hydrogen solubility in the samples dropped to a level of few percent (compared to $T = 20$°C) and a large screening became thus observable.
An explanation of the large effect in metals is provided by the plasma model of Debye applied to the quasi-free metallic electrons. A first evidence of the aplicability of Debye's model is that the deduced number of free electrons per metallic atom agrees with the calculated number from the Hall coefficient [2], for all metals investigated. A critical test of the classical Debye model is the temperature dependence $U_e \propto T^{-1/2}$. This temperature dependence measurement is in progress and new results will be presented.
Supported by BMBF(05CL1PC1/1), DFG(Ro429/31-1), and Dynamitron-Tandem-Laboratorium. [1]F.Raiola et al.: Eur. Phys. J.A19(2004)283; [2]C.M.Hurd: "The Hall effect in metals and alloys"; (Plenum Press, 1972).

HK 6.3 Fr 14:45 TU MA144

The total S factor of ^{14}N(p,γ)^{15}O — •J.N. Klug, C.E. Rolfs, F. Schümann, F. Strieder, and H.P. Trautvetter — Ruhr-Univ. Bochum

The ^{14}N(p,γ)^{15}O reaction is the slowest reaction in the hydrogen burning CNO cycle and thus of high astrophysical interest.The reaction rate determines the CNO neutrino spectrum of our sun and influences sensitively the age determination of globular clusters. A recent work [1] done at the LUNA facility at the Laboratori Nazionali del Gran Sasso at energies below 400 keV shows that R-matrix fits to the existing data reveal good agreement for the energy regime below 500 keV. Nevertheless, a precise determination of the astrophysical S factor at zero energy depends strongly on the data above 500 keV. Therefore a new measurement of ^{14}N(p,γ)^{15}O in the energy range of 500 to 2000 keV was performed at the Dynamitron Tandem Laboratory (DTL) of the Ruhr-Universität Bochum in order to remove systematic uncertainties in the existing data, e.g. summing corrections. supported by BMBF (05CL1PC1/1)

[1] A. Formicola et al., Phys. Lett. B **591**, 61-68 (2004).

HK 6.4 Fr 15:00 TU MA144

The European Recoil separator for Nuclear Astrophysics — •Daniel Schürmann for the ERNA collaboration — Institut für Experimentalphysik III, Ruhr-Universität Bochum, Universitätsstr. 150, 44780 Bochum

The fusion of Carbon and Helium in the nuclear reaction ^{12}C$(\alpha,\gamma)^{16}$O takes place in the helium burning phase of red giant stars. This reaction is commonly refered to as a key reaction in nuclear astrophysics. Still the uncertainties of the astrophysical S(E) factor used in stellar model calculations are too large. To improve this situation we are performing a new measurement of the ^{12}C$(\alpha,\gamma)^{16}$O cross section. Previous measurements are mainly based on the detection of the reaction gamma rays.

As a new tool for this research field the European Recoil separator for Nuclear Astrophysics (ERNA) was developed at the Dynamitron Tandem Laboratory of the Ruhr-Universität Bochum. In ERNA a ^{4}He gas target is bombarded by a ^{12}C ion beam. A combination of two Wien filters and a dipole magnet filters reaction products from beam particles. The oxygen recoils are then identified and detected freely, i.e. without the necessity of γ-ray coincidences. Such coincidences can be performed additionaly, resulting in background-free γ-ray spectra.

The talk will discuss key parameters of the separator, such as suppression and acceptance. The importance of knowledge about charge state distributions and charge exchange effects will be pointed out. First results will be shown on the ^{12}C$(\alpha,\gamma)^{16}$O case and upcoming measurements of ^{3}He$(\alpha,\gamma)^7$Be will be introduced. This project is supported by the Deutsche Forschungsgemeinschaft (RO 429/35-3).

HK 6.5 Fr 15:15 TU MA144

The Electron Asymmetry A in the Decay of free neutrons — •Daniela Mund[1], Hartmut Abele[1], Stefan Baessler[2], Markus Brehm[1], Jochen Krempel[1], Michael Kreuz[1,3], Bastian Märkisch[1], Alexander Petoukhov[3], Marc Schuman[1], and Torsten Soldner[2] — [1]Physikalisches Institut Universität Heidelberg — [2]Institut für Physik Universität Mainz — [3]Institut Laue-Langevin (ILL)

We measured the β-asymmetry A, the correlation between the neutron spin and the electron momentum, in the decay of free polarized neutrons. From A and the neutron lifetime τ, you can derive the first element of the quark mixing CKM matrix, V_{ud}. Previous experimental values on V_{ud} and V_{us} violate the unitarity condition of the first row of this matrix. Hence we seek for clarification with this measurement.

Our spectrometer PERKEOII was placed at the ILL at the cold neutron beam PF1B. We improved our setup in systematics, like polarisation, background and detector function, and in statistics. We will report about our experiment and its results.

HK 6.6 Fr 15:30 TU MA144

Suche nach dem Mischungwinkel Theta13 — •Lothar Oberauer, Franz von Feilitzsch, Christian Grieb, Christian Lendvai, Tonias Lachenmaier, Walter Potzel und Marianne Neff — Physik Departement E15, Technische Universität München

Neutrinos haben Masse. Die Flavour-Eigenzustände sind Linearkombinationen von Masseneigenzuständen. Dieser Zusammenhang wird mit der unitären leptonischen Mischungsmatrix beschrieben. Mit atmosphärischen, solaren und Reaktorneutrinoexperimenten konnten kürzlich zwei der drei möglichen Winkel dieser Matrix bestimmt werden. Sie sind, im Gegensatz zu den Mischungswinkeln der hadronischen CKM-Matrix, groß und beschreiben die Kopplung der ersten zur zweiten und die der zweiten zur dritten Familie. Für die Kopplungsstärke zwischen erster und dritten Familie bestehen bisher nur obere Grenzen. Die Bestimmung des fehlenden Mischungswinkels Theta-13 ist aber wichtig für das Gebiet der schwachen Wechselwirkung, da z.B. zukünftige Experimente zur Suche nach einer leptonischen CP-Verletzung von dem Wert von Theta-13 abhängen. Mit neuen Reaktorexperimenten sowie zukünftigen Beschleunigerexperimenten wird in den nächsten Jahren nach Theta-13 gejagt werden. In dem Vortrag wird die Sensitivität der Projekte besprochen und insbesondere das neue Reaktorexperiment Double-Chooz vorgestellt werden.

HK 6.7 Fr 15:45 TU MA144

Loss and Depolarization Studies of Ultra-cold Neutrons — •Peter Fierlinger[1], I. Altarev[2], T. Brys[1], M. Daum[1], M. Gupta[1], R. Henneck[1], S. Heule[1], M. Gupta[1], M. Kasprzak[1], K. Kirch[1], M. Lasakov[3], M. Makela[4], A. Pichlmaier[1], U. Straumann[5] und A. Young[6] — [1]Paul Scherrer Institut, Villigen-PSI, Switzerland — [2]Technische Universität München — [3]Petersburg Nuclear Physics Institut — [4]Virginia Institute of Technology — [5]Universität Zürich — [6]North Carolina State University

Storage and depolarization of ultra-cold neutrons (UCN), although important for numerous experiments in fundamental and particle physics, is still not fully understood. We have carried out an experiment based on a cylindrical storage vessel with a magnetic shutter on the bottom, gravity and material walls. The loss and depolarization probability per wall interaction of the stored UCN was measured as a function of energy and temperature. We tested diamond-like carbon (DLC) coatings on Aluminum and quartz as wall materials and compared them to Beryllium. We also made a storage container using DLC coatings on plastic and Aluminum foil. We found the DLC loss parameters to be comparable to Beryllium.

HK 7 Instrumentation und Anwendungen

Zeit: Freitag 14:00–16:00 Raum: TU MA042

Gruppenbericht

HK 7.1 Fr 14:00 TU MA042

FOPIs MRPC-ToF Upgrade — •Andreas Schüttauf for the FOPI collaboration — GSI Planck Str.1 64291 Darmstadt

We present the results of the detector R&D for the new FOPI-ToF system at GSI. This proposed ToF-upgrade, an array surrounding the Central-Drift-Chamber (CDC) of FOPI, will have a size of $6m^2$ with 600 individual cells. The time resolution needed is below $\sigma_t \leq 100$ ps with a ϕ granularity of $d\phi \leq 3^o$ and a multihit capability. The use of Multigap Resistive Plate Chambers (MRPC) with segmented anodes seemed to be the most adequate solution in terms of time resolution, granularity and cost.

We will discuss the final MRPC-hardware design like the segmented anode structure (strip/pitch) as well as the optimized counter parameters for mass production. We have also developed a new Front End-Electronic-(FEE) which consists out of preamplifier (bandwidth of $\delta f \sim 1.5$ GHz at a gain of $g \sim 200$) followed by a discriminator stage. For the digitization we developed a TAC-ASIC based readout system which has an intrinsic electronic resolution of $\sigma_E \leq 10$ ps. Altogeter 4800 electronic channels are needed. Finally we will present results on time resolution, efficiency and double hit capability of the setup.

Gruppenbericht

HK 7.2 Fr 14:30 TU MA042

Test Resultate von dem AGATA γ-ray tracking Detektor Modul — •D. Weisshaar, J. Eberth und G. Pascovici für die AGATA-Kollaboration — Institut für Kernphysik, Universität zu Köln

Das **A**dvanced **GA**mma **T**racking **A**rray AGATA ist das erste komplette 4π γ-ray Spektrometer, das gänzlich nur aus Germaniumdetektoren aufgebaut sein wird. Neben der guten Energieauflösung können mit den AGATA Germaniumdetektoren auch die Positionen der γ-Wechselwirkungen mit einer Auflösung von wenigen Millimetern bestimmt werden. Dieses erlaubt den Streuweg eines γ-Quants zu rekonstruieren (Compton, Paarbildung und abschließender Photoeffekt), um zu entscheiden, ob es komplett absorbiert wurde.

Die Entwicklung des AGATA Detektors basiert auf der Technologie von MINIBALL [1,2]. Bei AGATA werden drei gekapselte, hexakonische Germaniumkristalle in einem gemeinsamen Kryostaten zusammengefasst. Jeder Kristall ist an seinem Außenkontakt 36-fach segmentiert [3].

Die ersten gekapselten AGATA Detektoren wurden in Köln mit radioaktiven Quellen und γ-Strahlung aus in-beam Reaktionen getestet. Es werden Daten vorgestellt, die die exzellente Energieauflösung, das gute Übersprechverhalten unterhalb von 0.1% und die Ortssensitivität zeigen. Über den aktuellen Fortschritt des AGATA-Projektes wird berichtet werden.

[1] D. Weißhaar, DPG-Verhandlungen 2001-2003
[2] J. Eberth *et al.*, Prog. Part. Nucl. Phys. 46, **389** (2001)
[3] D. Weißhaar, DPG-Verhandlungen 2004, HK4.2

gefördert durch das BMBF unter 06K167

HK 7.3 Fr 15:00 TU MA042

Charge carrier mobility in segmented large volume HPGe detectors — •B. Bruyneel, P. Reiter, J. Eberth, and D. Weisshaar — IKP, Universität zu Köln

γ-ray tracking in future HPGe arrays like AGATA will rely on pulse shape analysis of multiple γ-interactions. Therefore, an accurate description of electron and hole mobility as a function of the electric field strength is needed. Preamplified signals from a 12-fold segmented MINIBALL detector [1] were processed using digital XIA electronics [2]. For the electrons the whole crystal surface was scanned yielding 336 detector responses with a collimated ^{241}Am source. Anisotropy and crystal geometry cause considerable rise time differences in pulse shapes ranging up to 30% at the front side of the detector. Pulses of direct and transient signals are very well reproduced by weighting field calculations. Exploiting the segmentation a precise measurement of the hole drift anisotropy - a 10% rise time effect - was performed for the first time with 356 keV γ-rays from a ^{133}Ba source. The measured angular dependence of the rise times is caused by the crystal orientation and geometry, changing field strength and space charge effects. For the hole mobility in Ge semiconductors an applicable theoretical description is missing. Hence, a model based on the drifted Maxwellian hole distribution was developed for the hole drift anisotropy using the experimental velocity along the crystal axis as parameters.

∗ Supported by the German BMBF(06 K-167).

[1] P.Reiter *et al.*, Nucl. Phys. **A701** 209 (2002)
[2] DGF-4C User's Manual, XIA, http://www.xia.com

HK 7.4 Fr 15:15 TU MA042

Kalibration der Siliziumzähler für den HERMES-Recoil-Detektor — •Christian Vogel — Universität Erlangen-Nürnberg

Das HERMES-Experiment am HERA-Speicherring (DESY/Hamburg) dient zur Untersuchung der polarisierten Lepton-Nukleon-Streuung bei tiefinelastischer Kinematik ($Q^2 > 1\text{GeV}^2$, $W^2 > 4\text{GeV}^2$). Das Spektrometer erlaubt neben der Bestimmung der spinabhängigen Strukturfunktionen und Quarkverteilungen auch die Beobachtungen harter, exklusiver Prozesse, bei denen nur ein einziges, relativ hochenergetisches Meson oder Photon unter geringem Impulsübertrag auf den Targetkern erzeugt wird.

Das HERMES-Spektrometer besitzt zur Zeit nur eine eingeschränkte Messgenauigkeit für diese Prozesse. Eine Detektor-Erweiterung, der sogenannte Recoil-Detektor, soll ab Sommer 2005 zusätzlich das Rückstoßteilchen nachweisen.

Die Kalibration der Siliziumzähler, welche in diesem Detektor zum Einsatz kommen, wurde am Erlanger Tandem-Beschleuniger durchgeführt, die Ergebnisse werden in diesem Vortrag dargestellt.

Gefördert durch BMBF (Projekt 06 ER 125I).

HK 7.5 Fr 15:30 TU MA042

Test and performance of the scintillating fibre tracker for the HERMES recoil detector — •Roberto Perez, Michael Düren, Matthias Hartig, Matthias Hoek, Tibor Keri, Shaojun Lu, Lukas Rubacek, Björn Seitz, and Hasko Stenzel — II. Physikalisches Institut, Uni Giessen, 35392 Giessen

The HERMES recoil detector will operate a scintillating fibre tracker to identify and track protons for momenta up to 1400 MeV/c.

Scintillating fibers are an ideal tool to combine energy and position measurements for charged particles in an intermediate momentum range. They offer a high granularity while keeping the mechanical construction and material density at a minimum. Modules build from Kuraray SCSF–78 fibres of 1 mm diameter were tested at a secondary beam consisting of pions and protons at various momenta from 300 MeV/c to 900 MeV/c. Their particle identification and spatial resolution properties were tested. Data from these tests will be presented together with data using a 5 GeV/c electron beam for precise position and resolution studies of the final detector.

HK 7.6 Fr 15:45 TU MA042

Results from a beam test of a scintillating fibre hodoscope with multianode photomultiplier read-out — •Carlos Ayerbe Gayoso and Patrick Achenbach for the A1 collaboration — Institut für Kernphysik, Universität Mainz, 55099 Mainz

A scintillating fibre hodoscope has been designed as an electron detector with the future kaon spectrometer at MAMI. A prototype detector has been tested near the focal plane in one of the three existing spectrometers. A timing resolution of less than 1 ns (FWHM) width with detection efficiencies of 99% has been measured with 4 layers of 0.83 mm diameter multiclad fibres. Spatial resolution and the effect of cross-talk between neighbouring channels were studied in detail.

Performance of a prototype with a Cockroft-Walton voltage multiplier as PMT base is also presented.

Work supported by Deutsche Forschungsgemeinschaft (SFB443)

HK 8 Elektromagnetische und Hadronische Proben

Zeit: Freitag 16:30–19:00 Raum: TU MA001

HK 8.1 Fr 16:30 TU MA001

The Determination of the Gluon Polarisation via D Mesons at COMPASS — •Martin von Hodenberg, H. Fischer, J. Franz, S. Hedicke, F.H. Heinsius, D. Kang, O. Kilias, K. Königsmann, D. Matthiä, C. Schill, D. Setter, S. Trippel, and E. Weise for the COMPASS collaboration — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

COMPASS is an experiment at the SPS at CERN, which is aiming at a better understanding of the spin structure of the nucleon, by performing a measurement of the gluon polarisation $\Delta G/G$. In order to achieve this goal, polarised muons with an energy of 160 GeV are scattered from a polarised fixed LiD-target and events are studied where the underlying process is the fusion of a virtual photon with a gluon from the nucleon. This interaction can produce $c\bar{c}$-pairs, which result in charmed mesons in the final state. In average there are 1.2 D^0 or $\bar{D}^0$ mesons per $c\bar{c}$-pair. These mesons are detected in the COMPASS spectrometer via their decay products, where the most interesting decay is $D^0 \to K^-\pi^+$ and accordingly $\bar{D}^0 \to K^+\pi^-$. The presentation will inform about the current status of the ongoing analysis.

This project is supported by BMBF.

HK 8.2 Fr 16:45 TU MA001

Determination of the Gluon Polarisation using high-p_t hadron-pairs at COMPASS — •Sonja Hedicke, H. Fischer, J. Franz, F.H. Heinsius, M. von Hodenberg, D. Kang, O. Kilias, K. Königsmann, D. Matthiä, C. Schill, D. Setter, S. Trippel, and E. Weise for the COMPASS collaboration — Physikalisches Institut, Universität Freiburg

The COMPASS experiment at CERN is investigating the nucleon spin structure using polarised deep inelastic muon nucleon scattering. One of the main goals of COMPASS is to disentangle the gluon contribution to the nucleon spin.
Photon gluon fusion (PGF) events allow to probe gluon properties. These events can be enriched compared to background processes by requiring two hadrons with high transverse momentum p_t. Monte Carlo studies are used to estimate the contribution from PGF and background and thus allow to determine the gluon polarisation from the measured double spin asymmetry.
First results for the gluon polarisation from COMPASS using this method will be presented.
This work is supported by the BMBF.

HK 8.3 Fr 17:00 TU MA001

Measurement of the double helicity asymmetry in π^0 production in polarized p+p collisions at $\sqrt{s} = 200$ GeV. — •Oliver Zaudtke for the PHENIX collaboration — Institut für Kernphysik, Münster, Germany

Polarized deep-inelastic lepton scattering experiments have indicated that only 20-30% of the nucleon spin is carried by quarks and antiquarks in the nucleon. Gluons may contribute a significant part to the nucleon spin. Gluon polarization can not be directly measured in low energy polarized deep inelastic scattering fixed target experiments, since virtual photons do not couple to gluons directly. However, in polarized $p + p$ collisions at high energies the gluons participate directly and hence the gluon polarization can be probed. One promising method is the measurement of the double helicity asymmetry (A_{LL}) in high p_T π^0 production.

The Relativistic Heavy Ion Collider (RHIC) is the first accelerator to collide polarized protons at high energies. We will present first measurements of π^0 A_{LL} with the PHENIX detector at $\sqrt{s} = 200$ GeV.

HK 8.4 Fr 17:15 TU MA001

Measurement of Asymmetries in high-p_T Single Hadron Production at COMPASS[†] — •R. Kuhn, M. Becker, R. De Masi, A.-M. Dinkelbach, J. M. Friedrich, S. Gerassimov, B. Grube, B. Ketzer, I. Konorov, T. Nagel, S. Paul, L. Schmitt, and Q. Weitzel for the COMPASS collaboration — TU München, Physik-Department E18

During the three beamtimes 2002–2004 COMPASS has measured hard scattering processes of polarized muons off a polarized ^{6}LiD target. The spin asymmetry of the hadron production cross section at high transverse momenta is related to the polarized gluon density ΔG of the nucleon. A first analysis of this asymmetry for single hadrons at low Q^2 and small x_{Bj} will be presented.

[†] This work is supported by the BMBF and the Maier-Leibnitz-Labor, Garching.

HK 8.5 Fr 17:30 TU MA001

Two hadron production in longitudinally polarized lepton nucleon collisions — •Christof Hendlmeier, Marco Stratmann, and Andreas Schaefer — Institut fuer Theoretische Physik, Universitaet Regensburg, 93040 Regensburg

We consider the photoproduction of two hadrons in polarized lepton nucleon collisions in the framework of perturbative QCD. This process is studied experimentally at COMPASS (CERN) or HERMES (DESY). The goal of these studies is to extract the polarization Δg of gluons in the nucleon, which is still largly unknown at the moment and to quantify the theoretical errors.

Supported by BMBF

HK 8.6 Fr 17:45 TU MA001

Studies of High-P_t Hadrons at COMPASS — •Daniel Matthiä, H. Fischer, J. Franz, S. Hedicke, F.H. Heinsius, M. von Hodenberg, D. Kang, O. Kilias, K. Königsmann, C. Schill, D. Setter, S. Trippel, and E. Weise for the COMPASS collaboration — Physikalisches Institut, Universität Freiburg

One of the goals of the COMPASS experiment at CERN is to study the spin structure of nucleons, especially the gluon spin polarization. This is investigated in deep inelastic scattering of polarized muons off a polarized LiD target.
A powerful tool to study the gluon polarization in the nucleon is provided by the selection of photon-gluon fusion (PGF) events. The requirement of events which contain hadron jets with large transverse momentum p_t suppresses contributions from leading order DIS and QCD Compton and enhances the fraction of PGF events.
of the process of photon gluon fusion (PGF) in deep inelastic scattering. In PGF processes the back to back production of a quark and an antiquark causes a large number of hadrons with high transversal momentum p_t with respect to the virtual photon.
The status of the analysis of events with *high-p_t* hadrons will be presented. Cross sections for pion production and charged hadrons will be discussed in comparison to theoretical predictions.
This work is supported by the BMBF.

HK 8.7 Fr 18:00 TU MA001

Hadronenmultiplizitäten und Fragmentationsfunktionen bei HERMES — •Achim Hillenbrand für die HERMES-Kollaboration — Universität Erlangen-Nürnberg, Physikalisches Institut II, Erwin-Rommel-Str. 1, 91058 Erlangen

Im Rahmen des HERMES Experimentes bei HERA wurde die Erzeugung von Hadronen in der tiefunelastischen Positron-Proton Streuung bei einer Strahlenergie von 27.6 GeV untersucht. Der verwendete RICH-

Detektor mit zwei Radiatoren ermöglicht die Separation der Hadronen in Pionen, Kaonen, Protonen und Antiprotonen. Vorgestellt werden ladungsseparierte Multiplizitäten fuer diese Hadronen in Abhängigkeit von z, x_{Bj} und Q^2, letztere für verschiedene z-Bereiche. Die Daten wurden um Akzeptanzeffekte und Einflüsse durch radiative Prozesse korrigiert. Die dabei verwendete Methode ist die gleiche, die bei der Δq-Analyse verwendet wurde[1]. Sie berücksichtigt die Teilchenmigration zwischen verschiedenen Bins mittels aus Monte Carlo-Simulationen gewonnenen Matrizen. Unter Berücksichtigung der unterschiedlichen Energien werden die Ergebnisse mit den Resultaten von EMC verglichen.

Gefördert durch BMBF, Projekt 06 ER 125I.

[1] hep-ex/0407032

HK 8.8 Fr 18:15 TU MA001

First Measurements of DVCS off Nuclei — •Matthias Hoek for the HERMES collaboration — II. Physikalisches Institut, Universität Giessen, D-35392 Giessen

For the first time, a beam-spin azimuthal asymmetry has been measured in electroproduction of hard photons off nuclei. The asymmetry results from the interference between the Bethe-Heitler process and deeply virtual Compton scattering (DVCS), giving access to the latter at the amplitude level. The data have been obtained by the HERMES experiment at DESY, scattering the HERA 27.6 GeV positron beam off deuterium and neon gas targets.

HK 8.9 Fr 18:30 TU MA001

Messung der Spinstrukturfunktion g_1 — •Markus Ehrenfried für die HERMES-Kollaboration — Physikalisches Institut II der Universität Erlangen-Nürnberg, Erwin-Rommel-Straße 1, 91058 Erlangen

Die Struktur des Nukleons kann durch vier empirisch bestimmbare Strukturfunktionen parametrisiert werden: die beiden elektromagnetischen Strukturfunktionen F_1 und F_2 sowie die Spinstrukturfunktionen g_1 und g_2.

Zur Bestimmung der Spinstruktur des Nukleons ist es erforderlich, daß sowohl das Projektil als auch das Target polarisiert sind. Das HERMES Experiment am Deutschen Elektronensynchrotron in Hamburg hat während der vergangenen Jahre mit hoher Genauigkeit die spinabhängige Strukturfunktion g_1 des Protons und des Deuterons gemessen. Dazu wurden longitudinal polarisierte Positronen mit einer Energie von 27.6 GeV an einem ebenfalls longitudinal polarisierten Wasserstoff- bzw. Deuterium-Gastarget gestreut. Die gemessenen Spinasymmetrien wurden mit Hilfe einer Monte-Carlo-Simulation entfaltet und so um QED-Strahlungsprozesse und Detektoreffekte, die die Messung überlagern, korrigiert.

Die Ergebnisse der Messung der Proton- und Deuteron-Spinstrukturfunktionen g_1^p und g_1^d sowie der daraus ermittelten Neutron-Spinstrukturfunktion g_1^n werden vorgestellt und diskutiert.

Gefördert durch BMBF, Projekt 06 ER 125I.

HK 8.10 Fr 18:45 TU MA001

Präzessionsmessung der Tensor-Strukturfunktion b_1^d des Deuterons mit dem HERMES-Experiment — •Caroline Riedl — Universität Erlangen-Nürnberg

Das Hermes-Experiment am DESY/Hamburg untersucht die Spinstruktur des Nukleons unter Verwendung des longitudinal polarisierten Positronenstrahls von 27.6 GeV, der auf ein polarisiertes internes Wasserstoff- bzw. Deuterium-Gastarget geleitet wird.
Mit Hilfe der inklusiven tiefinelastischen Streuung an longitudinal vektorpolarisierten Targets wurden unter anderem die spinabhängigen Strukturfunktionen g_1 des Protons und Deuterons bestimmt.
Die verwendete Targettechnologie ermöglicht auch die Erzeugung einer hohen Tensorpolarisation der Deuteronkerne bei gleichzeitig verschwindender Vektorpolarisation. Dies gestattet erstmals einen Zugang zur Quadrupol-Strukturfunktion b_1^{d} des Deuterons. Das HERMES-Target wurde im Jahre 2000 sechs Wochen lang in solch einem Modus betrieben. Die entsprechenden Daten ermöglichen eine Bestimmung von b_1^{d} im kinematischen Bereich von $0.002 < x < 0.85$ und $0.1\ \mathrm{GeV}^2 < Q^2 < 20\ \mathrm{GeV}^2$.
Die präsentierten endgültigen Ergebnisse basieren auf einer aktualisierten Analyse der Daten; sie wurden für radiative Ereignisse und instrumentelle Effekte des Detektors unter der Verwendung eines Entfaltungs-Algorithmus korrigiert, der die Bin-Wanderung der Ereignisse berücksichtigt.

HK 9 Elektromagnetische und Hadronische Proben

Zeit: Freitag 16:30–19:00 Raum: TU MA004

Gruppenbericht

HK 9.1 Fr 16:30 TU MA004

Threshold production of open strangeness at COSY-11 — •Peter Winter for the COSY-11 collaboration — Institut für Kernphysik, Forschungszentrum Jülich

Strangeness production in proton-proton collisions enables to study not only nucleon-hyperon but also the KN and $K\bar{K}$ interaction. The COSY-11 detection system is perfectly suited to investigate such reactions in the near threshold energy region. Exclusive data on hyperon production and open strangeness ($pp \to ppK^+K^-$) have been collected. The data in the $pp \to pK^+\Lambda/\Sigma^0$ reactions revealed a cross section ratio $R = \sigma_{tot}(\Lambda)/\sigma_{tot}(\Sigma^0) \approx 28$ exceeding by an order of magnitude that at high energies. Different models within the framework of one-boson exchange cannot well reproduce this strong rise towards low excess energies Q. Additional information in other isospin channels will impose further constraints to theoretical descriptions and help to clarify the dominant reaction mechanisms. For this purpose, the COSY-11 collaboration gathered data in the channel $pp \to nK^+\Sigma^+$ at $Q = 13$ and 60 MeV. Besides the hyperon sector, exclusive data on the $pp \to ppK^+K^-$ reaction have been taken at excess energies of $Q = 10$ and 28 MeV where final state interactions (FSI) of the outgoing particles are pronounced. A strong enhancement of the total cross section close to the threshold compared to a pure phase space expectation is supported by the new data sets. Since the strong pp-FSI is not sufficient to explain this effect, it remains an open question if the rise origins e.g. from the K^-p system which should be dominated by the $\Lambda(1405)$, a K^+K^- interaction or effects from the 4-body final state. This work is supported by FZ-Jülich and DAAD.

HK 9.2 Fr 17:00 TU MA004

Strangeness production in pD interactions at ANKE/COSY — •Y. Valdau for the ANKE collaboration — Forschungszentrum Jülich, 52425 Jülich

ANKE is a magnetic spectrometer and detection system at an internal target position of COSY-Jülich. The device permits to momentum analyze ejectiles from hadronic interactions with forward emission angles around 0°. A major goal of the experimental program at ANKE is the investigation of proton-induced strangeness production in the nuclear medium. The K^+-production cross section in elementary pn collisions is an important input parameter for model calculations on K^+-production in pA and AA interactions. Experimental data in the close to threshold region are not available yet and theoretical predictions give various numbers ranging from one to six for the ratio of total cross sections σ_n/σ_p depending on the underlying model. The ANKE spectrometer at COSY-Jülich has been used to measure K^+ production in pD interactions at beam momenta of 2.055, 2.095, 2.65, 2.7, 2.83 and 3.46 GeV/c. For the extraction of σ_n/σ_p from the pD data at 2.65, 2.7 and 2.83 GeV/c, a naive phase-space approach has been used assuming that $\sigma_{\mathrm{D}} = \sigma_n + \sigma_p$. Cross sections and missing mass spectra for proton-kaon correlations have been obtained, and a ratio $\sigma_n/\sigma_p \sim 3-5$ has been found. The analysis of data measured below the free nucleon-nucleon K^+ production threshold as well as higher energy data will be presented. Supported by FZ-Jülich, DFG, WTZ.

HK 9.3 Fr 17:15 TU MA004

Observation of an excited neutral hyperon state in pp collisions* — •Izabella Zychor[1], Vladimir Koptev[2], Markus Büscher[3], Michael Hartmann[3], Irakli Keshelashvili[3], Vera Kleber[4], Rudiger Koch[3], Sigfried Krewald[3], Yoshikazu Maeda[3], Siergiej Mikirtichyants[2], Michail Nekipelov[2,3], and Hans Ströher[3] for the ANKE collaboration — [1]The Andrzej Sołtan Institute for Nuclear Studies, 05400 Świerk, Poland — [2]High Energy Physics Department, Petersburg Nuclear Physics Institute, 188350 Gatchina, Russia — [3]Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — [4]Institut für Kernphysik, Universität zu Köln, 550937 Köln, Germany

The reaction $pp \to pK^+Y^{0*} \to pK^+\pi^\pm X^\mp$ has been studied with the ANKE spectrometer at COSY Jülich in order to investigate heavy hyperon production. The momentum of the proton beam, incident on a hydrogen cluster-jet target, was 3.65 GeV/c. Protons, kaons and pions were identified with the ANKE detector system consisting of range telescopes, scintillation counters and multi–wire proportional chambers. The missing mass spectra $MM(pK^+)$ have been analyzed for both positive and negative charge final states and compared with extensive Monte Carlo simulations. Indications for a neutral excited hyperon resonance $Y^{0*}(1480)$ have been found. Consistent results for its mass and width as well as a production cross section were obtained for both final states. Experimental details, analysis procedure and a possible interpretation of this state will be discussed.

* supported by FZJ, BMBF, DFG

HK 9.4 Fr 17:30 TU MA004

ϕ-meson production in pp collisions* — •M. Hartmann[1], Y. Maeda[1], I. Keshelashvilli[1], H.R. Koch[1], S. Mikirtytchiants[2], and H. Ströher[1] for the ANKE collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — [2]High Energy Physics Department, Petersburg Nuclear Physics Institute, 188350 Gatchina, Russia

At the ANKE facility of COSY Jülich, data on ϕ-meson production in pp collisions in the near-threshold region have been obtained at incident beam energies of 2.83 GeV, 2.70 GeV and 2.65 GeV [1]. Detecting the K^+K^- decay mode we have identified 200-300 ϕ-mesons at each excess energy of 76 MeV, 35 MeV and 19 MeV, respectively. The energy dependence of the total cross section close to threshold will potentially give information on the production mechanism, in particular on the ϕNN coupling constant. Furthermore our result, combined with available SPESS-III and TOF results on ω-meson production, will provide information about violations of the OZI-rule.

As an exciting aspect an enhancement in the invariant ϕp mass spectrum is observed at a mass around 1.965 GeV/c^2.

* supported by FZ-Jülich.

[1] Presented at the conference BARYONS 2004. Will be published in the journal Nuclear Physics A.

HK 9.5 Fr 17:45 TU MA004

ϕ-meson production in pn collisions* — •Yoshikazu Maeda[1], Michael Hartmann[1], Irakli Keshelashvilli[1], Rüdiger Koch[1], Sergey Mikirtytchiants[2], and Hans Ströher[1] for the ANKE collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich, ermany — [2]High Energy Physics Department, Petersburg Nuclear Physics Institute, Russia

ϕ-meson production in both hadronic and electromagnetic processes has attracted the interest for the investigation of hidden strangeness in nucleon and the violation of the Okubo-Zweig-Iizuka rule. At the ANKE facility of COSY Jülich, first data of ϕ-meson production in pn collisions close to threshold have been measured using a proton beam on a deuterium cluster-jet target. The reaction $pn \to d\phi$ has been identified by detecting the fast deuteron in coincidence with the K^+K^- pairs from the ϕ decay. About 1000 clean events of ϕ-meson production have been accumulated. The data cover an excess energy range up to 80 MeV exploiting Fermi motion of the target neutron. The total cross section and angular dependence at several energies will be presented and discussed.

* supported by FZ-Jülich

HK 9.6 Fr 18:00 TU MA004

Untersuchungen zu $pp \to pK^0\Sigma^+$, $pp \to nK^+\Sigma^+$ bei $p_{beam} = 2.95$ und 3.2 GeV/c — •Leonhard Karsch, K.-Th. Brinkmann, S. Dshemuchadse, H. Freiesleben, E. Kuhlmann, R. Jäkel, M. Schulte-Wissermann und G.Y. Sun — TU Dresden*

Einer der Schwerpunkte des Meßprogramms am Kühler-Synchrotron COSY ist die Produktion von Hyperonen im Proton-Proton-Stoß. Für die Reaktion $pp \to pK^0\Sigma^+$ gab es bisher nur wenige schwellennahe Messungen, für $pp \to nK^+\Sigma^+$ gar keine. Der COSY-TOF-Detektor ist hervorragend geeignet, in diesen Reaktionen bei vollständiger Winkelüberdeckung die Impulse aller Ejektile simultan zu messen. Für diese Hyperonkanäle wurden Daten von COSY-TOF völlig unabhängig von bisherigen Methoden ausgewertet. Wirkungsquerschnitte und differentielle Observablen konnten bestimmt werden.

Die Wirkungsquerschnitte für diese Reaktionen sind durch die Isospinrelationen miteinander verbunden. Die relativen Stärken der Isospinkanäle sind unsicher. Durch den Vergleich der Wirkungsquerschnitte untereinander und mit den theoretischen Vorstellungen sind Aussagen über die relativen Phasen verschiedener Beiträge zum Reaktionsmechanismus möglich.

* gefördert durch BMBF und FZ Jülich

HK 9.7 Fr 18:15 TU MA004

Energy dependence of the pd$\to^3$Heη' production close to threshold. — •H.-H. Adam, A. Khoukaz, R. Santo, and A. Täschner for the COSY-11 collaboration — Institut für Kernphysik, Universität Münster, Germany

Measurements on the near-threshold production of neutral mesons in the reaction channel pd$\to^3$He X^0 (X$^0 = \eta, \omega, \eta', \phi$) are of general interest for many reasons. This reaction channel might be well suited for rare decay studies of neutral mesons and furthermore, in case of e.g. the η-meson production recent measurements resulted in data that are remarkable for both their strength and energy dependence. The observed rapid decrease of the production amplitude squared $|f|^2$ with increasing excess energy at threshold was found to be dominated by a strong ^{3}He-η final state interaction and the presence of N*(1535) resonance. In contrast to this, only little is known for the corresponding case of the η' meson production.

New data close to threshold are under evaluation by the COSY-11 collaboration, in order to study the corresponding production amplitude with respect to the absolute scale and a possible deviation from phase-space expectations, similar to the η case. The determination of the excitation function in the near-threshold region is also desirable for studies on the dominant production mechanism and for the confirmation of theoretical predictions.

Newest results on our investigations on the pd$\to^3$He η' excitation function close to threshold at excess energies up to 10 MeV, using the COSY-11 installation, will be presented. This work is supported by FZ Jülich.

HK 9.8 Fr 18:30 TU MA004

Study of the η meson production in the $\vec{d} + d \to {}^4He + \eta$ reaction using the vector and tensor polarised deuteron beam — •Mariola Lesiak for the GEM collaboration — Jagellonian Univ., Cracow, Poland — Inst. für Kernphysik, FZ Jülich

There is a great interest in η-physics in the recent years. Most of the experiments investigate η production in an electromagnetic reaction or in p+d collisions. The existing data for the $\vec{d} + d \to {}^4He + \eta$ reaction are so far limited to total cross sections for the beam momentum near threshold. There are many theoretical models describing the η production in $p + d \to {}^3He + \eta$ reaction. Kilian and Nann proposed a two step model to describe the $\vec{d} + d \to {}^4He + \eta$ reaction. However due to the lack of data the question of the underlying reaction mechanism can not be answered without new measurements.

The measurements of the $\vec{d} + d \to {}^4He + \eta$ reaction in a broad beam momentum range from the near threshold region to 3.0 GeV/c is performed at the COSY accelerator in Jülich. We used vector and tensor polarised deuteron beams. The first results of the data analysis will be presented.

Ref.: K. Kilian and H. Nann, AIP Conf. Proc. No. 221, p. 185 (1990)

HK 9.9 Fr 18:45 TU MA004

Investigation of $3\pi^0$ final states with the CELSIUS/WASA experiment* — •C. Pauly[1], F. Cappellaro[2], L. Demirörs[1], I. Koch[2], and W. Scobel[1] for the CELSIUS/WASA collaboration — [1]Institut f. Experimentalphysik, Universität Hamburg — [2]Dep. of Radiation Sciences, Uppsala University

In the WASA experiment (CELSIUS, Uppsala), decays of the η meson produced in pp and pd reactions are investigated. To obtain the necessary high luminosities a unique target of frozen Hydrogen pellets is used. A 4π CsI calorimeter together with a multilayered forward detector provides the necessary high acceptance and tagging accuracy.

In the last year, data were taken for the pp reaction with a mean luminosity of well above $5 \cdot 10^{30}$ cm^{-2} s^{-1} and projectile energies of 1360 MeV and 1450 MeV corresponding to excess energies Q=41 MeV and 75 MeV, above the η production threshold (1254 MeV). Due to the high geometric acceptance, $3\pi^0 \to 6\gamma$ final states can be fully reconstructed with all 6 gammas being detected in the calorimeter, and thus providing a very clean event sample. The $\eta \to 3\pi^0$ channel clearly stands out in the pp missing mass distribution; the η angular distribution will be shown and its Dalitz plot discussed in context with the slope parameter α as a measure of nonuniformity [1]. A cross section estimate for *prompt* $3\pi^0$ production can be deduced by decomposing the pp missing mass distribution of 6γ events based on MC simulations.

[1] W. B. Tippens et al., Phys. Rev. Lett. 87, 192001 (2001)

* supported by BMBF (06HH152)

HK 10 Kernphysik/Spektroskopie

Zeit: Freitag 16:30–19:00 Raum: TU MA005

Gruppenbericht

HK 10.1 Fr 16:30 TU MA005

Messung des Isospin-Charakters der Pygmyresonanz mit Hilfe von $(\alpha,\alpha'\gamma)$ Koinzidenzexperimenten* — •D. Savran[1], M.N. Harakeh[2], J. Hasper[1], K. Ramspeck[1], A.M. van den Berg[2], H.J. Wörtche[2] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt — [2]Kernfysisch Verneller Instituut, NL-9747 Groningen, Niederlande

Zur Untersuchung des Isospin-Charakters elektrischer Dipolstärke unterhalb der Teilchenschwelle eignen sich $(\alpha,\alpha'\gamma)$ Koinzidenzexperimente, da diese die hohe Selektivität auf Dipolanregungen und hohe Energieauflösung der Kernresonanzfluoreszenz (KRF) mit der Isospinselektivität von Streuexperimenten mit α-Teilchen bei Energien um 140 MeV verbindet. Der Isospin-Charakter liefert einen Test für zahlreiche z.T. widersprüchliche theoretische Beschreibungen des Charakters von starken $E1$-Anregungen unterhalb der Teilchenschwelle. Am Big-Bite Spektrometer des KVI haben wir $(\alpha,\alpha'\gamma)$ Koinzidenzmessungen bei $E_\alpha = 136$ MeV durchgeführt. Zur Detektion des γ-Zerfalls wurde erstmals ein Array von sechs hochauflösenden HPGe Detektoren mit BGO-Schild verwendet. Ein Vergleich des Aufbaus mit Pionierexperimenten [1], bei denen NaI Detektoren verwendet wurden, wird anhand einer Messung an ^{58}Ni durchgeführt. Ausserdem werden erste Ergebnisse einer Messung am doppelt magischen Kern ^{48}Ca präsentiert, für den die $E1$-Stärkeverteilung aus (γ,γ')-Experimenten bekannt ist [2].

* gefördert durch die DFG (SFB 634) und ...

[1] D. Poelhekken et al., Phys. Lett. **B 278** (1992) 423
[2] T. Hartmann et al., Phys. Rev. Lett. **85** (2000) 274

Gruppenbericht

HK 10.2 Fr 17:00 TU MA005

Niederenergetische E1 Übergangsstärke am $Z = 50$ Schalenabschluß: 2-Phonon-Kopplung und Clustering — •C. Kohstall[1], P. von Brentano[2], A. Gade[3], H. von Garrel[2], C. Fransen[2], U. Kneissl[1], A. Linnemann[2], H.H. Pitz[1], M. Scheck[1], F. Stedile[1], S. Walter[1] und V. Werner[1] — [1]Institut für Strahlenphysik, Universität Stuttgart — [2]Institut für Kernphysik, Universität zu Köln — [3]Department of Physics and Astronomy, Michigan State University, USA

Die kollektive, niederenergetische E1-Stärke in sphärischen Kernen zeigt an Schalenabschlüssen einen deutlichen Schaleneffekt und wird zumeist durch die Kopplung von Quadrupol- und Oktupolanregungen erklärt [1]. Aber auch im Cluster-Modell kann das Auftreten niederenergetischer E1-Stärke verstanden werden [2]. Für den $Z = 50$ Schalenabschluß sind die elektrischen Dipolübergangsstärken für eine Vielzahl von Isotopen aus Kernresonanzflureszenz Messungen bekannt. Diese Daten ermöglichen eine Analyse der Struktur der E1 Anregungen am $Z = 50$ Schalenabschluß als eine Schwingung von Valenznukleonen gegen einen magischen Core [3]. Durch die Analyse werden auch die Anregungsenergien der Dipolanregungen verständlich. Es kann ein Zusammenhang zu der E2 Anregungstärke des ersten Qudrupolphonons aufgezeigt werden.

[1] W. Andrejtscheff et al., Phys. Lett. **B 506**, 239 (2001).
[2] F. Iachello, Phys. Lett. **160B**, 1 (1985).
[3] C. Kohstall, PhD Thesis, Stuttgart (2004).

HK 10.3 Fr 17:30 TU MA005

Dipole strength in ^{112}Sn up to 9 MeV from resonant photon scattering* — •B. Özel[1], M. Babilon[1], J. Enders[1], H. von Garrel[2], O. Karg[1], U. Kneissl[2], C. Kohstall[2], P. von Neumann-Cosel[1], H. H. Pitz[2], I. Poltoratska[1], V. Yu. Ponomarev[1], I. Pysmenetska[1], A. Richter[1], M. Scheck[2], F. Stedile[2], S. Volz[1], and S. Walter[2] — [1]Institut für Kernphysik, Technische Univeristät Darmstadt — [2]Institut für Strahlenphysik, Universität Stuttgart

The ^{112}Sn(γ,γ') reaction was studied at endpoint energies of the incident bremsstrahlung spectrum of 3.8 MeV, 5.5 MeV, 7.0 MeV, and 9.5 MeV at the Stuttgart Dynamitron accelerator and the superconducting Darmstadt electron linear accelerator S–DALINAC. Dipole strength distributions have been extracted from the measured data. Around 3.4 MeV excitation energy, a candidate for the quadrupole-octupole-coupled E1 excitation has been identified which is discussed with respect to the systematics established in ^{116,118,120,122,124}Sn by Bryssinck *et al.* [1]. At higher energies, a concentration of dipole excitations is observed between 5 and 8 MeV. The strength of this so-called pygmy dipole resonance is compared to existing data for ^{116,124}Sn [2] and to quasiparticle-phonon model calculations.

[1] J. Bryssinck *et al.*, Phys. Rev. C 59, 1930 (1999)
[2] K. Govaert *et al.*, Phys. Rev. C 57, 2229 (1998)

*Work supported by the DFG through SFB 634.

HK 10.4 Fr 17:45 TU MA005

Gemischt-symmetrische Zustände in ^{98}Pd — •C. Fransen[1], F. Becker[2], P. von Brentano[1], M. Gorska[2], J. Jolie[1], A. Linnemann[1], S. Mandal[2], D. Mücher[1] und G. Münzenberg[2] — [1]Institut für Kernphysik, Universität zu Köln — [2]GSI, Darmstadt

Die Untersuchung von kollektiven Kernanregungen in schweren Kernen, die nicht vollständig symmetrisch bezüglich des Proton-Neutron (pn) Freiheitsgrades sind, sogenannte gemischt-symmetrische Zustände [1], ist zur Zeit von besonderem Interesse, da ihre Eigenschaften fundamentale Informationen über die pn-Wechselwirkung geben. Speziell für die N=52 Isotone ^{92}Zr, ^{94}Mo und ^{96}Ru exisitieren bereits sehr detaillierte Daten über gemischt-symmetrische Mehrphononenanregungen (siehe z.B. [2]). Allerdings liegen bislang keine Daten über solche Anregungen in protonenreichen N=52 Isotonen vor. Die Kenntnis über gemischtsymmetrische Zustände in diesen Kernen ist jedoch elementar für das Verständnis der Entstehung von Kollektivität in der Nähe des doppeltmagischen Kerns ^{100}Sn. Wir haben daher ein Experiment zur Untersuchung von Tiefspinzuständen in ^{98}Pd mit der Reaktion ^{96}Ru(^{3}He,n)^{98}Pd am Kölner Horus-Spektrometer durchgeführt, das eine wesentliche Erweiterung des Tiefspin-Termschemas von ^{98}Pd ermöglichte. Die Ergebnisse werden hinsichtlich der Identifikation von gemischt-symmetrischen Zuständen in ^{98}Pd diskutiert und mit der Systematik dieser Zustände in Nachbarkernen verglichen.

Gefördert durch die DFG, Fördernummer Jo 391/3-1.

[1] F. Iachello, Phys. Rev. Lett. **53**, 1427 (1984).
[2] C. Fransen, *et al.*, Phys. Rev. C **67**, 024307

HK 10.5 Fr 18:00 TU MA005

Neutron transfer reactions on Ni isotopes* — •M. Mahgoub[1], A. Bergmaier[1], G. Dollinger[1], T. Faestermann[1], H.-F. Wirth[2], R. Gernhäuser[1], R. Hertenberger[2], Th. Kröll[1], R. Krücken[1], T. Behrens[1], P. Maierbeck[1], F. Nebel[1], and M. Schlarb[1] — [1]Physik-Department E12, TU München, 85748 Garching, Germany — [2]Sektion Physik, LMU München, 85748 Garching, Germany

One and two neutron transfer reactions enable us to study the evolution of the shell structure for the long isotopic chain of magic Ni isotopes. We intend to test the residual interactions used in recent shell model calculations for the fp-shell region. Additionally, the investigation of simultaneous and sequential transfer of two neutrons reveals new information on the pairing correlations in these nuclei. For the reactions $(\vec{p},d)$ and $(\vec{p},t)$, the light reaction products were analyzed with the Q3D magnetic spectrograph. Since we plan to extend our studies to exotic Ni nuclei, we develop (d,p) and (t,p) reactions in inverse kinematics using CD_2 targets as well as deuterium or, in future, tritium loaded Ti foils. The protons are detected in backward direction by an annular Si detector (DSSSD). The data are analised with DWBA utilising the FRESCO code. The extracted spectroscopic factors are compared with predictions from shell model calculations. First results will be presented and discussed. * Supported by BMBF, MLL, and DFG under contract KR2326/1-1.

HK 10.6 Fr 18:15 TU MA005

Gemischt-symmetrische Zustände in Zink-Isotopen — •Dennis Mücher, Christoph Fransen, Jan Jolie, Andreas Linnemann und Nigel Warr — Institut für Kernphysik, Universität zu Köln

Die Proton-Neutron-Variante des Interacting-Boson-Model (IBM-2) sagt Zustände in gg-Kernen voraus, die nicht symmetrisch bezüglich des Proton-Neutron-Freiheitsgrades sind. Solchen gemischt-symmetrischen Zuständen wird ein nicht maximaler F-Spin zugeordnet, der analog dem gewöhnlichen Isospin konstruiert ist. Diese Zustände bilden analog zu den Proton-Neutron-symmetrischen Zuständen eine fundamentale Art von tiefliegenden Anregungen, die in den letzen Jahren intensiv untersucht wurden. Für Kerne nahe dem N=50 Neutronen-Schalenabschluss liegen bereits sehr detaillierte Daten über gemischt-symmetrische Zustände vor. Von besonderem Interesse ist nun der Vergleich der Systematik von gemischt-symmetrischen Zuständen in diesen Kernen mit den Eigenschaf-

ten von leichteren Kernen nahe dem Z=28 Protonen-Schalenabschluss. In ^{66}Zn wurden bereits Signaturen gemischt-symmetrischer Zustände gefunden [1]. Es wird gezeigt, dass neue Lebensdauermessungen [2] die Existenz der gemischt-symmetrischen Zustände in ^{66}Zn bestätigen. Weiter wird gezeigt, dass auch in den Nachbar-Isotopen ^{64}Zn und ^{68}Zn Hinweise auf Zustände gemischter Symmetrie vorliegen und sich so ein konsistentes Gesamtbild ergibt. Dieses Bild zeigt eine Analogie zu den N=52 Isotonen, welche durch die in ^{92}Zr und ^{70}Zn vorliegende F-Spin-Brechung durch N=40 bzw. Z=40 Unterschalenabschlüsse komplettiert wird.
[1] A. Gade et al., Phys.Rev. C 65,054311 (2002)
[2] M. Koizumi et al., Nucl. Phys. A 730 (2004)

HK 10.7 Fr 18:30 TU MA005

The decay of 1^+ states as a new probe of the structure of 0^+ shape isomers * — •R. Schwengner[1], G. Rusev[1,2], F. Dönau[1], S. Frauendorf[1,3], L. Käubler[1], L.K. Kostov[2], S. Mallion[1], K.D. Schilling[1], A. Wagner[1], H. von Garrel[4], U. Kneissl[4], C. Kohstall[4], M. Kreutz[4], H.H. Pitz[4], M. Scheck[4], F. Stedile[4], P. von Brentano[5], J. Jolie[5], A. Linnemann[5], N. Pietralla[6], and V. Werner[7] — [1]FZ Rossendorf, 01314 Dresden — [2]INRNE, 1784 Sofia, Bulgaria — [3]Univ. of Notre Dame, IN 46556, USA — [4]IfS, Univ. Stuttgart, 70569 Stuttgart — [5]IKP, Univ. Köln, 50937 Köln — [6]SUNY, NY 11794-3800, USA — [7]Yale University, CT 06520-8124, USA

The nuclides ^{98}Mo and ^{100}Mo have been studied in photon-scattering experiments by using bremsstrahlung produced from electron beams with kinetic energies from 3.2 to 3.8 MeV. Six electromagnetic dipole transitions in ^{98}Mo and 19 in ^{100}Mo were observed for the first time in the energy range from 2 to 4 MeV. A specific feature in both nuclides is the deexcitation of one state with spin $J = 1$ to the 0^+ ground state as well as to the first excited 0^+ state, which cannot be explained in standard models. We present a model based on one-particle-one-hole excitations which allows us to deduce the mixing coefficients for the two 0^+ shape-isomeric states from the experimental ratio of the transition strengths from the $J = 1$ state to the 0^+ ground state and to the 0^+ excited state.
* Supported by the DFG with contract Do 466/1-2.

HK 10.8 Fr 18:45 TU MA005

Gamow-Teller strength distributions relevant for supernova modelling measured thru the (d,^{2}He) reaction — •Sönke Hollstein, C. Bäumer, D. Frekers, E.-W. Grewe, and S. Rakers — Institut für Kernphysik, Westfälische-Wilhelms-Universität, Münster, Germany

In the explosion dynamics of supernovae electron capture (EC) processes on pf-shell nuclei play an important role. Gamow-Teller (GT) strength distributions for the pf-shell target nuclei ^{57}Fe, ^{61}Ni, and ^{67}Zn have been measured by means of the (d,^{2}He) reaction [1] at an energy of E_d=180 MeV using the BBS-ESN setup at the AGOR cyclotron facility at KVI, Groningen. Energy resolutions ranged between 100 and 120 keV. The interest in the odd-N nuclei originates from the fact that in the Fuller-Fowler-Newman parameterizaton [2] of the weak EC process the centroid GT resonance energies are by and large located at about 1 to 2 MeV higher than what recent large shell model (SM) calculations predict, with the exception of ^{61}Ni where it is vice versa. The centroid position of the GT resonance is a more sensitive parameter of the deleptonization process in supernova modeling codes than e.g. the details of the distribution. In order to solve that issue our data will be compared to the most recent SM calculations [3] for these nuclei.
[1] S.Rakers et. al., Nucl. Instr. Meth. A 481, 253 (2002); C.Bäumer et. al., Phys. Rev. C 68, 031303R (2003).
[2] G.M. Fuller, W.A. Fowler, and M.J. Newman, Astrophys. J., Suppl. 252, 715 (1982) and references therein.
[3] K.Langanke et. al. Nucl. Phys A 673, 481 (2000).

HK 11 Physik mit schweren Ionen

Zeit: Freitag 16:30–19:00 Raum: TU MA042

Gruppenbericht

HK 11.1 Fr 16:30 TU MA042

Kaon and pion production in heavy-ion collisions at 1-40 A GeV — •Alexei Larionov, Ulrich Mosel, and Markus Wagner — Institut für Theoretische Physik, Universität Giessen, Germany

We present transport calculations of heavy-ion collisions at SIS, AGS and lower SPS energies basing on the BUU model [1]. At SIS energies we study an influence of the K^+ mean field potential on the phase space distributions of kaons. To describe the data on the in-plane flow, a strong repulsive K^+ potential (+30 MeV at $\rho = \rho_0$) is needed in order to compensate an effect of the Lorentz force caused by the space component of the kaon vector field, in agreement with [2]. We show that also the K^+ azimuthal distribution is well described using the same potential. At AGS and SPS energies we introduce the new meson-meson channels of the $K\bar{K}$ production which leads to the enhancement of the K^+/π^+ ratio in central Au+Au and Pb+Pb collisions in a better agreement with data. We also propose a simple method to take into account the in-medium (Dirac) masses of incoming and outgoing particles in FRITIOF events and study an influence of this effect on particle production. Supported by GSI Darmstadt.
[1] M. Effenberger, E.L. Bratkovskaya, and U. Mosel, Phys. Rev. C **60**, 44614 (1999); M. Effenberger, PhD thesis, Uni. Giessen, 1999, http://theorie.physik.uni-giessen.de/html/dissertations.html.
[2] Y.-M. Zheng, C. Fuchs, A. Faessler, K. Shekhter, Y.-P. Yan and C. Kobdaj, Phys. Rev. C **69**, 034907 (2004).

HK 11.2 Fr 17:00 TU MA042

Results from C+C reactions at 2 GeV per nucleon at HADES* — •Peter Zumbruch[1], Malgorzata Sudol[1], Tassilo Christ[2], and Kalliopi Kanaki[3] for the HADES collaboration — [1]Gesellschaft für Schwerionenforschung Darmstadt — [2]Technische Universität München — [3]Forschungszentrum Rossendorf

HADES, the High Acceptance Di-Electron Spectrometer operational at the GSI SIS facility in Darmstadt, designed to study pair correlations of leptons emitted in heavy ion as well as elementary reactions, offers due to its large acceptance and momentum reconstruction precision also the possibilities to study hadrons and hadronic pair correlations in detail.
This paper will report on analysis and the results taken in two beam-times in November 2001 and November 2002 with an incindent energy of 2 GeV per nucleon. Besides single particle production we will present results from hadronic pair correlations.
The K^0_S meson with its decay channel $K^0_S \rightarrow \pi^+\pi^-$ and a lifetime of 8.9×10^{-11} ns, is a valuable candidate to explore the identification and track reconstruction capabilities of the HADES setup.
The results will be contrasted/compared to simulations as well as available experimental data.
*supported by GSI, BMBF, DFG, INTAS, EC

Gruppenbericht

HK 11.3 Fr 17:15 TU MA042

The Compressed Baryonic Matter (CBM) Experiment at FAIR — •Volker Friese for the CBM collaboration — Gesellschaft für Schwerionenforschung mbH Darmstadt

The goal of the proposed Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt is to explore the QCD phase diagram in the region of the highest baryon densities. The beam energy range (up to 45 AGeV (35 AGeV) for nuclei with Z = 0.5A (0.4 A)) is well suited to study fundamental aspects of QCD including the chiral and deconfinement phase transition at high baryon densities, the critical endpoint of the deconfinement phase transition, the properties of highly compressed baryonic matter and the in-medium properties of hadrons. The corresponding key observables include low-mass vector mesons decaying into electron-positron pairs which serve as penetrating probes, hidden and open charm produced at threshold beam energies, (multi-) strange hyperons, and global features like collective flow of hadrons and event-by-event fluctuations of observables. The CBM detector is designed as a universal instrument measuring both hadrons and electrons with large acceptance. Particular technical challenges are the operation of detectors at very high particle intensities and the handling of very high data rates. A status report will be presented.

Gruppenbericht

HK 11.4 Fr 17:45 TU MA042

Mass and Isospin Effects in Multifragmentation — •Concettina Sfienti for the ALADiN2000 collaboration — GSI, Planckstr. 1, D-64291 Darmstadt

A systematic study of isospin effects in the breakup of projectile spectators at relativistic energies has been performed with the ALADiN

spectrometer at the GSI laboratory. Four different stable and unstable projectiles ^{197}Au, ^{124}La, ^{124}Sn and ^{107}Sn, all with an incident energy of 600 AMeV, have been used, thus allowing a study of various combinations of masses and N/Z ratios in the entrance channel.
The measurement of the momentum vector and of the charge of all projectile fragments with $Z > 1$ entering the acceptance of the ALADiN magnet has been performed with the high efficiency and resolution achieved with the TP-MUSIC IV detector.
The Rise and Fall behavior of the mean multiplicity of IMFs as a function of Z_{bound} and its dependence on the isotopic composition has been determined for the studied systems. Other observables investigated so far include mean N/Z values of the emitted light fragments and neutron multiplicities.

HK 11.5 Fr 18:15 TU MA042

Spectator response to the participant blast in the reaction 197Au+197Au at 1A GeV - results of the first dedicated experiment — •Vladimir Henzl for the CHARMS collaboration — GSI, Planckstr. 1, 64291, Darmstadt, Germany

The response of the spectators to the participants' blast can result in a gain of the residue longitudinal momenta such that the mean spectator-like residue velocities can exceed the velocity of the original projectile. Such re-acceleration effect is predicted to exhibit sensitivity to the momentum-dependent properties of the nuclear mean field and at the same time stay almost unaffected by the stiffness of the nuclear matter. This indicates that the re-acceleration of projectile spectators represents a new tool for investigating the momentum dependent properties of nuclear matter and its impact on the nuclear EOS.

This contribution presents the results of the first experiment entirely dedicated to the precise measurements of the momenta of the projectile fragments in the reaction 197Au+197Au at 1 A GeV performed with the high-resolution magnetic spectrometer FRS at GSI-Darmstadt. The experimental results are confronted with BUU calculations for different nuclear equations of state and mean-field potentials.

HK 11.6 Fr 18:30 TU MA042

Isotopically resolved residues from the fragmentation of projectiles with largely different N/Z — •Daniela Henzlova for the CHARMS collaboration — GSI Darmstadt, Planckstrasse 1, 642 91, Germany — on leave from Nuclear Physics Institute, 25068 Rez, Czech Republic

With the use of the high-resolution magnetic spectrometer, the FRagment Separator (FRS), at GSI Darmstadt, the isotopic identification of the final residues may be extended up to the mass of the heavy projectile. The dependence of the isotopic composition of final residues on the N/Z of the projectile is studied over the full range of residue charge for 136Xe (N/Z=1.519) and 124Xe (N/Z=1.296) projectiles, fragmenting in a lead target at 1 A GeV. The final mean N-over-Z of the final residues as well as the ratio of isotopic yields from both reactions is investigated. The final mean N-over-Z preserves a memory on the N/Z of the projectile for all charges, a feature which may be related to the break-up of the highly excited primary fragment. The sensitivity of the data to the thermal conditions at the freeze-out after break-up is explored and the isospin-thermometer method is applied to deduce the corresponding freeze-out temperature. The ratios of the isotopic yields from the two reactions exhibit exponential dependence on N and Z, the observation termed isoscaling. The corresponding logarithmic slope is used to extract the symmetry-term coefficient.

HK 11.7 Fr 18:45 TU MA042

Systematic study of spallation reactions in inverse kinematics at the FRS at GSI. — •Maria Valentina Ricciardi[1], P. Armbruster[1], J. Benlliure[1,2], M. Bernas[3], A. Boudard[4], E. Casarejos[2], S. Casarejos[5], T. Enqvist[1], B. Fernandez[4], A. Kelic[1], S. Leray[4], P. Napolitani[1,3], J. Pereira[2], F. Rejmund[1,3], K.-H. Schmidt[1], C. Stéphan[3], J. Taieb[1,3], L. Tassan-Got[3], C. Villagrasa[4], C. Volant[4], W. Wlazlo[4], and O. Yordanov[1] — [1]GSI Darmstadt, Germany — [2]Univ. Santiago de Compostela, Spain — [3]IPN Orsay, France — [4]DAPNIA / SPhN CEA / Saclay, France — [5]CEN Bordeaux, France

In 1996, at GSI, Darmstadt, a European collaboration started a dedicated experimental program to investigate spallation reactions. Spallation residues and fission fragments from ^{238}U, ^{208}Pb, ^{197}Au, ^{136}Xe and ^{56}Fe projectiles, in the energy range 200-1500 MeV per nucleon, irradiating liquid ^{1,2}H targets were studied with the FRagment Separator for magnetic selection of reaction products including ray-tracing, energy-loss and ToF techniques. All nuclides were fully identified, and from the longitudinal-momentum evaporation residues and fission fragments could be separated. For almost all the produced nuclides, production cross-sections and velocity distributions were determined. These results provided an important insight into the physics of these reactions. In addition, these data are relevant for the design of ADS and RIBs facilities.

HK 12 Theorie

Zeit: Freitag 16:30–19:00 Raum: TU MA041

Gruppenbericht

HK 12.1 Fr 16:30 TU MA041

Signal of confinement in SU(2) propagators — •Kurt Langfeld, Gunnar Schulze, Wolfgang Lutz, and Hugo Reinhardt — Institute for Theoretical Physics, University of Tuebingen, D-72076 Tuebingen

Recently, a tight relation was established [1] between the Gribov-Zwanziger horizon criterion for confinement and the vortex picture, using the Maximal Center Gauge. On the basis of these findings, we show that the Maximal Center Gauge disentangles the confining degrees of freedom from the gluon and ghost fields; the latter fields appear in Landau gauge. The gluon-, ghost- and center field propagators are studied. It is shown that the ghost form factor is finite in the IR limit while the center fields act as confiners. Finally, the investigation of the low lying eigenmodes of a chirally improved Dirac operator reveals an intimate relation between the center fields and spontaneous chiral symmetry breaking.

[1] Gattnar, Langfeld, Reinhardt, Phys. Rev. Lett. 93, 061601 (2004)

HK 12.2 Fr 17:00 TU MA041

The infrared behaviour of QCD propagators at non-vanishing temperatures and densities — •D. Nickel[1], R. Alkofer[2], B. Grüter[2], A. Maas[1], W. Schleifenbaum[1], and J. Wambach[1] — [1]Institute for Nuclear Physics, Technical University Darmstadt — [2]Institute of Theoretical Physics, Tübingen University

The propagators of QCD, and especially their infrared behavior, contain important information about the phase structure of matter. In our work [1,2,3] we investigate these with a truncated system of Dyson-Schwinger equations in Landau gauge.

We present for the Yang-Mills propagators analytical and numerical results at non-vanishing temperatures. These are in quantitative and qualitative agreement with corresponding lattice results. It turns out that the chromomagnetic sector stays confining even at infinite temperatures.

For the quark propagator at finite chemical potentials we explore the chirally broken and unbroken phase, as well as the superconducting 2SC and CFL phase. The pressure difference between both phases is approximately determined. This method bridges the gap between weak coupling investigations at high densities and densities of the order of nuclear saturation.

[1] A. Maas et al., Eur. Phys. J. **C37** (2004) 335.
[2] B. Grüter et al., arXiv:hep-ph/0408282.
[3] W. Schleifenbaum et al., arXiv:hep-ph/0411052.

Supported by the BMBF under grant number 06DA116, and by the Helmholtz association (Virtual Theory Institute VH-VI-041).

HK 12.3 Fr 17:15 TU MA041

Topologically non-trivial QCD field configurations on the lattice — •Stefan Solbrig[1], Christof Gattringer[1], Hugo Reinhardt[2], Jochen Gattnar[2], Kurt Langfeld[2], Torsten Tok[2], and Andreas Schäfer[1] — [1]Institut für Theoretische Physik, Universität Regensburg, 93040 Regensburg — [2]Institut für Theoretische Physik, Auf der Morgenstelle 14, 72076 Tübingen

Gluon field configurations with non-trivial topology play a crucial role in QCD. Instantons are clearly related to chiral symmetry breaking and center vortices are strongly correlated with confinement. We present evidence, that there is a deep connection between these two classes of objects. We use the chirally improved lattice Dirac operator to compute eigenvectors and eigenvalues of various lattice gauge field configurations.

Removing the vortices from thermalized configurations also removes the topological content of the gauge field. As a consistency check, we apply random changes to raw configurations.

(Supported by BMBF)

HK 12.4 Fr 17:30 TU MA041

Nuclear Lattice Simulations with Chiral Effective Field Theory — •B. Borasoy[1], D. Lee[1], and T. Schaefer[2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn, Germany — [2]Physics Department, North Carolina State University, Raleigh, USA

We study nuclear and neutron matter by combining chiral effective field theory with non-perturbative lattice methods and treating nucleons and pions as point particles on a lattice. This allows us to probe larger volumes, lower temperatures, and greater nuclear densities than in lattice QCD. The low energy interactions of these particles are governed by chiral effective theory and operator coefficients are determined by fitting to zero temperature few-body scattering data. The leading dependence on the lattice spacing can be understood from the renormalization group and absorbed by renormalizing operator coefficients. In this way a realistic simulation of many-body nuclear phenomena is obtained with no free parameters, a systematic expansion, and a clear theoretical connection to QCD. Results for hot neutron matter at temperatures 20 to 40 MeV and densities below twice nuclear matter density are presented.

Financial support of the DFG, DOE and NSF is gratefully acknowledged.

[1] D. Lee, B. Borasoy and T. Schaefer, Phys. Rev. C70 (2004) 014007.

HK 12.5 Fr 17:45 TU MA041

Automated Generation of Feynman Rules for Lattice Chiral Perturbation Theory — •Georg von Hippel[1,2], Buğra Borasoy[3], Alistair Hart[4], Ron Horgan[2], and Randy Lewis[1] — [1]Department of Physics, University of Regina, Regina, SK, S4S 0A2, Canada — [2]DAMTP, CMS, University of Cambridge, Cambridge CB3 0WA, U.K. — [3]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn, Nußallee 14-16, 53115 Bonn, Germany — [4]School of Physics, University of Edinburgh, King's Buildings, Edinburgh EH9 3JZ, U.K.

We present an algorithm to systematically and efficiently generate Feynman rules for chiral perturbation theory on a lattice, which is based on a similar algorithm implemented by some of the authors for the case of improved actions in lattice QCD [1]. A program written in Python performs the perturbative expansion of the lattice action and generates the vertices and propagators, which then can be output in either a human-readable format or as data files that can serve as input for programs to perform automated numerical evaluations of lattice Feynman diagrams. A FORTRAN library is presented as an example of the latter approach. We expect this automated approach to significantly facilitate future calculations in lattice-regularized χPT.

[1] A. Hart, G.M. von Hippel, R.R. Horgan, L.C. Storoni, Automatically generating Feynman rules for improved lattice field theories, submitted to J.Comp.Phys.

HK 12.6 Fr 18:00 TU MA041

Quark mass dependence of nucleon properties and lattice QCD — •Massimiliano Procura, Thomas R. Hemmert, Bernhard U. Musch, and Wolfram Weise — Institute for Theoretical Physics (T39), TU München, Germany

We present an updated analysis of the quark mass dependence of the nucleon mass M_N [1,2] and the nucleon axial-vector coupling constant g_A [2], comparing two different formulations of $SU(2)$ Baryon Chiral Effective Field Theory, with [3] and without [4] explicit $\Delta(1232)$ degrees of freedom. We perform an interpolation of these nucleon properties between their physical values and sets of fully dynamical two-flavor lattice QCD data. We obtain good interpolation functions already at the one-loop level. The inclusion of $\Delta(1232)$ as an explicit degree of freedom turns out to be not essential for the nucleon mass, but crucial for g_A. Our study represents a first step towards a systematic approach for chiral extrapolation of lattice results for nucleon observables.

Work supported in part by DFG and BMBF.

[1] M. Procura, T.R. Hemmert and W. Weise, Phys. Rev. D69 (2004).
[2] M. Procura, T.R. Hemmert, B.U. Musch and W. Weise, in preparation.
[3] V. Bernhard, T.R. Hemmert and U.-G. Meißner, Phys. Lett. B565 (2003).
[4] T. Becher and H. Leutwyler, Eur. Phys. J. C9 (1999).

HK 12.7 Fr 18:15 TU MA041

A Nucleon in a Tiny Box — •Harald W. Griesshammer — T39, Technischen Universität München, D-85747 Garching

Chiral Perturbation Theory techniques are used to compute the nucleon mass-shift due to finite-volume and temperature effects. We interpolate between the infinite-volume limit and very small volumes (the "ϵ-régime" $1/\Lambda_\chi \ll L \sim \beta \ll 1/m_\pi$ as first discussed by Gasser and Leutwyler). This first extension to nucleons can be used to extrapolate lattice results from temporal and spatial sizes smaller than the pion cloud and avoids the numerically costly simulation of Physics well under theoretical control. Based on the two leading orders, we discuss the convergence of the expansion as a function of the lattice size and quark masses. An extraction of the experimentally ill-determined low-energy coefficients c_2, c_3 of the chiral Lagrangean from lattice simulations at small volumes and a "magic" ratio $\beta = 1.22262L$ is possible. Further observables are commented on.

HK 12.8 Fr 18:30 TU MA041

Quarkmass Dependence of Baryon Magnetic Moments — •Tobias A. Gail and Thomas R. Hemmert — Technische Universität München

We discuss the chiral extrapolation of recent lattice data [1] for the nucleon magnetic moment using relativistic p^4 ChPT.

For the three moments of the $N\Delta$ transition the established nonrelativistic [2] and a new relativistic calculation using infrared regularization adapted for spin $\frac{3}{2}$ fields are discussed in the context of lattice data [3] and recent experimental results.

[1] M.Göckeler et al. (QCDSF Collaboration), hep-lat/0303019
[2] G.C.Gellas, T.R.Hemmert, C.N.Ktorides, G.I.Poulis, Phys.Rev.D60:054022,1999
[3] C.Alexandrou et al., Phys.Rev.D69:114506,2004

HK 12.9 Fr 18:45 TU MA041

Volume Dependence of the pion mass from Renormalization Group flows. — •Bertram Klein[1], Jens Braun[2], and Hans-Juergen Pirner[2] — [1]GSI, Planckstr.1, 64291 Darmstadt — [2]Institut fuer Theoretische Physik, Universitaet Heidelberg, Philosophenweg 19, 69120 Heidelberg

We investigate finite volume effects on the pion mass and the pion decay constant. An understanding of such effects is necessary in order to interpret results from lattice QCD and extrapolate reliably from finite lattice volumes to infinite volume.

We consider the quark-meson-model in a finite 3+1 dimensional volume. In order to break chiral symmetry in the finite volume, we introduce a small current quark mass. In the corresponding effective potential for the meson fields, the chiral O(4) symmetry is broken explicitly, and the sigma and pion fields are treated individually. Using the proper-time renormalization group (RG), we derive renormalization group flow equations in the finite volume and solve these equations in the local potential approximation.

We calculate the volume dependence of pion mass and pion decay constant and investigate the influence of different boundary conditions for the quark fields on the result.

We compare our results with results from chiral perturbation theory in finite volume and with results from lattice QCD.

HK 13 Kern- und Teilchen-Astrophysik

Zeit: Freitag 16:30–19:00 Raum: TU MA144

Gruppenbericht

HK 13.1 Fr 16:30 TU MA144

Das KASCADE-Grande Experiment — •Andreas Haungs für die KASCADE-Grande-Kollaboration — Forschungszentrum Karlsruhe, Institut für Kernphysik, 76021 Karlsruhe

Das KASCADE-Grande Experiment ist ein Multi-Detektor Aufbau zur detaillierten Messung ausgedehnter Luftschauer im Energiebereich 0.1–1000 PeV der primären kosmischen Strahlung. Die unterschiedlichen Detektorkomponenten erlauben eine gleichzeitige Vermessung der elektromagnetischen, myonischen und hadronischen Sekundärteilchenkomponente jedes einzelnen registrierten Luftschauers. Die damit gewonnene redundante Information in hoher Qualität wird ausgenutzt, um sowohl das primäre Energiespektrum und die Massenzusammensetzung der kosmischen Strahlung zu rekonstruieren, als auch um die hochenergetische hadronische Wechselwirkung in der Atmosphäre zu untersuchen. Die Ergebnisse des KASCADE-Experimentes für Energien bis zu 30 PeV und Status und Perspektiven von KASCADE-Grande werden diskutiert. Insbesondere erste Analysen der Daten eines Antennenarrays (LOPES) zur Messung der Radio-Emission in Luftschauern werden vorgestellt.

Gruppenbericht

HK 13.2 Fr 17:00 TU MA144

Status und Ziele des solaren Neutrinoexperiments BOREXINO — •Lothar Oberauer für die Borexino-Kollaboration — Physik Departement E15, Technische Universität München

Mit BOREXINO soll der niederenergetische Teil des solaren Neutrinospektrums vermessen werde. Die Neutrinos werden über die elastische Elektronstreuung in einem grossvolumigen Flüssigszintillator nachgewiesen. Damit können die thermonuklearen Fusionsprozesse im Innern der Sonne detailliert studiert und der Effekt der Sonnenmaterie auf Neutrinooszillationen nachgewiesen werden. Zudem können über eine "long-baseline"Messung von Reaktorneutrinos Oszillationsparameter überprüft werden. Der Nachweis von Geoneutrinos kann Aufschluss über den Einfluß der Radioaktivität zur terrestischen Wärmeerzeugung liefern. Bei einer Supernova des Typs II in unserer Milchstrasse können über mehrere flavourspezifische Neutrinoreaktionen Informationen über den Gravitationskollaps gewonnen werden. Im Vortrag wird der Status von BOREXINO gezeigt, Probleme beim Nachweis niederenergetischer Neutrinos diskutiert und das physikalische Programm von BOREXINO und zukünftiger Projekte auf diesem Gebiet aufgezeigt.

HK 13.3 Fr 17:30 TU MA144

Status des KATRIN Experiments — •Joachim Wolf für die KATRIN-Kollaboration — Universität Karlsruhe (TH), Institut für experimentelle Kernphysik

Die Skala der absoluten Neutrinomassen ist von fundamentaler Bedeutung für die Kosmologie und die Astroteilchenphysik. Die Bestimmung dieser Skala stellt daher eine vordringliche Aufgabe für die experimentelle Neutrinophysik der kommenden Jahre dar. Das KArlsruhe TRItium Neutrinomassenexperiment ist ein Tritiumzerfallsexperiment der nächsten Generation, das es erlaubt, die Sensitivität bei der Suche nach der Neutrinomasse um eine Größenordnung zu verbessern. KATRIN basiert auf der Kombination einer fensterlosen molekularen Tritiumquelle hoher Luminosität und einem hochauflösenden System von zwei elektrostatischer Retardierungsspektrometern (MAC-E-Filtern). Das Signal einer Neutrinomasse von $m_\nu = 0,35(0,30)$ eV/c^2 kann mit einer Evidenz von $5(3)\sigma$ gemessen werden. Falls kein Hinweis auf eine Neutrinomasse gefunden werden sollte, erreicht das KATRIN Experiment nach 3 Jahren Meßzeit eine Sensitivität von $m_\nu < 0,2$ eV/c^2 (90%CL).

Der Vortrag gibt einen Überblick über das KATRIN-Experiment und berichtet vom Status und Ergebnissen erster Messungen mit dem Vorspektrometer. Teilweise gefördert vom BMBF unter den Förderkennzeichen 05CK1VK1/7, 05CK1UM1/5 und 05CK2PD1/5

HK 13.4 Fr 17:45 TU MA144

Deuteron-Induced Reactions on Light Odd-Odd Nuclei at Very Low Energies — •K. Czerski, D. Bemmerer, T. Dorsch, P. Heide, M. Hoeft, A. Huke, and G. Ruprecht — Institut für Atomare Physik und Fachdidaktik, Technische Universität Berlin, Germany

Nuclear reactions induced by deuterons on three self-conjugated nuclei ^{2}H, ^{6}Li and ^{10}B have been investigated both experimentally and theoretically at energies far below the Coulomb barrier. Besides nuclear astrophysics effects such as subthreshold resonances or an enhancement of the cross section due to electron screening, some additional phenomena such as an excitation of giant resonances and the internal isospin mixing could be observed. Furthermore, the investigations performed on ^{6}Li and ^{10}B nuclei solved some long-standing problems concerning branching ratios and experimental angular distributions for different reaction channels. A consistent description of reaction mechanisms was obtained by means of a coherent superposition of compound nucleus resonances and the direct reaction contribution. The reactions ^{2}H(d,p)^{3}H and ^{2}H(d,n)^{3}He were studied on deuterons embedded in different metallic lattices being a unique model for astrophysical strongly coupled plasmas. The electron screening energy in metallic environments was found to be larger by about one order of magnitude compared to a gas target experiment. An improved theoretical approach, based on dielectric function theory, describes the experimental results qualitatively and allows for calculations of nuclear reaction rates down to room temperature.

HK 13.5 Fr 18:00 TU MA144

Enhanced Screening of the d+d Fusion Reactions in Metallic Environments — Experimental Results and Numerical Simulations — •Armin Huke, Konrad Czerski, and Peter Heide — Institut für Atomare Physik und Fachdidaktik, Technische Universität Berlin, Berlin, Germany

The measurements of the reactions ^{2}H(d,p)^{3}H and ^{2}H(d,n)^{3}He were performed with an electrostatic accelerator at incident deuteron energies between 5 and 60 keV at different self-implanted target materials. The resulting screening energy values are about one order of magnitude larger compared to a gas target experiment and exceed significantly the theoretical predictions. A thorough investigation of the processes in the targets under deuteron ion irradiation shows that there are multi-parameter collateral effects which are crucial for the correct interpretation of the observed enhancements. They mainly originate from target surface contaminations due to residual gases in the vacuum as well as from inhomogeneities in the deuteron density distribution in heterogeneous targets. Experimental evidence for the influence of such effects and a mathematical model for their assessment are given and compared with the results of other groups. A numerical model of the electron screening effect in metallic lattices based on an ab-initio Hartree-Fock simulation is presented.

HK 13.6 Fr 18:15 TU MA144

Polarisationstransfer in der Reaktion D($\vec{d},\vec{p}$)^{3}H @ E$_d$ = 58 keV — •Astrid Imig, C. Düweke, R. Emmerich, J. Ley, K.-O. Zell und Hans Paetz gen. Schieck — IKP, Universität zu Köln

Das Verständnis des Vier-Nukleonen-Systems ist von fundamentaler Bedeutung. Die niederenergetischen Fusionsreaktionen D(d,n)^{3}He und D(d,p)^{3}H sind wichtig sowohl im Zusammenhang der Fusionsenergieproduktion als auch in astrophysikalischen Fragestellungen wie der Big-Bang-Nukleosynthese. Realistische Vorhersagen von Vier-Nukleonen-Observablen gelingen in mikroskopischer Behandlung mit Hilfe von Faddeev-Yakubovskiĭ-Gleichungen. Informationen über die Mechanismen der Kernreaktionen können durch Analysen von Wirkungsquerschnitt und Analysierstärken gewonnen werden. Jedoch fehlen im Weltdatensatz Observablen zweiter Ordnung wie Polarisationstransferkoeffizienten bei kleinen Energien. Nach der Entwicklung von hocheffizienten Polarimetern wurde daher ein Doppelstreu-Experiment zwischen der Quelle polarisierter Ionen und dem Kölner Tandembeschleuniger aufgebaut. Mit Hilfe eines eigenen Analysators zur Datenaufnahme gelang es, eine Dauermessung parallel zu anderen Experimenten am Tandembeschleuniger durchzuführen, um so eine genügende Statistik zu erhalten. Schließlich ist die Zählrate nach doppelter Streuung eine von vielen experimentellen Herausforderungen in der Untersuchung des Polarisationstransfers, desweiteren ein stark abfallender Wirkungsquerschnitt bei abnehmenden Energien. Erstmals konnte bei einer niedrigen Reaktionsenergie von 58 keV mit vektorpolarisierten Deuteronen eine Polarisationstransferobservable $K_y^{y'}$ bestimmt werden. Gefördert durch die DFG, PA 488/7-1.

HK 13.7 Fr 18:30 TU MA144

Indirect determination of the astrophysical S_{17} factor via high-energy Coulomb dissociation of ^{8}B — •F. Schümann for the S223 collaboration — Institut für Physik mit Ionenstrahlen, Ruhr-Universität Bochum, Germany

The low-energy ^{7}Be(p,g)^{8}B cross section is directly linked to the flux of high-energy solar neutrinos and their flavor oscillations. Recently, a new proton-capture measurement on ^{7}Be found a low-energy astrophysical S_{17} factor which differed markedly from previous results [1]. We have measured at GSI the same quantity by a completely different method, Coulomb dissociation of a 254 A MeV radioactive ^{8}B beam, and studied the angular correlations of the breakup particles, p and ^{7}Be. We could show that these angular correlations can be explained to good accuracy by pure E1 multipolarity [2]. From a recent reanalysis of our data we obtained results that are in good agreement with those of Ref.[1]. These results also compare favorably with recent theoretical predictions for S_{17}.
[1] A.R. Junghans et al., Phys. Rev. C 68, 065803 (2003).
[2] F. Schümann et al., Phys. Rev. Lett. 90, 232501 (2003).

HK 13.8 Fr 18:45 TU MA144

The Neutrino Asymmetry B and the Proton Asymmetry C in Neutron Decay — •Marc Schumann[1], Hartmut Abele[1], Stefan Baessler[2], Marc Deissenroth[1], Jochen Krempel[1], Michael Kreuz[3], Bastian Märkisch[1], Daniela Mund[1], Alexandre Petoukhov[3], and Torsten Soldner[3] — [1]Physikalisches Institut, Universität Heidelberg — [2]Institut für Physik, Universität Mainz — [3]Institut Laue-Langevin (ILL), Grenoble

The β-decay of the free cold neutron is an unique system to perform precision measurements on the structure of the weak interaction since corrections are very small. Correlation coefficients between the decay products may give hints on physics beyond the standard model, such as the electron asymmetry A and the proton asymmetry C test the unitarity of CKM-matrix. Both, the neutrino asymmetry B and the coefficient A are sensitive to admixtures of right handed currents.

We have measured the asymmetries B and C, i.e. the correlations between neutron spin and the momentum of neutrino or proton. The spectrometer PERKEO II was equipped with a combined electron-proton detector allowing us to reconstruct the neutrino momentum and to measure both asymmetries simultaneously. The experiment was carried out at the cold polarised neutron beam facility PF1b of the ILL in 2004. Systematic uncertainties of former PERKEO B measurements have been reduced considerably.

We will give a brief report on the experiment and its motivation and present first results.

HK 14 Hauptvorträge

Zeit: Samstag 08:30–10:00 Raum: TU MA001

Hauptvortrag

HK 14.1 Sa 08:30 TU MA001

Hyperkerne: Gestern und Morgen — •Bogdan Povh — Max-Planck-Institut Heidelberg — Träger der Stern-Gerlach-Medaille

Mit der Entdeckung der ersten Hyperkerne in den 50er Jahren hat man sofort realisiert, dass in Kernen eingebaute Lambdateilchen sich als eine einmalige Sonde anbieten. Die ersten Emulsionsexperimente waren allerdings nur auf die Untersuchung der Grundzustände leichter Hyperkerne begrenzt.

In den 70er Jahren wurden einerseits die niederenergetischen Kaonstrahlen wesentlich verbessert und andererseits die experimentellen Methoden zur Spektroskopie mit Teilchen im GeV-Energiebereich entwickelt. Dadurch wurde eine Spektroskopie angeregter Zustände quer durch die Hyperkern-Landschaft ermöglicht. Alle globalen Eigenschaften der Hyperkerne sind mittlerweile gut bekannt. Insbesondere werde ich über die Spin-Bahn-Kopplung von Lambda-, Nukleon- und Sigma-Teilchen berichten.

Eine dritte Generation von Hyperonexperimenten ist in Vorbereitung, dank dem Bau neuer Beschleuniger die der hadronischen Physik gewidmet sind. In Japan ist ein 50 GeV Beschleuniger für Neutrinophysik und ein aufwändiges Hyperonkern-Programm im Bau.

An der GSI wird ein Beschleuniger mit einem intensiven Antiprotonstrahl aufgebaut, der sich auch zur Erzeugung von Hyperkernen eignet. Präzisionsexperimente der dritten Generation werden das Verhalten der Hyperonen in dichter Kernmaterie untersuchen und möglicherweise Deconfinementeffekte aufdecken. Der Bereich der Spektroskopie der Hyperkerne soll auf multiple Lambda-, Sigma- und Xi-Hyperkerne erweitert werden.

Hauptvortrag

HK 14.2 Sa 09:00 TU MA001

Heavy-Ion Atom Collisions – Atomic Physics under Extreme Condidtions — •Andrzej Warczak — Jagiellonian University, Krakow — Träger des Marian Smoluchowski - Emil Warburg Physikpreises

One of the actual frontiers in physics is the study of matter exposed to extremely strong electromagnetic fields. In particular, highly charged ions form unique laboratories where such conditions are largely fulfilled. These species can be stored in form of intense beams and used in collision experiments. For such investigations, precise spectroscopy of photons emitted in collisions of heavy ions with atoms is required. This emission gives the details of the specific electronic transition mechanisms operating in strong fields as well as information on electronic structure of the exotic atomic systems (e.g. H-like uranium). Among others, details concerning photoionization of very heavy atoms can be revealed in such experiments when observing radiative electron capture (REC). Moreover, accurate measurements of electron binding energies are very well suited to deduce characteristic quantum electrodynamics (QED) phenomena in strong fields. QED, the basis and cornerstone of all present field theories, is the best confirmed theory in physics, however, a precise test in the strong-field limit is still pending.

Hauptvortrag

HK 14.3 Sa 09:30 TU MA001

Upcoming Hadron Physics Projects with Internal Targets - from WASA at COSY to PANDA at FAIR — •James Ritman — Forschungszentrum Juelich — Ruhr-Universitaet-Bochum

As a result of the rapid rise of the coupling constant α_s at low momentum transfers perturbation theory is not an appropriate method to describe the strong interaction. In this kinematic regime other methods such as Lattice QCD or Effective Field Theories are more appropriate to investigate the appearance of still unsettled phenomena: confinement and chiral symmetry breaking. Furthermore, the confinement of quarks and gluons to hadrons allows crucial tests of fundamental symmetries that are inherent to the QCD Lagrangian but are broken in hadronic systems. Thus, high precision measurements of the production and decay of specific hadronic states provides decisive benchmarks to investigate the properties of QCD in this regime. A new series of experiments are being prepared using nearly full acceptance detectors for neutral and charged particles around internal targets in high intensity, phase space cooled hadronic beams. Later this year it is planned to transfer the WASA detector from the CELSIUS to the COSY ring in order to measure the production and various decay channels of the eta and eta′mesons, thereby investigating the violation of P, C, T, and combinations thereof, as well as isospin violation. The experimental and theoretical techniques employed here will provide an important basis to extend these investigations to the static and dynamical properties of hadrons with charm quark content with the high energy storage ring for antiprotons at the new GSI/FAIR facility.

HK 15 Hauptvorträge

Zeit: Montag 10:15–12:15 Raum: TU MA001

Hauptvortrag HK 15.1 Mo 10:15 TU MA001

Meson Production and Decay Studies at CELSIUS-WASA* — •H. Clement for the CELSIUS-WASA collaboration — Physikalisches Institut, Universität Tübingen

At the CELSIUS cooler ring *pp* and *pd* collisions with the emission of γs, πs, η and ω have been measured using the WASA 4π detector with hydrogen and deuterium pellet targets. The WASA detector containing magnetic field, tracking detectors and calorimeters allows the detection of both charged and neutral particles.
One major aspect in the research program is the production and the decay of the η. The decay studies are being pursued in particular by use of the newly installed zero-degree spectrometer, which provides very clean η tagging in the production reaction $pd \rightarrow {}^3He\ \eta$. High-statistics runs are currently being carried out.
Another focal point are multi-pion production processes. Whereas close to threshold the data for the $pp\pi^+\pi^-$ channel exhibit features of Roper excitation and/or dynamic formation of the σ meson, at higher energies the formation of the $\Delta\Delta$ system becomes increasingly important. Surprisingly the $\pi^0\pi^0$ channel shows a systematic enhancement at small invariant masses, in ${}^3He\pi^0\pi^0$ this is even much larger than expected from Bose-Einstein correlations - pointing possibly to (dynamic) isospin breaking due to $\pi\pi$ rescattering. Also, in the invariant mass spectrum $M_{\gamma\gamma}$ a small, narrow line has been observed at $M_{\gamma\gamma} = 2m_\pi$. In search of the nature of this line we pursue a variety of scenarios.
* supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg) and Landesforschungsschwerpunkt (Quasiteilchen)

Hauptvortrag HK 15.2 Mo 10:45 TU MA001

First Results from the CERN Axion Solar Telescope — •F. H. Heinsius for the CAST collaboration — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The axion has been postulated as a light pseudo-scalar particle to solve the problem of an absence of CP violation in strong interactions and could be a candidate for dark matter. Solar axions can be converted by the Primakoff process to X-rays in a magnetic field. A prototype LHC magnet has been set up for the CERN Axion Solar Telescope (CAST) to detect axions for masses below 0.02 eV through its coupling to photons. The magnet is mounted on a platform with $\pm 8°$ vertical and $\pm 40°$ horizontal movement to follow the sun track. At the ends of the 9.26 m long, 9 Tesla magnet three low noise X-ray detectors have been mounted. A micromesh gas chamber and a CCD measures 90 minutes during sunrise, a time projection chamber during sunset. New upper limits will be presented as well as future plans to extend the significance in the mass range up to 1 eV.

The project is supported by BMBF.

Hauptvortrag HK 15.3 Mo 11:15 TU MA001

Exploring the QCD phase diagram — •Christoph Blume for the NA49 collaboration — Institut für Kernphysik, J.W.Goethe Universität Frankfurt am Main

In the recent years the NA49 experiment at the CERN SPS has collected data on heavy ion reactions in the beam energy range 20 - 158 AGeV. Together with data from the AGS and RHIC, this allows for a comprehensive study of the energy dependence of various hadronic observables. In my talk I would like to review results of this study and will discuss what we have learned about the QCD phase diagram. Of prime interest is the question whether a possible phase transition to a quark gluon plasma is reflected in these observables.

Hauptvortrag HK 15.4 Mo 11:45 TU MA001

Exploring the *"Island of Inversion"*: Coulomb excitation of ^{30}Mg and ^{32}Mg with MINIBALL at REX-ISOLDE — •Heiko Scheit for the REX-MINIBALL collaboration — Max-Planck-Institut für Kernphysik, Heidelberg

Since the discovery in 1975 [1] that the neutron rich ^{31,32}Na isotopes are more tightly bound than expected, the unusual properties of the neutron-rich Na and Mg isotopes in this region (*"island of inversion"*) near the $N = 20$ shell closure are subject of intense theoretical and experimental investigations. Nevertheless, the knowledge on these nuclei is sparse and some of the existing experimental data are not consistent, e.g. the $B(E2; 0^+_{gs} \rightarrow 2^+_1)$ values for ^{30,32}Mg measured by different groups differ from each other by as much as a factor of two [2-4].

We therefore studied the collective properties of the neutron-rich isotopes ^{30,32}Mg at the energy-upgraded REX-ISOLDE facility using the MINIBALL array to detect the de-excitation γ rays after "safe" Coulomb excitation.

After a short introduction to REX and MINIBALL the present status of our knowledge of the structure of the nuclei in or near the "island of inversion" will be reviewed with special emphasis on the collectivity of the $0^+_{gs} \rightarrow 2^+_1$ excitation in ^{30,32}Mg.

[1] C. Thibault *et al.*, Phys. Pev. C **12**, 644 (1975)
[2] T. Motobayashi *et al.*, Phys. Lett. B **346**, 9 (1995)
[3] B.V. Pritychenko *et al.*, Phys. Lett. B **461**, 322 (1999)
[4] V. Chisté *et al.*, Phys. Lett. B **514**, 233 (2001)

HK 16 Elektromagnetische und Hadronische Proben

Zeit: Montag 14:00–16:00 Raum: TU MA001

HK 16.1 Mo 14:00 TU MA001

First measurement of helicity dependent photoabsorption cross sections on the neutron from 815 to 1825 MeV — •Jochen Krimmer für die GDH-Kollaboration — Physikalisches Institut der Universität Tübingen, Germany

Helicity dependent total photoabsorption cross sections on the deuteron have been measured for the first time at ELSA (Bonn) in the photon energy range from 815 to 1825 MeV. Circularly polarized tagged photons impinging on a longitudinally polarized LiD target have been used together with a highly efficient 4π detector system. The data around 1 GeV are not compatible with predictions from existing multipole analyses. From the measured energy range an experimental contribution to the GDH integral on the neutron of $(33.9 \pm 5.5(\text{stat}) \pm 4.5(\text{syst}))\ \mu$b is extracted.

HK 16.2 Mo 14:15 TU MA001

Status of the GDH Experiment on the Deuteron at MAMI — •Oliver Jahn for the A2 collaboration and the GDH collaboration — Institut für Kernphysik, Becherweg 45, 55099 Mainz

The GDH sum rule connects ground state properties of the nucleon with helicity dependent cross sections. To investigate these cross sections on the deuteron, experiments have been carried out in the A2-Collaboration at the Mainz Microtron, Germany, in 1998 and in 2003, using circularly polarized photons on a polarized d-butanol target. A status report of the data analysis and latest results from the pilot experiment of 1998 are given.

HK 16.3 Mo 14:30 TU MA001

Das Crystal Ball/TAPS Experiment am Mainzer Mikrotron — •Martin Kotulla — Universität Basel, Basel, Schweiz

Ein 4π Kalorimeter wurde am Mainzer Mikrotron (MAMI) für Experimente mit reellen Photonen aufgebaut. Die Energie der Photonen wird dabei mit dem Glasgow-Mainz Tagger markiert. Der Crystal Ball Detektor, bestehend aus 672 NaJ Kristallen, deckt dabei den überwiegenden Raumwinkelanteil in diesem Aufbau ab und ist im Vorwärtswinkelbereich ergänzt durch das BaF_2-Kalorimeter TAPS (510 Detektoren). Beide Detektorsysteme sind unabhängig voneinander mit einer neuen modernen Elektronik und Datenerfassung ausgestattet worden. Zusätzlich sind ein zylindrischer Plastikdetektor umgeben von zwei Drahtkammern zur Teilchenidentifikation und Spurrekonstruktion installiert.

Das Experimentierprogramm begann im Juni 2004 und wird im Überblick mit ersten vorläufigen Ergebnissen vorgestellt. Dazu gehört die Untersuchung der Struktur des Nukleons und seiner Resonanzanregungen durch die Messung sensitiver Observablen mithilfe linear und zirkular polarisierter Photonen sowie der Bestimmung des magnetischen Dipolmoments der $\Delta^+(1232)$ Resonanz. Mit Präzisionsmessungen

kann die chiralen Störungstheorie durch die π^0- und $2\pi^0$-Produktion an der Schwelle getestet werden und die Mediummodifikation der $\pi\pi$-Wechselwirkung in nuklearer Materie untersucht werden. Tests der C und CP Invarianz werden mit der Untersuchung seltener Zerfälle des η-Mesons durchgeführt.

HK 16.4 Mo 14:45 TU MA001

η and η' photoproduction off the deuteron and off the proton — •Igal Jaeglé — Universität Basel, CH-4056 Basel, Klingelbergst. 82

The photoproduction of η and η' mesons off the deuteron and off the proton has been measured up to 2.8GeV at the tagged photon beam of the Bonn ELSA accelerator with a combined setup of the Crystal Barrel and TAPS detectors, which formed a 4π electromagnetic calorimeter. For the deuteron, the mesons were detected in coincidence with the (participant) recoil nucleons. Models predict a strong rise of the ratio at higher energies due to the contribution from other resonances such as $D_{15}(1675)$. An alternative explanation is the possible photoexcitation of the non-strange pentaquark state, which is associated with the second member of an antidecuplet of exotic baryons. Angular distributions and photon beam asymetries will be analysed in view of these effects.
Furthermore the invariant mass region around 2 GeV where many resonances are predicted is still not very well explored. The finding and investigation of selective channels which couple only to a very small number of resonances is very desirable. In that sense, the photoproduction of η' mesons off the proton is a promising tool, since at threshold only a few partial waves contribute. So far, the current data status is very poor and insensitive. The measurement of η' production off the deuteron is the first attempt to study this reaction on the neutron. It aims furthermore at an investigation of the threshold behaviour (η' nucleon - interaction) on the deuteron. We will discuss preliminary results.

HK 16.5 Mo 15:00 TU MA001

Messung der Photoproduktion von $\pi^0\omega$ am Proton und der Reaktion γp $\rightarrow$ $\Delta\omega$ — •Jörg Junkersfeld für die CBELSA-Kollaboration — Hemholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

Das CBELSA-Experiment verfügt über einen hervorragend zur Untersuchung von Multiphoton-Endzuständen geeigneten Detektor, mit dem bereits die totalen und differentiellen Wirkungsquerschnitte der Reaktionen $\gamma p \rightarrow p\pi^0$ und $\gamma p \rightarrow p\eta$ erfolgreich gemessen und zu neuen Energie- und Winkelbereichen erweitert wurden.

In diesem Vortrag werden Ergebnisse zur Photoproduktion von $\pi^0\omega$ am Proton vorgestellt, wobei insbesondere auf Δ-Resonanzen, die über $\Delta\omega$ in $p\pi^0\omega$ zerfallen, eingegangen wird. Von einigen *Fehlenden Resonanzen* wird erwartet, dass sie eine hohe Photokopplung und eine starke Kopplung an $\Delta\omega$ besitzen [1] und somit in diesem Kanal auftauchen. In diesem Vortrag werden totale und differentielle Wirkungsquerschnitte für die Reaktionen vorgestellt.

Gefördert durch den SFB Transregio 16.

[1] S. Capstick and W. Roberts. *Phys. Rev.*, D57:4301–4309, 1998.

HK 16.6 Mo 15:15 TU MA001

Omega production on the nucleon with linearly polarised photons at ELSA* — •Frank Klein for the CBELSA/TAPS collaboration — Physikalisches Institut, Universität Bonn

The reaction $\vec{\gamma} + N \rightarrow \omega + N$ was measured at the electron accelerator ELSA with the Crystal Barrel and TAPS calorimeter.

A 3.2 GeV electron beam from ELSA was used to obtain a tagged photon beam (0.6 - 2.6 GeV) by bremsstrahlung from a crystal radiator. Utilising the coherent bremsstrahlung at the aligned crystal radiator, we have produced linear polarised photons up to 2 GeV with a maximum degree of polarization of about 50%. The photon beam impinged on a 5 cm long liquid hydrogen or deuterium target in the center of the Crystal Barrel detector. The 1290 CsI(Tl) crystals of the Crystal Barrel were complemented in this setup by 528 BaF_2 crystals of the TAPS detector. The TAPS modules were arranged as a forward wall to cover the polar angles up to 30°. The combination of these two detectors yields an azimuthally symmetric electromagnetic calorimeter, which covers 90% of 4π and is ideally suited for multi-photon final states and polarisation measurements. The measurement of polarisation observables in addition to the angular distribution of the omega production will help to disentangle the involved baryon resonances. This improves the identification of specific resonances. The neutral decay cascade of the omega: $\omega \rightarrow \pi^0\gamma \rightarrow 3\gamma$ is used to reconstruct the produced ω. The status of the analysis of the photon beam asymmetry Σ and the unpolarized cross section will be reported.

* supported by DFG (SFB/TR 16).

HK 16.7 Mo 15:30 TU MA001

η photoproduction on nuclei — •Thierry Mertens — Universität Basel, CH-4056 Basel, Klingelbergst. 82

Total photo-absorption cross sections on nuclei show a clear disappearance of the second resonance region. Theoritical models predict such a depletion caused by a large increase of the $D_{13}(1520)$ width. The η photoproduction on nuclei is a very powerful tool to investigate properties and possible in-medium modification of the $S_{11}(1535)$ resonance. It allows us to select one particular resonance since η photoproduction in this energy range is completely dominated by the excitation of the $S_{11}(1535)$. The Experiments have been carried out using the combined Crystall Barrel and Taps detectors at the ELSA accelerator facility in Bonn with an incident photon beam up to 2.2 GeV. The inclusive η cross section covering the entire lineshape of the $S_{11}(1535)$ has been measured on four nuclear targets: carbon, calcium, nyobium and lead. Furthermore the final state interaction of η mesons in nuclear matter was analysed in view of the η -mean free path. Previous experiments extracted an average value of $\approx$ 2 fm using incident photons up to 800 MeV. This is the region where the η - nucleon interaction is dominated by the excitation of the $S_{11}(1535)$. The present experiment extends to much larger momenta of the η meson.

HK 16.8 Mo 15:45 TU MA001

Σ^+ production in photonuclear reactions — •Mariana Nanova for the CBELSA/TAPS collaboration — II. Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

The exclusive study of the reaction $\gamma p \rightarrow \Sigma^+(1189)K^{*0}$ leading to the $p4\pi^0$ final state is presented. The experiment has been performed at the tagged photon facility of the ELSA accelerator (Bonn), using photons in the energy range up to 3.3 GeV. Data have been taken using lineary polarised photons with the polarisation peak at 1950 MeV. The 8 photon final state is detected in the Crystal Barrel and TAPS detector system which provides an almost 4π coverage for photon detection. The analysis has been checked by studying known reactions leading to the same final state, i.e. $\gamma p \rightarrow p\pi^0\eta \rightarrow p4\pi^0$. The total cross section for the reaction $p(\gamma, \Sigma^+K^{*0})$ has been measured from threshold to 2600 MeV and will be compared to theoretical calculations [1].

[1] Q. Zhao et al. , Phys. Rev. C 64, (2001) 052201

HK 17 Kernphysik/Spektroskopie

Zeit: Montag 14:00–16:00 Raum: TU MA004

Gruppenbericht HK 17.1 Mo 14:00 TU MA004

Search for New Shell Structure in Neutron-Rich Cr Isotopes* — •A. Bürger[1], T. Saito[2], A. Al-Khatib[1], A. Banu[2], T. Beck[2], F. Becker[2], P. Bednarczyk[2], G. Benzoni[3], P. Doornenbal[4], J. Gerl[2], H. Geissel[2], M. Górska[2], H. Grawe[2], J. Grębosz[2], G. Hammond[5], H. Hübel[1], M. Kavatsyuk[2], O. Kavatsyuk[2], I. Kojuharov[2], M. Kmiecik[6], N. Kurz[2], R. Lozeva[2], A. Maj[6], S. Mandal[2], Zs. Podolyák[7], P. Reiter[4], N. Saito[2], H. Weick[2], O. Wieland[3], and H.-J. Wollersheim[2] for the RISING collaboration — [1]HISKP, Univ. Bonn — [2]GSI, Darmstadt — [3]Univ. Milano, Italy — [4]IKP, Univ. Köln — [5]Keele Univ., UK — [6]IFJ PAN, Kraków, Poland — [7]Univ. of Surrey, UK

Very neutron rich nuclei may exhibit new shell structure due to the monopole part of the effective nuclear interaction and a modification of the spin-orbit force. For the Cr isotopes, the excitation energies of the first 2^+ states suggest a possible subshell closure at $N = 32$ [1], however $B(E2)$ values as a crucial signature are missing for instable isotopes. We have determined the $B(E2; 2^+ \rightarrow 0^+)$ for ^{54,56,58}Cr from relativistic Coulomb excitation using the FRS-RISING setup at GSI. The Cr ions produced by fragmentation of a high-energy ^{86}Kr beam impinged on a secondary Au target at an energy of $\approx 100 \cdot A$ MeV. Gamma-rays were observed by the Ge Cluster detectors of the RISING setup and recorded together with particle and position information. The $B(E2)$ values for ^{54,56,58}Cr will be compared to results of new shell model calculations.

[1] D. Appelbe *et al.*, Phys. Rev. C **67**, 034309 (2003)
*Supported by BMBF, DFG and the Polish Committee for Scientific Research.

HK 17.2 Mo 14:30 TU MA004

Coulombanregung von neutronenreichen Cd-Isotopen an REX-ISOLDE* — •T. Behrens[1], V. Bildstein[2], R. Gernhäuser[1], Th. Kröll[1], R. Krücken[1], D. Martin[3], T. Morgan[4], A. Scherillo[3], P. Thirolf[4], and N. Warr[3] for the MINIBALL collaboration — [1]Physik-Department E12, TU München — [2]MPI für Kernphysik, Heidelberg — [3]Institut für Kernphysik, Universität Köln — [4]Sektion Physik, LMU München

In jüngerer Zeit wurde entdeckt, dass die B(E2) Werte bei neutronenreichen Sn und Te Isotopen trotz sinkender Anregungsenergie des ersten 2^+ Zustandes niedriger sind als man es aus gängigen Systematiken erwartet hatte [1,2]. Das Ziel des bei REX-ISOLDE am CERN durchgeführten Experimentes IS411 ist es, die B(E2;$0^+ \rightarrow 2^+$) Werte in neutronenreichen gg-Kernen mit einer Masse in der Gegend von $A \approx 140$ zu messen. In einer ersten Messkampagne 2004 haben wir die an die Coulombanregung von ^{122,124,126}Cd-Strahlen folgenden $2^+ \rightarrow 0^+$ Gammaübergänge mit dem MINIBALL Spektrometer gemessen. Damit kann die Genauigkeit des B(E2;$2^+ \rightarrow 0^+$) Wertes von ^{122}Cd verbessert werden und zum ersten Mal ein B(E2) Wert für ^{124}Cd bestimmt werden. Wir zeigen vorläufige Ergebnisse der Analyse und diskutieren Perspektiven für zukünftige Experimente.

*Gefördert durch BMBF 06MT190.

[1] D.C. Radford *et.al.*, Phys.Rev.Lett. **88**, 222501 (2002)
[2] J. Terasaki *et.al.*, Phys.Rev. C **66**, 054313 (2002)

HK 17.3 Mo 14:45 TU MA004

Spektroskopische Faktoren in ^{49}Ca* — •P. Maierbeck[1], T. Behrens[1], R. Gernhäuser[1], R. Krücken[1], T. Kröll[1], M. Mahgoub[1], H. Wirth[1], R. Hertenberger[2], R. Lutter[2], T. Nilsson[3], M. Pantea[3], G. Schrieder[3], S. Volz[3] und N. Warr[4] für die MINIBALL-Kollaboration — [1]Physik-Department, TU München — [2]Sektion Physik der LMU München — [3]IKP, TU Darmstadt — [4]IKP, Universität zu Köln

In neuen Schalenmodellrechnungen wird ein Schalenabschluss für eine Neutronenzahl N=34 in der Kalzium-Region vorhergesagt. Um die Evolution der Schalenstruktur zu bestimmen, ist die Untersuchung der Kerneigenschaften der Kalziumisotope ^{48}Ca bis ^{54}Ca notwendig.

Experimente hierzu wurden mit dem MINIBALL-Gammaspektrometer am Kölner Tandem-Beschleuniger und am Q3D-Magnetspektrographen am Münchner Tandem-Beschleuniger durchgeführt. In Köln wurde die Reaktion d(^{48}Ca,p)^{49}Ca in inverser Kinematik verwendet, während am Q3D die (d,p) Reaktion in normaler Kinematik studiert wurde. Aus beiden Experimenten wurden spektroskopische Faktoren bestimmt und verglichen. Dies wird auch die Genauigkeit der Bestimmung von spektroskopsichen Faktoren in inverser Kinematik mit MINIBALL bei REX-ISOLDE testen.

Erste Ergebnisse der laufenden Analyse werden präsentiert.

*Gefördert durch und GSI und BMBF (Fördernummer 06MT190).

HK 17.4 Mo 15:00 TU MA004

Gamma spectroscopy of ^{236}U — •T. Striepling[1], P. Reiter[1], S. Binder[1], P. Bringel[2], B. Bruyneel[1], M. Chatzistamatiou[1], J. Eberth[1], G. Gersch[1], H. Hess[1], H. Hübel[2], M. Lauer[3], R. Lutter[4], C. Miller[1], T. Morgan[4], A. Neusser[2], W. Schwerdtfeger[4], I. Stefanescu[1], P. Thirolf[4], N. Warr[1], D. Weisshaar[1], and A. Wiens[1] — [1]IKP, Uni Köln — [2]ISKP, Uni. Bonn — [3]MPI-K, Heidelberg — [4]LMU München

A two weeks long, high statistics experiment at the Cologne tandem accelerator has been conducted to study γ-decays of ^{236}U. The motivation of this measurement is the search for unknown γ-decaying superdeformed states of vibrational and single particle character. Moreover it allows for a high resolution study of the delayed γ-decay of the shape isomeric ground state of the second minimum back into the normal deformed configuration. Inside the MINIBALL spectrometer a $\Delta E - E$ Si detector telescope was used to identify protons after ^{235}U(d,p) reactions at E_{lab}=11 MeV and to suppress the overwhelming background from prompt fission events. The beam pulse distance of $\Delta t = 400$ ns was adapted to the half live of the isomer $t_{1/2}$=115 ns. More than $2.5 \cdot 10^6$ photo peak counts in the ground state transitions from the first normaldeformed 1^- levels were recorded. With the known isomer ratio for the reaction [1] hundreds of photo peak counts are expected by gating on delayed gamma cascades depopulating the second minimum. The results of the ongoing analysis will be presented.

∗ Supported by the German BMBF(06 K-167).
[1] J.Schirmer,*et al.*, Phys. Rev. Lett. **63** 2196 (1989)

HK 17.5 Mo 15:15 TU MA004

Pb and Bi isotopes at $N = 104$ mid-shell studied by laser and nuclear decay spectroscopy. — •Maxim Seliverstov[1], Gerhard Huber[1], Peter Kunz[1], Andrey Andreyev[2], Hilde de Witte[2], Piet van Duppen[2], Serge Franchoo[2], Valentine Fedosseev[3], Brigitte Roussiere[4], Jocelyne Sauvage[4], and Bruce Marsh[3,5] — [1]University of Mainz, 55099, Mainz, Germany — [2]University of Leuven, 3001 Leuven, Belgium — [3]ISOLDE CERN, 1211 Geneve 23, Switzerland — [4]Institut de Physique Nucleaire, IN2P3-CNRS, 91406 Orsay, France — [5]University of Manchester, Manchester M13 9PL, UK

Mean-square charge radii and magnetic moments have been measured for the neutron deficient Pb and Bi isotopes (near and below the neutron mid-shell $N = 104$). This region is of particular interest for its prominent nuclear shape isomerism.

The measurements were performed at the on-line mass-separator ISOLDE (CERN) with in-source laser spectroscopy. The combination of the atomic spectroscopy using the resonant ionisation laser ion source (RILIS) with the simultaneous nuclear spectroscopy (α-γ, β-γ) at the detection set-up provides a very high sensitivity. This is essential in view of very low production yields of the isotopes under study. This combination yields high isomer selectivity and gives an excellent opportunity to study magnetic and shape properties of the low-lying isomeric states.

The (preliminary) results for $^{183-190}$Pb and $^{189-191}$ Bi isotopes will be presented; the experimental data will be compared with theoretical IBM calculations.

HK 17.6 Mo 15:30 TU MA004

Measurement of beam contamination at the REX-ISOLDE radioactive beam accelerator — •Vinzenz Bildstein — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Due to the production and acceleration method for radioactive ions at REX-ISOLDE[1] there are three sources for beam contaminations: The first source is a direct isobaric contamination as the general purpose mass separator of ISOLDE is not able to separate different isobars (e.g. ^{30}Mg and ^{30}Al). Second when the ions are captured in the REX-trap and charge bred in the EBIS part of them may β-decay also resulting in an isobaric contamination of the beam (e.g. during 30 ms of trapping and breeding of ^{30}Mg 6.0 % of it will decay to ^{30}Al). Finally, the beam may contain stable contaminants from the residual gas in the REXEBIS if their mass to charge ratio allows them to pass the mass separator of REX, wich has a resolution of $\frac{\Delta(A/q)}{(A/q)} < 1/100$ [1] (e.g. $^{30}Mg^{8+}$ and $^{15}N^{4+}$ or $^{32}Mg^{9+}$ and $^{32}S^{9+}$).

Besides trying to reduce these contaminants it is important to identify the contaminants qualitatively and quantitatively. One possibility for ions with Z below about 20 is to measure their specific energy loss using a thin silicon detector. In September 2004 two 10 μm thick silicon pindiodes were installed at the MINIBALL setup in order to determine the beam contaminations of neutron rich Mg beams continuously. Sources of contamination and the results of these measurements will be discussed.

[1] Accelerated radioactive beams from REX-ISOLDE, O. Kester et. al, Nucl. Instr. and Meth. in Phys. Res. B 204 (2003) 20-30

HK 17.7 Mo 15:45 TU MA004

Zeitabhängige Radioaktivitätsverteilung bei MAFF — •Florian Nebel[1,2], Ernst Zech[1,2], Thomas Faestermann[1,2], Reiner Krücken[1,2] und Peter Maier-Komor[1,2] für die MAFF-Kollaboration — [1]Physik Department E12, Technische Universität München — [2]Maier-Leibnitz-Laboratorium

Zum besseren Verständnis von Aktivitätsverteilung durch atomare und ionisierte Spaltprodukte am Münchner Spaltfragmentbeschleuniger MAFF wurde ein wahrscheinlichkeitsbasierter Monte-Carlo Code entwickelt. Der Code verwendet eine zwei dimensionale Näherung für die Geometrie, ist zeitabhängig und berücksichtigt radioaktiven Zerfall. Damit wurde die Aktivitätsverteilung im System für alle Spaltprodukte auf allen Oberflächen bestimmt. Grundlagen des Codes und Ergebnisse werden vorgestellt. Ionisierte Aktivität wird zum größten Teil in den Schlitzen nach dem Massenseperator doponiert. Dies hat den Vorteil das die Aktivität stark lokalisiert ist und leicht abzuschirmen. Durch Sputtereffekte wird allerdings bereits implantierte Aktivität wieder freigesetzt, was zu einer ungewollten Kontamination der Magnetkammer führen kann. Verschiedene Maßnahmen zur Reduzierung des Sputterfaktors werden vorgestellt und experimentelle Ergebnisse präsentiert.

HK 18 Physik mit schweren Ionen

Zeit: Montag 14:00–16:00 Raum: TU MA041

Gruppenbericht HK 18.1 Mo 14:00 TU MA041

Direct Photon Production Measured with the PHENIX Experiment — •Christian Klein-Bösing and Baldo Sahlmüller for the PHENIX collaboration — Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

Direct photons with a large transverse momentum p_T are in heavy ion collisions predominantly produced by parton scattering in the early phase of the reaction, similar to the direct photon production in p+p collisions. An additional source in heavy ion collisions is the thermal production in the possible quark-gluon plasma phase and in the subsequent hadron-gas phase, as well as the interaction of hard scattered partons with the medium.

The search for direct photons is in general a difficult task because of the large photon background from the decay of π^0s and other mesons. But while the production of π^0s with high transverse momentum in central Au+Au collisions is suppressed due to final state interactions of the hard-scattered partons, direct photons should be unaffected by the surrounding medium. The comparison of the photon and neutral pion production at large p_T in heavy ion collisions thus provides a direct verification of the jet quenching scenario, while the direct photon production in the intermediate p_T region ($p_T = 1 - 3\,\mathrm{GeV}/c$) is most sensitive to thermal sources, such as the QGP.

This work is supported by BMBF.

HK 18.2 Mo 14:30 TU MA041

Lambda Production at Forward Rapidity in d+Au Collisions at $\sqrt{s_{NN}}$ = 200 GeV — •Frank Simon for the STAR collaboration — Max–Planck–Institut für Physik, München, Germany

We present results on the production of lambda and anti-lambda particles at forward rapidity in d+Au collisions at $\sqrt{s_{NN}} = 200$ GeV. Using the forward time projection chambers in the STAR experiment, measurements of net lambda yields and the anti-lambda/lambda ratio at forward and backward rapidity at $y = \pm 2.75$ were obtained.

The contributions of different processes to particle production and baryon transport are probed using the asymmetry of d+Au collisions. Comparisons to a variety of model calculations show that the baryon transport on the deuteron side is due to multiple collisions of the deuteron nucleons with gold participants, while on the gold side the inclusion of target excitations or hadronic transport appears to be necessary.

Gruppenbericht HK 18.3 Mo 14:45 TU MA041

Anisotropic Flow of Charged Hadrons for Au+Au Collisions at RHIC — •Gerhard Burau[1], Johannes Bleibel[1], Christian Fuchs[1], Amand Fässler[1], Larissa Bravina[2], and Eugene Zabrodin[3] — [1]Institute for Theoretical Physics, University of Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen — [2]Department of Physics, University of Oslo, N-0316 Oslo — [3]Centre of Mathematics for Applications, University of Oslo, N-0316 Oslo

The pseudorapidity distributions of the azimuthal anisotropy parameters $v_1(\eta)$ and $v_2(\eta)$ of inclusive charged hadrons and their centrality dependence has been studied in Au+Au collisions at full RHIC energy of $\sqrt{s} = 200$ GeV within the microscopic quark-gluon string model. The QGSM simulation results for the directed flow show qualitatively and quantitatively a good agreement with the $v_1(\eta)$ data measured experimentally at high pseudorapidities, but cannot reproduce the flat behaviour of $v_1(|\eta| \leq 1.3)$. The η dependence of the elliptic flow v_2 exracted from our simulation agrees well in the whole pseudorapidity range for all centrality classes. Furthermore, the transverse momentum dependence of the elliptic flow $v_2(p_T)$ of identified and inclusive charged hadrons obtained with the QGSM is presented. The QGSM descriptions are rather good at low p_T, whereas they underestimate the measured elliptic flow for transverse momenta $p_T > 1$ GeV/c. Nevertheless, they coincide quite well with the qualitative p_T behaviour of the experimental data. In particular, the model is able to reproduce the experimental evidence of the crossing of the elliptic flow for mesons and baryons.

HK 18.4 Mo 15:15 TU MA041

Universal behaviour of the nuclear modification factor at RHIC ? — •Jörn Putschke — Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München

Measurements of the nuclear modfication factor R_{dAu} (and R_{CP}) and back-to-back correlations at high p_T at mid-rapidity from d+Au collisions at RHIC at $\sqrt{s_{NN}} = 200$ GeV demonstrated, that the strong supression of high p_T particle production previously observed in central Au+Au collisions are due to final-state interactions with the dense medium generated in such collisions [1]. Recent results of the pseudorapidity and centrality dependence of R_{dAu} (and R_{CP}) from the BRAHMS collaboration [2] were interpreted as a possible onset of parton saturation in the Color Glass Condensate [3].

An alternative explanation of the strong supression of R_{dAu} (and R_{CP}) at forward rapidities will be presented. In this Ansatz the supression at higher rapidities is explained by the supression of particle yields in d+Au relative to p+p collisions caused by a shift of the center of mass in the asymmetric d+Au collisions with respect to the nucleon-nucleon center of mass system.

In this new reference system the pseudorapidity and centrality dependence of R_{dAu} (and R_{CP}) can be explained and taking the asymmetry into account R_{dAu} (and R_{CP}) show a universal behaviour at RHIC energies.

[1] J. Adams, et al., *Phys.Rev.Lett.*, 91:072304, 2003
[2] I. Arsene et al., arXiv:nucl-ex/0403005
[3] D. Kharzeev, E. Levin, and M. Nardi, *Nucl. Phys. A*, 730:448, 2004

Gruppenbericht HK 18.5 Mo 15:30 TU MA041

Ultraperipheral Collisions at RHIC and LHC — •Kai Hencken[1], Gerhard Baur[2], Ute Dreyer[1], and Dirk Trautmann[1] — [1]Uni Basel — [2]FZ Jülich

Ultraperipheral Collisions (UPC) use the strong Coulomb fields surrounding the ions at relativistic energies to study photon-photon and photon-hadron processes in collisions with an impact parameter $b > 2R$. RHIC has published results on UPC and ALICE, CMS and ATLAS plan to study UPCs in the future as part of their HI program.

STAR/RHIC has recently measured electron-positron pairs at small impact parameter ($b \approx 20$fm). We compare their results with our QED calculation with good agreement.

Coherent vector meson production in photon-nucleus collisions has been measured for the ρ at STAR/RHIC. Interference occurs in these processes as the role of the two ions can be exchanged. We study the transverse momentum distribution of this process especially for b. The results can be compared with the STAR measurements and are of importance for future experiments at the LHC.

Inelastic pair production offers the possibility to study quark pdfs inside nuclei, that is medium modifications, at moderate Q^2 and small x. We compare results of a full calculation with the equivalent photon and lepton approximation.

HK 19 Theorie

Zeit: Montag 14:00–16:00 Raum: TU MA005

Gruppenbericht HK 19.1 Mo 14:00 TU MA005

Baryon properties in the perturbative chiral quark model — •Thomas Gutsche, V. E. Lyubovitskij und Amand Faessler — Institut für Theoretische Physik, Universität Tübingen, D-72076 Tübingen, Germany

We review recent applications of the perturbative chiral quark model (PCQM) to analyze low-energy properties of baryons: meson-nucleon sigma-terms [1], static strange characteristics of the nucleon [2] and the ground state baryon spectrum [3] among others. The PCQM is based on an effective Lagrangian, where baryons are described by relativistic valence quarks and a perturbative cloud of Goldstone bosons as required by chiral symmetry. Analytical expressions for baryon observables are obtained in terms of fundamental parameters of low-energy pion-nucleon physics (weak pion decay constant, axial nucleon coupling constant, strong pion-nucleon form factor) and of only one model parameter (radius of

the nucleonic three-quark core).

[1] T. Inoue, V. E. Lyubovitskij, T. Gutsche and A. Faessler, Phys. Rev. C **69** (2004) 035207

[2] V. E. Lyubovitskij, P. Wang, T. Gutsche and A. Faessler, Phys. Rev. C **66** (2002) 055204

[3] T. Inoue, V. E. Lyubovitskij, T. Gutsche and A. Faessler, arXiv:hep-ph/0404051

Gruppenbericht

HK 19.2 Mo 14:30 TU MA005

Hadron attenuation by (pre-)hadronic FSI at HERMES and RHIC — •Thomas Falter, Wolfgang Cassing, Kai Gallmeister und Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We investigate the relation between the hadron attenuation in deep inelastic electron-nucleus scattering (DIS) at HERMES and the observed quenching of high p_T-jets in ultra-relativistic heavy-ion collisions at RHIC. Our transport theoretical approach [1,2] allows for a realistic coupled-channel treatment of the final state interactions (FSI) that goes far beyond the usual Glauber approach. The nuclear DIS data provides us with essential information on the space-time picture of the hadronization process which turns out to be important for the interpretation of jet quenching in ultrarelativistic heavy-ion collisions as a signature for the quark-gluon plasma. We find that (pre-)hadronic FSI play the dominant role for the observed hadron attenuation at HERMES while they cannot fully explain the situation at most central heavy-ion collisions at RHIC. Work supported by BMBF.

[1] T. Falter, W. Cassing, K. Gallmeister, and U. Mosel, Phys. Lett. B **594**, 61 (2004); Phys. Rev. C (in press), nucl-th/0406023.

[2] W. Cassing, K. Gallmeister, and C. Greiner, Nucl. Phys. A 735, 277 (2004); K. Gallmeister and W. Cassing, Nucl. Phys. A (in press), hep-ph/0408223.

HK 19.3 Mo 15:00 TU MA005

Deep inelastic lepton nucleus scattering and hadronization — •Daniel Grünewald — Institut für theoretische Physik der Universität Heidelberg Philosophenweg 19, D-69120 Heidelberg, Germany

Semi-inclusive deep inelastic scattering on nuclei is investigated. An absorption model for possible hadron interaction inside the nucleus is derived and employed, based on flavor dependent hadron formation lengths, which are calculated in the framework of the LUND string fragmentation model. Additionally, the rescaling of parton distribution and fragmentation functions in the nuclear medium due to the hypothesis, that a quark in a bound nucleon has access to a larger region of space, are considered in the partial deconfinement model. The model predictions are compared with recent HERMES results for the multiplicity ratios normalized to deuterium on various hadron species and different nuclei. Beside the proton, a good agreement is found. Furthermore, the mass number dependence of the multiplicity ratios is predicted for both nuclear absorption and energy loss mechanism, providing a possible tool in order to disentangle them.

HK 19.4 Mo 15:15 TU MA005

Some consistency conditions in effective field theory with vector mesons — •Matthias Schindler[1], Dalibor Djukanovic[1], Jambul Gegelia[1,2], and Stefan Scherer[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz, Germany — [2]High Energy Physics Institute, Tbilisi State University, Tbilisi, Georgia

Effective field theories (EFT) are non-renormalizable in the traditional sense. However, in a consistent EFT all ultraviolet divergences must be absorbable in the redefinition of fields, masses, and coupling constants. The renormalization procedure imposes consistency conditions among the parameters of the Lagrangian.

We first consider the effective Lagrangian describing the interaction among ρ mesons, pions, and nucleons. We perform a one-loop order analysis of the nucleon and ρ-meson self-energies as well as the $\rho\rho\rho$ and ρNN vertex functions. Both the universal coupling of the ρ meson as well as the KSRF value of the ρ-meson coupling constant turn out to be consequences of the self-consistency conditions [1].

Next we include the electromagnetic interactions in the EFT. From the construction as the most general Lagrangian the vector mesons have an arbitrary magnetic moment related to a free constant κ. We analyze self-energies as well as three-particle vertex diagrams at the one-loop level. Imposing the consistency conditions we find that the constant κ is equal to the electric charge, $\kappa = e$, and the $\rho^\pm - \rho^0$ mass ratio is given by $M_\pm/M_0 = \sqrt{1 - e^2/g^2}$, where g is the ρ meson coupling constant.

[1] D. Djukanovic, M. R. Schindler, J. Gegelia, G. Japaridze, and S. Scherer, Phys. Rev. Lett. **93**, 122002 (2004).

HK 19.5 Mo 15:30 TU MA005

Hadronic decays of η and η' — •R. Nissler and B. Borasoy — Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn, Germany

Future experiments at the planned WASA at COSY facility [1] aim for a precision determination of η and η' decay parameters and have stimulated renewed interest in accurate theoretical investigations of such processes. In this context, the isospin-breaking decays of η and η' into three pions play a prominent role since electromagnetic effects are negligible and hence their decay amplitude is directly proportional to the light quark mass difference $m_d - m_u$. Furthermore, the hadronic decays of η and η' provide important information on η-η' mixing.

Employing a unitarized U(3) chiral effective field theory which includes final state interactions in the s- and p-wave amplitudes, we have calculated the decay widths and Dalitz plot parameters of the hadronic decays $\eta \to \pi\pi\pi$, $\eta' \to \pi\pi\pi$ and $\eta' \to \eta\pi\pi$ extending previous work on s-waves [2]. We find p-wave interactions to be important in the decay $\eta' \to \pi^+\pi^-\pi^0$, where phase space is large enough to allow for significant contributions of the $\rho(770)$ resonance.

Financial support of the DFG is gratefully acknowledged.

[1] B. Höistad et al., "Proposal for WASA at COSY", http://www.fz-juelich.de/ikp/wasa/

[2] N. Beisert and B. Borasoy, Nucl. Phys. **A716** (2003) 186.

HK 19.6 Mo 15:45 TU MA005

Study of axial charge of $N(1535)$ in threshold $\eta\pi$ production — •Daisuke Jido[1], Atsushi Hosaka[2], and Makoto Oka[3] — [1]Phyisik-Department, Technische Universität München,James-Franck-Strasse, D-85747 Garching — [2]Research Center for Nuclear Physics, Osaka University, Ibaraki,Osaka, 567-0047, Japan — [3]Physics Department, Tokyo Institute of Technology, Meguro, Tokyo, 152-8551, Japan

Axial charge is one of the most important static properties of hadrons. Especially a relatively negative sign of a parity partner of nucleon opens a new possibility to form a chiral doublet of nucleon and its parity partner. In the linear realization of chiral symmetry in nucleons, there are two possible ways to assign the chiral multiplets to nucleon and its parity partner depending on the sign of the axial charge of the parity partner. These two assignments are shown to have phenomenologically distinguished predictions. We report on a theoretical study of double meson production reaction of the eta and pi mesons in the threshold region in order to determine the sign of the axial charge of $N(1535)$ (N^*). The eta meson is used as a probe for N^* production in the intermediate state. The pion emmited in the final state is then used to extract the sign of the axial charge. Calculating cross section of the $\pi^- p \to \pi^- \eta p$ reaction, we find that the most distinct dependence on the sign of N^* is seen in the slope of the angular distribution of the final π^- state as a result of an interference of the p-wave nature of the $\pi N^* N^*$ coupling and the s-wave nature of the πNN^* coupling.

[1] D. Jido, M. Oka and A. Hosaka, Prog. Theor. Phys. **106** (2001) 823, 873.

* *Work of D.J. in Germany is supported by AvH.*

HK 20 Kern- und Teilchen-Astrophysik

Zeit: Montag 14:00–16:00 Raum: TU MA144

HK 20.1 Mo 14:00 TU MA144

Neutrino transport in proto neutron stars — •Jens Berdermann[1], David Blaschke[2,3], and Hovik Grigorian[1,4] — [1]Fachbereich Physik, Universität Rostock, Germany — [2]Bogoliubov Laboratory of Theoretical Physics, ¿ Joint Institute for Nuclear Research, 141980, Dubna, Russia — [3]Fakultät für Physik, Universität Bielefeld, ¿ D-33615 Bielefeld, Germany — [4]Department of Physics, Yerevan State University, 375025 ¿ Yerevan, Armenia

¿ Proto neutron stars (PNS) are created after type II supernova explosions ¿ with initial temperatures up to 40 MeV. ¿ In such a hot, dense environment, as long as the ¿ temperature $T \geq 1$ MeV, the neutrino mean free path ¿ is much smaller than the star radius $R \sim 10$ km and the ¿ PNS is practically opac for neutrinos. ¿ The neutrino transport in this neutrino trapping regime ¿ is described in the equilibrium diffusion approximation, ¿ which gives a satisfactory description for the limiting cases of ¿ trapping ¿ ($Y_l \approx 0.38, s \simeq 1, T \geq 1 \div 3$ MeV) ¿ and free radiation ($Y_\nu \approx 0, s \simeq 2, T \leq 1 \div 3 >$ MeV). ¿ We show the advantages and limitations of this approximations and give ¿ an ¿ outlook to effects due to the inclusion of accretion and rotation ¿ of the PNS. ¿ ¿ ¿ *Partially supported by DFG Graduiertenkolleg 567 "Stark korrelierte ¿ ¿ Vielteilchensysteme" at Universität Rostock. ¿ ¿ ¿ ¿ ¿ ¿*

HK 20.2 Mo 14:15 TU MA144

Cooling of neutron stars with color superconducting quark core — •Hovik Grigorian[1,2], David Blaschke[3,4], and Dmitri Voskresensky[5,6] — [1]Fachbereich Physik, Universität Rostock, Germany — [2]Department of Physics, Yerevan State University, 375025 Yerevan, Armenia — [3]Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980, Dubna, Russia — [4]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany — [5]Theory Division, GSI mbH, D–64291 Darmstadt, Germany — [6]Moscow Institute for Physics and Engineering, 115409 Moscow, Russia

We present a nonlocal, chiral quark model which allows hybrid star configurations with color superconducting quark matter cores and masses below 1.4 $M_\odot$. We study the cooling of these objects in isolation for different values of the gravitational mass and thus different composition and structure of the interior. phase We argue that, if phases with unpaired quarks were allowed, the corresponding hybrid stars would cool too fast to describe the neutron star cooling data existing by today. We discuss two possibilities to have all quarks paired in two-flavor quark matter under neutron star constraints: (1) the "2SC+X"phase and (2) the CSL phase. In both cases the weak pairing gaps are of the order of 10 - 100 keV with a decreasing density dependence giving the best explanation of the cooling data. *Partially supported by Virtual Institute of the Helmholtz Association under grant No. VH-VI-041, DFG grant No. 436 RUS 117/17/03 and by the DAAD Partnership Programme.*

HK 20.3 Mo 14:30 TU MA144

Heavy particle production in a conformal cosmological model — •David Blaschke[1,2,3], Alexander Prozorkevich[4], and Stanislav Smolyansky[3,4] — [1]Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980, Dubna, Russia — [2]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany — [3]Fachbereich Physik, Universität Rostock, Germany — [4]Physics Department, Saratov State University, 410026, Saratov, Russia

In the framework of a conformal cosmological model, we consider the vacuum creation of heavy massive particles (vector bosons and top quarks). The inertial mechanism due to a time dependence of the conformal mass, $m(t) = a(t)m_0$ (m_0 is the present-day value of the mass) is the foundation of this effect. The function $a(t)$ is the conformal factor of the isotropic FRW space-time, $a(t) = (t/t_H)^\alpha$, where $\alpha = 2/(3\gamma - 2)$, γ is the barotropic parameter, $t_H = (1 + \alpha)H$ is the age of the Universe, H is the Hubble constant. We derive the corresponding kinetic equations of non-markovian type for the vacuum creation of massive vector bosons and fermions and we solve these KE's numerically for different equations of state of the matter filling the Universe (stiff fluid, radiation etc.). The basic result of the work is demonstration of the fact that the general contribution of the produced matter can be sufficient to explain the present density of CMB photons. *Partially supported by DFG Graduiertenkolleg 567 at Universität Rostock and DFG grant No. 436 RUS 117/78/04.*

HK 20.4 Mo 14:45 TU MA144

Two-flavor color superconducting quark matter phases in compact stars — •Deborah Nancy Aguilera[1,2], David Blaschke[1,3,4], and Hovik Grigorian[5] — [1]Fachbereich Physik, Universität Rostock, Universitätsplatz 1, D-18051 Rostock, Germany — [2]Instituto de Física Rosario, Bv. 27 de febrero 210 bis, 2000 Rosario, Argentina — [3]Bogoliubov Laboratory for Theoretical Physics, JINR Dubna, 141980 Dubna, Russia — [4]Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany — [5]Department of Physics, Yerevan State University, Alex Manoogian Str. 1, 375025 Yerevan, Armenia

We study the occurrence of two-flavor color superconducting phases (2SC = two-flavor color superconductivity and CSL = color spin locking) in quark matter under compact star constraints within a nonlocal model. We analyze the sensitivity to changes in the formfactor and the coupling constants for the quark interaction.
As observables we calculate the configurations and show that stable hybrid star branches with 2SC quark cores could explain observations of small compact objects.
The CSL phase leads to a pairing pattern in which all quarks are paired and the smallest gaps do not exceed 1 MeV. Such a phase is a candidate for a successful explanation of the cooling behaviour of neutron stars with quark matter cores. *Partially supported by the Virtual Institute of the Helmholtz Association under grant no. VH-VI-041 and by the Landesgraduiertenförderung MV.*

HK 20.5 Mo 15:00 TU MA144

Photoactivation of *p*-process nuclei — •M. Erhard[1], E. Grosse[1,2], A. Hartmann[1], A.R. Junghans[1], K. Kosev[1], C. Nair[1], N. Nankov[1], G. Rusev[1], K.D. Schilling[1], W. Schulze[1], R. Schwengner[1], and A. Wagner[1] — [1]Institut für Kern- und Hadronenphysik, Forschungszentrum Rossendorf, Dresden, Germany — [2]Technische Universität Dresden, Dresden, Germany

A research program was started at the ELBE-bremsstrahlung beam to study experimentally the near-threshold photodisintegration reaction of nuclides in the chain of cosmic heavy-element production. An important prerequisite for such studies is the profound knowledge of the bremsstrahlung characteristic which has been investigated experimentally as well as theoretically. First data of astrophysical importance were obtained for the target nucleus ^{92}Mo by observing the radioactive decay of nuclides produced in the photodissociation at electron energies between 11.8 and 13.2 MeV. The results are compared to recent calculations by Rauscher and Thielemann[1].
[1] T. Rauscher and F.-K. Thielemann, Atomic Data and Nuclear Data Tables, **88** (2004) 1

HK 20.6 Mo 15:15 TU MA144

***s*-Prozess Wirkungsquerschnitte – Experimente mit reellen Photonen** — •K. Sonnabend[1], D. Galaviz[1], A. Kretschmer[1], S. Müller[1], T. Rauscher[2], M. Zarza[1] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D–64289 Darmstadt — [2]Institut für Physik, Universität Basel, CH–4056 Basel, Schweiz

Im astrophysikalischen *s*-Prozess wird die relative Häufigkeit der Isotope eines Elements wesentlich durch das Verhältnis von β-Zerfallsrate λ_β und Neutroneneinfangrate $\lambda_{(n,\gamma)}$ der sogenannten Verzweigungskerne bestimmt. Die direkte Messung des Neutroneneinfangquerschnitts $\sigma_{(n,\gamma)}(E)$ der kurzlebigen Verzweigungskerne mit Halbwertszeiten im Bereich einiger Dutzend Tage ist nur schwer möglich. Um die Vorhersagen für diese Wirkungsquerschnitte [1] im Rahmen des Statistischen Modells [2] einzuschränken, wird die Umkehrreaktion (γ,n) mit Hilfe reeller Photonen und der Methode der Photoaktivierung am S–DALINAC untersucht [3]. Wir stellen die Ergebnisse unserer Experimente zu den Verzweigungskernen ^{95}Zr, ^{187}Re und ^{193}Ir und deren astrophysikalische Konsequenzen vor.
* gefördert durch die DFG (SFB 634)
[1] Z.Y. Bao *et al.*, At. Data Nucl. Data **76**, 70 (2000).
[2] T. Rauscher, F.-K. Thielemann, At. Data Nucl. Data **75**, 1 (2000).
[3] K. Sonnabend *et al.*, Astroph. J. **583**, 506 (2003).

HK 20.7 Mo 15:30 TU MA144

The (n,γ) cross sections of light p nuclei at kT= 25 keV: Towards an updated experimental database for the p process — •Iris Dillmann[1,2], Michael Heil[1], Franz Käppeler[1], Thomas Rauscher[2], and Friedrich-Karl Thielemann[2] — [1]Forschungszentrum Karlsruhe, Postfach 3640, D-76021 Karlsruhe — [2]Universität Basel, Klingelbergstrasse 82, CH-4056 Basel

Experimental reaction rates of p nuclei are still very scarce. Therefore these (n,γ), (p,γ), (α,γ) and the respective inverse rates have to be inferred by statistical Hauser-Feshbach calculations. Concerning stellar (n,γ) rates of the 19 p-only nuclei between ^{74}Se and ^{132}Ba, experimental data are available for 13 of these nuclei. We report on first results of the missing cross sections of ^{74}Se, ^{84}Sr, ^{102}Pd, ^{120}Te and ^{132}Ba at kT= 25 keV, which were measured with the activation method using the ^{7}Li(p,n)^{7}Be reaction. The aim of this work is the update of the Bao et al. compilation for p nuclei and the creation of a website containing all experimental data on (n,γ), (p,γ), (α,γ) and inverse cross sections for p-process studies.

HK 20.8 Mo 15:45 TU MA144

Neutrinonukleosynthese der ungerade-ungerade Isotope^{138}La und ^{180}Ta* — •A. Byelikov[1], T. Adachi[2], P. von Brentano[3], D. Frekers[4], D. De Frenne[5], H. Fujita[6], Y. Fujita[2], A. Heger[7], E. Jacobs[5], Y. Kalmykov[1], K. Langanke[8], E. Kolbe[9], A. Negret[5], P. von Neumann-Cosel[1], L. Popescu[5], S. Rakers[4], A. Richter[1], A. Shevchenko[1] und Y. Shimbara[2] — [1]TU Darmstadt — [2]Osaka University — [3]Universität zu Köln — [4]Universität Münster — [5]UniversiteitGent — [6]University of Witwatersrand — [7]LosAlamos — [8]University of Aarhus — [9]Universität Basel

Der Ursprung der exotischen Isotope ^{138}La und ^{180}Ta ist weitgehend ungeklärt. Neueste Rechnungen im Rahmen einer umfassenden Modellierung der Nukleosynthese in massiven Sternen >10 $M_\odot$ sagen eine signifikante Produktion durch geladene Stromreaktionen (ν_e, e) voraus. Die Wirkungsquerschnitte werden durch die GT Stärke bei niedrigen Energien im Tochterkern dominiert. Diese lassen sich in hochauflösenden ^{138}Ba, ^{180}Hf(^{3}He,t) Experimenten unter null Grad vermessen. Erste experimentelle Resultate und ihre astrophysikalische Relevanz werden diskutiert.

* Gefördert durch die DFG unter SFB 634 und 446 JAP-113/267/0-1

HK 21 Instrumentation und Anwendungen

Zeit: Montag 14:00–16:00 Raum: TU MA042

Gruppenbericht HK 21.1 Mo 14:00 TU MA042

Investigation of solid D_2 for UCN sources — •K. Kirch[1], F. Atchison[1], K. Bodek[2], B. van den Brandt[1], T. Bryś[1], M. Daum[1], P. Fierlinger[1], P. Geltenbort[3], M. Giersch[4], P. Hautle[1], M. Hino[5], R. Henneck[1], S. Heule[1], M. Kasprzak[1,2,4], J. Kohlbrecher[1], J.A. Konter[1], G. Kühne[1], M. Kuźniak[1,2], A. Michels[1], A. Pichlmaier[1], Y. Pokotilovskiy[6], U. Szerer[2], M. Utsuro[5], M. Wohlmuther[1], A. Wokaun[1], and J. Zmeskal[4] — [1]PSI, Villigen, CH — [2]JU, Cracow, PL — [3]ILL, Grenoble, FR — [4]OeAW, Wien, AU — [5]KU, Kyoto, JP — [6]JINR, Dubna, RU

Solid deuterium (sD_2) will be used for the production of ultra-cold neutrons (UCN) in the PSI UCN source. In order to optimize the source performance it is important to know the UCN production cross sections as well as the relevant cross sections for UCN transport out of the sD_2. Also future cold moderator development calls for knowing neutron cross sections in liquid D_2. In addition, the scattering system, neutron-D_2, is simple enough to allow a complete theoretical treatment; thus measured cross sections should be compared with theoretical models. We report on transmission measurements of slow neutrons (CN, VCN, UCN) through gaseous, liquid and solid D_2 and the extraction of total scattering cross sections. We also give results from a recent experiment in which UCN have been produced from a cold neutron beam on gaseous, liquid and solid D_2 targets.

HK 21.2 Mo 14:30 TU MA042

The New Source of Ultra Cold Neutrons at PSI — •Axel Pichlmaier[1], M. Daum[1], F. Atchison[1], K. Bodek[2], B. van den Brandt[1], T. Brys[1], P. Fierlinger[1], P. Geltenbort[3], W. Gloor[1], P. Hautle[1], G. Heidenreich[1], R. Henneck[1], St. Joray[1], K. Kirch[1], S. Kistryn[2], K. Kohlik[1], J. A. Konter[1], G. Kühne[1], S. Mango[1], H. Obermaier[1], Ch. Perret[1], U. Rohrer[1], H. J. Temnitzer[1], H. Zmeskal[4], and G. Szigmond[1] — [1]Paul Scherrer Institut, Villigen, Switzerland — [2]Jagellonian University, Cracow, Poland — [3]Institut Laue Langevin, Grenoble, France — [4]Österreichische Akademie der Wissenschaften, Vienna, Austria

Ultra-cold neutrons (UCN) are used, among others, for precision measurements in particle physics. Experiments are often crippled by statistical limitations. A new high intensity source of UCN is currently being built at PSI. It uses the full intensity proton beam of the PSI ring cyclotron (2 mA, 590 MeV) in macro pulses of a few seconds length. Spallation neutrons are produced on a heavy metal target, thermalized in heavy water and finally down scattered into UCN in solid D_2. The UCN are extracted into a storage volume from where neutron guides lead to experiments. We expect UCN densities of up to 4000 cm^{-3} in the storage tank, an improvement of about two orders of magnitude compared to the only UCN source in operation now. The primary aim for the new source is to provide UCN for a new precision search for a neutron electric dipole moment. Other applications include neutron lifetime measurements or a phase space transformer to produce a high intensity beam of cold neutrons.

HK 21.3 Mo 14:45 TU MA042

Diamond-like carbon coatings for ultra-cold neutron reflectors — •St. Heule[1], T. Brys[1], M. Daum[1], P. Fierlinger[1], A. Foelske[1], M. Gupta[1], R. Henneck[1], M. Kasprzak[1], K. Kirch[1], T. Lippert[1], C.-F. Meyer[2], F. Nolting[1], A. Pichlmaier[1], B. Schultrich[2], P. Siemroth[2], and U. Straumann[3] — [1]Paul Scherrer Institut, 5232 Villigen, Switzerland — [2]Fraunhofer Institut fuer Werkstoff- und Strahltechnik, Winterbergstrasse 28, 01277 Dresden, Germany — [3]Physik-Institut der Universitaet Zuerich, Winterthurerstrasse 190, 8057 Zuerich, Switzerland

At PSI we are presently setting up a new, high-intensity source for ultracold neutrons (UCN). For the storage (and transport) of UCN so far one has widely used Beryllium-coatings which are toxic and therefore difficult to handle. As an alternative to Be we investigate diamond-like carbon (DLC), for which loss factors close to that of Be have been obtained in a recent experiment at ILL. We produce DLC-coatings by Pulsed Laser Deposition (PLD), a process which results in a very low hydrogen content of the films. This is crucial for our applications as UCNs are up-scattered on hydrogen atoms and therefore immediately lost. The deposition process will be optimized to obtain maximum density in order to get maximum limiting velocity. We are in the process of optimizing the coating process with small-size test samples and - in parallel - building up a facility for coating real guide tubes. We report first results on the characterization of these samples as well as of additional calibration samples by Raman spectroscopy, x-ray spectroscopy (XPS,NEXAFS), neutron reflectometry and laser-acoustic methods.

HK 21.4 Mo 15:00 TU MA042

A superconducting magnetic UCN trap for the precise measurement of the neutron lifetime — •Rüdiger Picker, Igor Altarev, Johannes Bröcker, Andreas Frei, Erwin Gutsmiedl, F. Joachim Hartmann, Axel R. Müller, Stephan Paul, Gerd Petzoldt, Daniele Tortorella, and Oliver Zimmer — Physik-Department E18, Technische Universität München

The lifetime τ_n of the neutron has important implications on our picture of the weak interaction and on cosmology. The latest experimental result for τ_n is smaller by 7.2 s ($\approx 6\,\sigma$) than the value recommended by the Particle Data Group (PDG), $\tau_n = (885.7 \pm 0.8)\,s$. The new measurement was performed by storing ultra-cold neutrons (UCN) in material bottles, similar to the most precise earlier experiments. Losses during the UCN collisions with the bottle walls prevent the systematic errors to be decreased to values well below 0.5 s. Magnetic storage is a good alternative.

In our planned experimental set-up UCN shall be stored in a large ($\approx 800\,dm^3$) volume between two nested cylinders: superconducting coils at walls and bottom of the cylinder produce a magnetic multipole field that reaches about 2 Tesla at 1 cm distance from the magnets. Gravitation serves as the upper cover of the trap. We intend to determine τ_n not only from the number of surviving neutrons but also, more important, by real-time detection of the decay protons. Using the new UCN source

of FRM-II at Garching, we envisage to trap up to 10^8 neutrons per cycle. We thus expect to reach an accuracy for τ_n of $\approx 10^{-4}$.
Supported by Maier-Leibnitz-Laboratorium and BMBF.

HK 21.5 Mo 15:15 TU MA042

Die Mini-D_2 Quelle für ultrakalte Neutronen an der Forschungsneutronenquelle FRM-II — •Andreas Frei, Igor Altarev, Erwin Gutsmiedl, F. Joachim Hartmann, Stephan Paul, Wolfgang Schmid, Daniele Tortorella und Oliver Zimmer — Physik-Department E18, Technische Universität München, D-85748 Garching

Für die Forschungsneutronenquelle FRM-II in München ist eine Quelle zur Erzeugung ultrakalter Neutronen (UCN) mit festem D_2 als Konvertermaterial vorgesehen, die Mini-D_2 Quelle. Sie wird im horizontalen, direkt auf die Kalte Quelle gerichteten Strahlrohr SR-4 installiert. Zur UCN-Erzeugung dient ein Konverter bestehend aus etwa 200 cm^3 festem D_2 bei einer Temperatur von 5 K. Dieser Konverter befindet sich am reaktorseitigen Ende eines mit Be beschichteten Speicherrohres (Durchmesser 6 cm, Länge etwa 8 m), dessen Wände auf 30 K gekühlt werden. Modellrechnungen lassen erwarten, dass sich im Speicherrohr eine UCN-Dichte von bis zu 10^4 cm^{-3} aufbauen sollte, eine wesentliche Verbesserung im Vergleich zu bestehenden Quellen. Erste Testmessungen zur UCN-Erzeugung werden im Winter 2004/05 am TRIGA-Reaktor in Kooperation mit der Universität Mainz durchgeführt. Zu diesem Zweck wurde mit Hilfe des Maier-Leibnitz-Laboratoriums der LMU und TU München (MLL) und mit finanzieller Unterstützung der Deutschen Forschungsgemeinschaft (DFG) ein Testkryostat samt zugehörigem D_2-Gassystem aufgebaut. Der Vortrag gibt einen Überblick über den aktuellen Stand des Projektes am FRM-II sowie über erste Ergebnisse der Messungen in Mainz.

HK 21.6 Mo 15:30 TU MA042

Detectors for Bound Quantum States of Neutrons in the Earth's Gravitational Field — •Sophie Nahrwold and Hartmut Abele — Physikalisches Institut, Philosophenweg 12, 69120 Heidelberg, Germany

A new kind of position sensitive detector for neutrons has been developed. The detector consists of a nuclear trace detector coated with a thin layer of ^{10}Boron. It has a very high spatial resolution of 1 to 2 μm.

In summer 2004, this detector was used to further establish the existence of bound quantum states of ultracold neutrons in the earth's gravitational field. It was possible to directly measure the density distribution of ultracold neutrons above a totally reflecting, horizontal mirror.

The experiment is also sensitive to gravity-like forces on a scale of 10μm or below. These forces would deform the density distribution of the neutrons and also change their energy. Some limits for the existence of such forces can be deduced from the experiment and will be presented in the talk.

HK 21.7 Mo 15:45 TU MA042

Energieerhöhung des REX-ISOLDE LINACs* — •O. Kester, T. Sieber, K. Rudolph, M. Pasini und D. Habs für die REX-ISOLDE-Kollaboration — Department für Physik der LMU München, Am Coulombwall 1, D-85748 Garching

Das Hauptexperiment mit den an Abstand meisten Strahlschichten von ISOLDE ist REX-ISOLDE. Die erfolgreichen Strahlzeitkampagnen sind das Resultat eines stabilen Betriebs des REX-ISOLDE Linearbeschleuigers. Um den Erfolg von REX-ISOLDE für die Zukunft zu garantieren, ist eine Erweiterung des Massenbereichs der Isotope zu schweren Massen hin wünschenswert, z.B. in dem Bereich der Uranspaltprodukte. Um kernphysikalische Experimente über Teilchentransfer und Coulomb-Anregung auch bei den schweren Massen durchführen zu können, ist eine Erhöhung der Endenergie des REX-ISOLDE Linearbeschleunigers von den im Moment verfügbaren 3 MeV/u auf 4.2 MeV/u erforderlich. Dies ist bei Einhalten des vorhandenen Platzangebotes, speziell für die Leistungssender nur möglich, wenn man zwei der 7-Spalt-Spiralstrukturen durch einen 1.5 m langen IH-Resonator ersetzt, der bei 202.56 MHz Resonanzfrequenz läuft. Dieser Resonator kann einen Energiehub von 2.2 MeV/u ermöglichen und in Verbindung mit dem für das MAFF-Projekt entwickelten IH-7-Spalter eine Endenergie zwischen 3.2-4.2 MeV/u erzielen. Der magnetische Ablenker, der im Moment bei REX-ISOLDE in Betrieb ist, kann einen Strahl dieser Energie nicht mehr um 65^o in die MINIBALL-Strahllinie ablenken, so daß eine Modifikation der Transportstrahllinien zu den Targetstatinen erforderlich wird.

* Unterstützt durch BMBF Projekte 06ML188, 06ML185, 06 ML186I

HK 22 Postersitzung

Zeit: Montag 16:30–18:00 Raum: TU MA141

HK 22.1 Mo 16:30 TU MA141

Der mittlere quadratische Radius des Protons. * — •I. Pysmenetska, P. von Neumann-Cosel, A. Richter, S. Rathi und G. Schrieder — Institut für Kernphysik, TechnischeUniversität Darmstadt

Die genaue Messung des mittleren quadratischen Radius des Protons ist ein altes, aber immer noch ein unbefriedigend gelöstes Problem. Die Analyse neuer Experimente mit der Lamb-Shift Methode in Rahmen der QED werden durch die ungenaue Kentnis des Protonradius begrenzt. Die Systematik aller Weltdaten für den Radius des Protons ist in [1] zusammengefasst. Eine etablierte Methode ist elastische Elektronenstreuung, die experimentellen Werte unterscheiden sich aber stark. Am S-DALINAC wird zur Zeit ein neuartiges Experiment vorbereitet, bei den statt der Elektronen die rückgestreute Protonen nachgewiesen werden sollen.

Die neue Methode bringt eine ganze Reihe von Vorteilen, so dass eine die relative Ungenauigkeit besser als 1 % erreicht werden kann. So kann die ganze Winkelverteilung und damit die Impulsübertragsabhängigkeit gleichzeitig gemessen werden, was das Problem Absolutnormierung einzelner Messungen vermeidet. Zuzätzlich kann das Verhältnis des elektrischen zum magnetischen Formfaktor bestimmt werden.

[1] S.G.Karshenboim, arXiv:hep-ph/9712347

*Gefördert durch die DFG unter SFB 634.

HK 22.2 Mo 16:30 TU MA141

Polarisierbarkeit des Nukleons* — •O. Yevetska[1], J. Ahrens[2], V. Chizhov[3], V. Iatsioura[3], A. Richter[1], G. Schrieder[1], L. Sergeev[3], Yu. Smirenin[3] und S. Watzlawik[1] — [1]Institut für Kernphysik, TU Darmstadt, Deutschland — [2]Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz, Deutschland — [3]Petersburg Nuclear Physics Institute, Petersburg, Russland

Am supraleitenden Darmstädter Elektronenlinearbeschleuniger S-DALINAC wurde ein Experiment zur Bestimmung der elektrischen und magnetischen Polarisierbarkeit des Nukleons aufgebaut. Ziel ist es, mit einer neuen experimentellen Methode den differenziellen Wirkungsquerschnitt von elastischer γp-, bzw. γd-Streuung im Gammaenergiebereich von 20-100 MeV modellunabhängig mit einer Genauigkeit von $\leq$ 1% absolut zu bestimmen. Ein kollimierter Gammastrahl wird in zwei Hochdruckionisationskammern an Wasserstoff (Deuterium) gestreut. Die gestreuten Photonen werden unter 90° und 130° in 10"x14" NaJ-Detektoren nachgewiesen, koinzident werden Energie und Winkel der Rückstoßprotonen bzw. -deuteronen in der Ionisationskammer bestimmt.

Es werden der fertige Experimentaufbau, sowie Ergebnisse von Simulationen und ersten Messungen präsentiert.

*Gefördert durch die DFG, SFB 634.

HK 22.3 Mo 16:30 TU MA141

Study of the parity violation in the $\Delta(1232)$ region — •Luigi Capozza — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, 55099 Mainz

A measurement of the parity violation asymmetry in electron-proton scattering using a polarised electron beam is performed at MAMI. So far the asymmetry has been fully extracted and interpreted for the elastic part of the observed spectrum. With the same apparatus, inelastic processes are recorded in parallel to the elastic scattering events. Contributions to the inelastic spectrum arise from processes such as resonance excitation, non-resonant pion production, radiative tail from the elastic scattering and other processes. In order to study parity violation in the excitation if the $\Delta(1232)$ resonance, it is important to recognise which phenomena are responsible for the experimental spectrum and with which magnitude. The aim of this work is a simulation including all relevant

processes in order to extract an estimate of the parity violation asymmetry in the $\Delta(1232)$ region.

HK 22.4 Mo 16:30 TU MA141

Single-Spin-Asymmetrien im A4-Experiment an MAMI — •Sebastian Baunack für die A4-Kollaboration — Institut für Kernphysik, Universität Mainz, J.J. Becherweg 45, 55099 Mainz

Die A4-Kollaboration führt Untersuchungen zur Struktur des Protons durch. Dazu werden am Elektronenbeschleuniger MAMI polarisierte Elektronen an unpolarisierten Protonen gestreut. Im Falle longitudinal polarisierter Elektronen wird die Paritätsverletzung in der elastischen ep-Streuung gemessen. Aus den gemessenen Asymmetrien im Wirkungsquerschnitt können Rückschlüsse auf den Beitrag von Strange-Seequarks zu den Vektorformfaktoren des Protons gezogen werden. Im Falle transversal polarisierter Elektronen werden Azimutalasymmetrien gemessen, welche den Zugriff auf den Imaginärteil der Zweiphoton-Austauschamplitude ermöglichen.
Die gemessenen Asymmetrien liegen in der Größenordnung 10^{-6}. Es wird die Analyse der Meßprogramme bei Impulsüberträgen von $Q^2 = 0.23(GeV/c)^2$ und $Q^2 = 0.11(GeV/c)^2$ sowohl bei Longitudinal- als auch bei Transversalpolarisation vorgestellt.

HK 22.5 Mo 16:30 TU MA141

Longitudinal single-spin asymmetries in semi-inclusive DIS — •Marc Schlegel and Andreas Metz — Institut fuer Theoretische Physik II, Ruhr-Universitaet Bochum, D-44780 Bochum, Germany

Non-zero single-spin asymmetries (SSA) in semi-inclusive lepton nucleon scattering have been observed recently by the HERMES collaboration. In general, SSA can be generated by time-reversal odd (T-odd) parton distributions and fragmentation functions, where the former are of particular interest, because they are non-zero only if the gauge-link in their operator definition is included [1,2]. The gauge link encodes the re-interaction of the struck quark with the target system. By means of a calculation in a perturbative spectator model for the nucleon we show explicitly that not only the leading twist SSA for a transversely polarized target is affected by the rescattering of the struck quark but also the twist-3 longitudinal SSAs (beam or target polarization) [3]. Our result indicates that previous analyses of these observables are incomplete. We also discuss if, for the twist-3 observables, the rescattering effect can be described by T-odd parton distributions in a factorized picture.
[1] Brodsky, Hwang, Schmidt [2] Collins [3] Metz, Schlegel

HK 22.6 Mo 16:30 TU MA141

Two-proton correlation function for the $pp \to pp\eta$ reaction. — •Pawel Klaja for the COSY-11 collaboration — Institute of Physics, Jagellonian University, Cracow, PL-30-059 Poland

A large enhancement in the excitation function of the $pp \to pp\eta$ reaction observed close to the kinematical threshold indicates a strong attractive interaction within the $pp\eta$ system [1, 2]. The effect can be described assuming, that the proton-proton pair is produced from a large object of a 4 fm radius [3]. It is however still not established whether the low energy $pp\eta$ system can form a Borromean or resonant state. Recently published high statistics data for the $pp \to pp\eta$ reaction measured by the COSY-11 collaboration will be used to elucidate this question. This data are presently evaluated using the well known intensity interferometry method, commonly referred to as the HBT effect [4]. This technique permits the size of the source from which protons are emitted to be determined. It is based on the correlation function of two protons relative momenta. A comparison of the experimental results with theoretical predictions will be presented and the achieved accuracy of the determination of the source size will be discussed. In particular it will be shown how the shape of two-proton correlation function calculated including Coulomb interaction and Pauli exclusion principle depends on the spatial size of the source.

Supported by FZ-Jülich and DAAD. [1] P. Moskal, Physical Rev. C **69** (2004) 025203.
[2] M. Abdel-Bary et al., Eur. Phys. J. A **16** (2003) 127.
[3] S. Wycech, Acta Phys. Polon. **B 27** (1996) 2981.
[4] D. H. Boal, C.-K. Gelbke, B. K. Jennings,
Rev. Mod. Phys. **62** (1990) 553.

HK 22.7 Mo 16:30 TU MA141

Analysing power measurements for the $\vec{p}p \to pp\eta$ reaction at COSY-11 — •Rafał Czyżykiewicz for the COSY-11 collaboration — IKP, FZ-Jülich, Germany — Jagellonian University, Kraków, Poland

Supported by FZ-Jülich and DAAD.

It is generally expected that in NN collisions the η meson is predominantly created via the mesonic excitation of the $S_{11}(1535)$ resonance, and its subsequent decay into a proton-η system. At present it is still not established what the relative production amplitudes for the $S_{11}(1535)$ resonance are. Among the available models Nakayama et al. [1] postulated a dominance of π and η as exchange mesons, while Fäldt and Wilkin [2] found a main contribution originating from the vector meson exchange. Both models are in good agreement with unpolarised observables, however they differ significantly when predicting polarisation observables – such as the analysing power A_y.

In this contribution we report on the COSY-11 measurements of A_y for the $\vec{p}p \to pp\eta$ reaction [3] determined at different close-to-threshold energies. The techniques of the polarisation determination at COSY-11 and their comparison with the results [4,5] obtained by means of the other polarimeters operating at COSY will be presented.
[1] K. Nakayama et al., Phys. Rev. **C 65** (2002) 045210.
[2] G. Fäldt and C. Wilkin, Phys. Scripta **64** (2001) 427.
[3] COSY-11: P. Winter et al., Phys. Lett. **B 544** (2002) 251; erratum-ibid. **B 553** (2003) 339.
[4] B. Lorentz, FZ-Jülich, private communication (2003).
[5] K. Ulbrich, Bonn University, private communication (2003).

HK 22.8 Mo 16:30 TU MA141

Single-Pion Production Measured at COSY-TOF* — •E. Doroshkevich, K. Haug, H. Clement, K. Ehrhardt, A. Erhardt, R. Meier, and G. J. Wagner for the COSY-TOF collaboration — Physikalisches Institut, Universität Tübingen

The single-pion production channels $pp \to d\pi^+, pp \to pn\pi^+$ and $pp \to pp\pi^0$ have been measured at COSY at incident proton energies of 400 and 800 MeV, the latter with polaried beam. In order to have minimum contributions from pion decay in flight and simultaneously an optimum phase space coverage by the central calorimeter the TOF spectrometer has been used in its short version. Track reconstruction is achieved by pixel informations from start, fiber, quirl and ring hodoscopes. Particle identification and kinetic energies have been obtained for particles detected in the central calorimeter. For particles detected at larger angles in the ring hodoscope the time-of-flight information has been utilized for the determination of their kinetic energy. This way the full event information is obtained with four overconstraints in case of the $d\pi^+$ channel and one overconstraint in case of $pp\pi^0$ and $pn\pi^+$ channels. For $pp \to d\pi^+$ the resulting angular distributions agree well with SAID. Our data for $pp \to pp\pi^0$ at $T_p = 400MeV$ agree with a previous experiment [1] in the overall features, however, deviate significantly in the angular distributions.
Graduiertenkolleg)
[1] R. Bilger et al., Nucl. Phys. **A693** (2001) 633
* supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg), FZ Jülich (FFE) and Landesforschungsschwerpunkt (Quasiteilchen)

HK 22.9 Mo 16:30 TU MA141

Determination of Effective Target Thickness and Luminosity from Beam Energy Losses at the ANKE Cluster Target* — •Irakli Keshelashvili, Michael Hartmann, Hans Joachim Stein, Yoshikazu Maeda, and Dieter Prasuhn for the ANKE collaboration — Forschungszentrum Jülich, Jülich, Germany

The thickness of a hydrogen cluster jet target and the corresponding luminosity in an experiment at the ANKE spectrometer at the internal beam of the COSY-Jülich accelerator were determined by measuring the energy loss of the circulating proton beam[1]. Possible error sources of the measurement, especially residual gas influences, were carefully studied resulting in a relative accuracy better than 10%. In parallel, the luminosity was determined by the standard technique of elastic scattering based on known cross sections. The results do compare reasonably well. Practicability and limitations of the energy loss method are discussed. * This work is supported by the FZJ.
[1] H.J.Stein, D.Prasuhn, IKP annual report 2001, 64

HK 22.10 Mo 16:30 TU MA141

Nuclear Polarization of Hydrogen and Deuterium Molecules after Recombination of Polarized Atoms in a Storage Cell — •M. Poltavtsev[1], N. Chernov[1], L. Kochenda[1], A. Kovalev[1], P. Kravtsov[1], M. Mikirtychyants[1], S. Sherman[1], V. Trofimov[1], A. Vasilyev[1], R. Engels[2], K. Grigoriev[2], F. Rathmann[2], H. Seyfarth[2], and H. Paetz gen. Schieck[3] — [1]PNPI, St. Petersburg, Russia — [2]IKP, FZ Jülich — [3]IKP, Uni. Köln

The experiment will investigate the nuclear polarization of hydrogen and deuterium molecules recombined from nuclear polarized atoms under different conditions (surface material, temperature, external magnetic field, and spin states of atoms). The experimental setup consists of three components*:
1.) An atomic beam source [1] to deliver a beam of nuclear polarized hydrogen and deuterium atoms.
2.) A Lamb-shift polarimeter [2] to analyse the polarization of the stored particles.
3.) A recombiner including a superconducting solenoid with the ionization and electrostatic extraction system.
The present status and first results will be presented.
* Supported by the ISTC, project 1861.
[1] M. Mikirtychiants et al., Proc 9th Int. Workshop PST01, USA, World Scientific, 47 (2002).
[2] R. Engels et al., Rev. Sci. Instr. **74**, 4607 (2003).

HK 22.11 Mo 16:30 TU MA141

Spektroskopie exotischer Kerne durch Transferreaktionen mit MINIBALL an REX-ISOLDE — •Monica Pantea — Institut für Kernphysik der TechnischenUniversität Darmstadt

Transferreaktionen mit leichten und schweren Ionen sind eine wichtige Quelle spektroskopischer Informationen. Mit niederenergetischen radioaktiven Strahlen, deren Intensitäten nur einige 10^4 Teilchen pro Sekunde betragen können, ist es möglich, Spektroskopie an neutronenreichen, instabilen Kernen zu betreiben [2]. Mit dem hocheffizienten und hochauflösenden γ-Spektrometer MINIBALL [3] war es in ersten Experimenten bei REX-ISOLDE [4] am CERN möglich, direkte Anregungen und Zerfall der Single-Particle-States zu studieren. Hierbei mußten wegen der geringen Strahlintensitäten Reaktionen mit hohem Wirkungsquerschnitt und angemessenen Targets wie ^{2}H oder gewählt, sowie in inverser Kinematik und bei Energien nahe der Coulombbarriere gemessen werden. Neben Experimenten zur Coulombanregung der Kerne ^{30}Mg und ^{32}Mg ist es auch gelungen, die Neutronentransferreaktion ^{2}H(^{30}Mg,^{31}Mg*)^{1}H und damit die angeregten Zustände des Kerns ^{31}Mg zu untersuchen. Erste Ergebnisse werden hier vorgestellt.
*Diese Arbeit wird gefördert durch BMBF 06 DA 115.
[2] H. Lenske and G. Schrieder, Eur. Phys. J. **A2** (1998) 41.
[3] J. Eberth et al., Prog. Part. Nucl. Phys. **46** (2001) 389.
[4] D. Habs et al., Nucl. Phys. **A616** (1997) 29.

HK 22.12 Mo 16:30 TU MA141

Untersuchung der Zustände $D^*_{sJ}(2317)^+$ und $D_{sJ}(2460)^+$ — •Marc Pelizäus für die Babar-Kollaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum, 44780 Bochum

Das Babar-Experiment am asymmetrischen e^+e^--Speicherring PEP-II des SLAC hat seit 1999 eine einer integrierten Luminosität von über 240 fb^{-1} entsprechende Datenmenge aufgezeichnet.

Durch das Babar-Experiment wurden in $e^+e^- \to c\bar{c}$ Fragmentationsereignissen erstmals die Zustände $D^*_{sJ}(2317)^+$ und $D_{sJ}(2460)^+$ beobachtet, deren Natur bisher unzureichend geklärt ist. Gegenstand der aktuellen Diskussion ist u.a. die Interpretation des $D^*_{sJ}(2317)^+$ als exotisches DK-Molekül, zu dem ebenfalls doppelt geladene und neutrale Komponenten existieren sollten. Weiterhin spielt die Messung relativer Verzweigungsverhältnisse radiativer Zerfälle der beiden Zustände eine wichtige Rolle beim Test theoretischer Vorhersagen.

Vorläufige Ergebnisse der Messung relativer Verzweigungsverhältnisse und die Suche nach doppelt geladenen und neutralen Partnern des $D^*_{sJ}(2317)^+$ im $D^+_s\pi^+$ bzw. $D^+_s\pi^-$ System werden vorgestellt.

Gefördert durch das bmb+f (Förderkennzeichen 06BO9041).

HK 22.13 Mo 16:30 TU MA141

An Experiment for the Measurement of the Bound β-Decay of the Free Neutron — •Wolfgang Schott, G. Dollinger, Th. Faestermann, J. M. Friedrich, J. Hartmann, R. Hertenberger, S. Paul, and A. Ulrich — Physik-Department TU-München und Sektion Physik der LMU-München, D-85748 Garching

The H hyperfine state population after the neutron bound β decay yields directly the neutrino left-handedness or a possible right-handed admixture, and small scalar (g_S) and tensor (g_T) contributions to the weak force. We present a possible setup to detect the two-body decay and to determine the hyperfine state of the resulting H atom. We will show that an improvement of the experimental limits of g_S and g_T by at least a factor of 10 seems possible.

HK 22.14 Mo 16:30 TU MA141

Bestimmung der Gamow-Teller-Stärke in der Reaktion ^{90}Zr(^{3}He,t)^{90}Nb* — •Y. Kalmykov[1], T. Adachi[2], G.P.A. Berg[3], H. Fujita[3], Y. Fujita[2], P. von Neumann-Cosel[1], V.Yu. Ponomarev[1], A. Richter[1], A. Shevchenko[1], Y. Shimbara[2], F.D. Smit[4] und J. Wambach[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Department of Physics, Osaka University, Japan — [3]Research Center for Nuclear Physics, Osaka University, Japan — [4]iThemba LABS, Somerser West, South Africa

Der Kern ^{90}Zr wurde am RCNP, Osaka, mit Hilfe der (^{3}He,t)-Reaktion unter 0° untersucht. Das Hauptziel des Experiments war, die Feinstruktur der Gamow-Teller-Resonanz zu untersuchen und ihre charakteristische Energieskalen zu bestimmen. Außerdem wurde die Gamow-Teller-Stärke in ^{90}Nb im Bereich $E_x < 9.7$ MeV aus dem $L = 0$ Wirkungsquerschnitt bestimmt, wobei die diskrete Waveletanalyse eine neuartige modellunabhängige Methode zur Festlegung des Untergrundverlaufs liefert. Die Ergebnisse wurden mit den Resultaten von ^{90}Zr$(p,n)^{90}$Nb–Messungen [1] verglichen. Die kumulative $B(GT_-)\uparrow$ Stärke von 6.0 ± 0.6 bis $E_x = 9.7$ MeV ist deutlich geringer als der Wert 10 ± 1.5, der aus den (p,n)–Daten extrahiert wurde. Vermutlich resultiert diese Diskrepanz zum großen Teil aus den unterschiedlichen Normierungsmethoden. In dieser Arbeit wurde die Systematik des Verhältnisses zwischen dem auf β–Zerfallsdaten normierten GT-Übergang zum Grundzustand und zum isobaren Analogzustand verwendet.
* Gefördert durch die DFG unter SFB 634 und 446 JAP 113/2670-1.
[1] T. Wakasa et al., Phys. Rev. C55 (1997) 2909.

HK 22.15 Mo 16:30 TU MA141

Kernresonanzfluoreszenz-Experimente zur Untersuchung der Pygmy-Resonanz* — •S. Volz, M. Babilon, M. Elvers, J. Hasper, K. Lindenberg, S. Müller, D. Savran und A. Zilges — Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt

In den letzten Jahren wurden zahlreiche Experimente an mittelschweren und schweren Kernen durchgeführt, um die Verteilung elektrischer Dipolstärke zwischen 4 und 12 MeV zu untersuchen.

Eine ideale Methode für solche Untersuchungen ist die Kernresonanzfluoreszenz [1]. Im Rahmen der Experimente wurden Z=20 [2] und N=82 [3] Kerne am supraleitenden Darmstädter Elektronenbeschleuniger S-DALINAC systematisch untersucht. Als generelles Phänomen wurde dabei das Auftreten einer Häufung von E1 Stärke zwischen 5 und 9 MeV - der Pygmy-Resonanz - beobachtet. Die Ergebnisse werden mit Modellrechnungen im Quasi Particle Phonon Modell (QPM) [4] und in der Extended Theory of Finite Fermion Systems (ETFFS) [5] verglichen.
* Gefördert durch die DFG (SFB 634)
[1] U. Kneissl *et al.*, Prog. Part. Nucl. Phys. **37** (1996) 349
[2] T. Hartmann *et al.*, Phys. Rev. **C65** (2002) 034301
[3] A. Zilges *et al.*, Phys. Lett. **B542** (2002) 43
[4] N. Tsoneva *et al.*, Nucl. Phys. **A731** (2004) 273
[5] T. Hartmann *et al.*, Phys. Rev. Lett., im Druck

HK 22.16 Mo 16:30 TU MA141

Paritätsmessungen in ^{172,174}Yb mit Hilfe polarisierter Photonen und die K-Quantenzahl in den Kernen der Seltenen Erden* — •D. Savran[1], M.W. Ahmed[2], M. Babilon[1,3], J.H. Kelley[4], J. Li[5], S. Müller[1], N. Pietralla[6], I. Pinaev[5], A. Tonchev[2], W. Tornow[2], H.R. Weller[2], Y. Wu[5], A. Zapp[1] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt — [2]Duke University, Durham, NC, USA — [3]Wright Nuclear Structure Laboratory, Yale University, New Haven, CT, USA — [4]North Carolina State University, Raleigh, NC, USA — [5]Free Electron Laser Laboratory, Department of Physics, Duke University, Durham, NC, USA — [6]Nuclear Structure Laboratory, Department of Physics & Astronomy, SUNY, Stony Brook, NY, USA

Mit Hilfe des zu 100 % polarisierte Photonenstrahls der High Intensity γ-ray Source (HIγS) an der Duke University wurden die Paritäten von sechs Dipolanregungen in den deformierten Kernen ^{172,174}Yb in Photonen-Streuexperimenten gemessen. Die Ergebnisse wer-

den mit Zuweisungen basierend auf der K-Quantenzahl verglichen, die in Kernresonanzfluoreszenz-Experimenten (KRF) über die Alaga-Regeln zugewiesen wurden. Darüber hinaus wird eine systematische Untersuchung der Beziehung zwischen Verzweigungsverhältnissen und Paritäten von Dipolanregungen in den Kernen der Seltenen Erden präsentiert.
* gefördert durch die DFG (SFB 634), DAAD und U.S. DOE Grant No. DE-FG02-97ER41033.

HK 22.17 Mo 16:30 TU MA141

ANGULAR CORRELATIONS OF THE DECAY CHANNELS OF ^{56}Ni* FORMED IN THE ^{24}Mg + ^{32}S REACTION — •G. Efimov[1,2,3], W. von Oertzen[1,2], G. Gebauer[2], S. Thummerer[2], Tz. Kokalova[1,2], C. Wheldon[1], Ch. Schulz[2], H.G. Bohlen[2], D.R. Napoli[4], S.M. Lenzi[5], C. Beck[6], M. Rousseau[6], P. Papka[6], and D. Kamanin[3] — [1]Freie Universität, Berlin, Germany — [2]SF7, Hahn-Meitner-Institut Berlin, Germany — [3]Joint Institute for Nuclear Research, JINR, Dubna, Russia — [4]INFN-Laboratori Nazionali di Legnaro, Legnaro, Italy — [5]Dipartimento di Fisica and INFN, Padova, Italy — [6]Institut de Recherches Subatomiques, Strasbourg, France

Using the Binary Reaction Spectrometer (BRS) together with the EUROBALL array of Ge detectors the coplanarity of events with two heavy fragments in the decay channels of the reaction ^{32}S + ^{24}Mg → ^{56}Ni at an energy of E_L = 163.5 MeV has been reconstructed. For the correlated detection of two heavy ejectiles, the BRS combines 2 large-area gas detector telescopes in a kinematic coincidence set-up.

Extremely narrow out-of-plane angular correlations are observed not only in the case of binary decays with no charge loss, but also for the events with missing charges of 4 and 6. This observation can be interpreted as due to ternary fission processes, proceeding through elongated shapes of the hyper deformed compound nucleus.

HK 22.18 Mo 16:30 TU MA141

TERNARY FISSION OF THE COMPOUND NUCLEUS ^{60}Zn FORMED IN THE ^{24}Mg + ^{36}Ar REACTION — •V. Zherebchevsky[1,2,3], W. von Oertzen[1,2], G. Gebauer[2], S. Thummerer[2], Ch. Schulz[2], H.G. Bohlen[2], Th. Wilpert[2], and D. Kamanin[3] — [1]Freie Universität Berlin, Germany — [2]Hahn-Meitner-Institut Berlin, Germany — [3]Joint Institute for Nuclear Research, JINR, Dubna, Russia

This experiment has been performed in Berlin using the Binary Reaction Spectrometer (BRS) combined with the Gamma-Spectrometer OSIRIS.

"Binary" coincidences with missing charges of $\Delta Z = 4$ and 6 are observed as ternary fission events. The systematics of the ternary fission process (energy spectra, yields, etc.) have been studied and are interpreted using the Extended Hauser Feshbach formalism.

HK 22.19 Mo 16:30 TU MA141

Search for Short-Lived Fission Isomers in light Actinides* — •P.G. Thirolf, D. Habs, R. Hertenberger, H.J. Maier, T. Morgan, O. Schaile, W. Schwerdtfeger, and J. Szerypo — Ludwig-Maximilians-Universität München

Spectroscopic studies of super- and hyperdeformed actinide nuclei offer the possibility to gain insight into the multiple-humped fission barrier landscape of these heavy nuclei. With the identification of deep third minima in ^{234,236}U the systematics of fission isomers in light actinides was revisited, especially searching for short-lived isomers in light uranium isotopes. Using a geometrical projection method and solid state nuclear track detectors, we started an experimental search for their observation. This rather old detection technique [1] nowadays benefits from an efficient analysis technology based on a PC-controlled auto-focus microscope and a CCD camera together with pattern recognition software. Using the ^{232}Th(α,2n) reaction, evidence was found for a new fission isomer in ^{234}U with a halflife of 110±10 ps. The reaction ^{238}U(α,2n) was used for calibration and normalization. Excitation functions and absolute prompt and isomeric fission cross sections were measured. Also the (^{3}He,3n) reactions on ^{232}Th and ^{235}U target were studied in a similar way, searching for an isomer in ^{232}U and measuring the known isomer in ^{238}Pu for calibration purposes, respectively. First results will be presented. [1] V. Metag et al., Nucl. Instr. Meth 114 (1974) 445.
* Supported by the DFG under contract HA 1101/12-1

HK 22.20 Mo 16:30 TU MA141

Bestimmung der Kernladungsradien von ^{8,9}Li und ^{11}Li — •Guido Ewald[1], Daniel Albers[2], John Behr[2], Pierre Bricault[2], Bruce Bushaw[3], Andreas Dax[4], Jens Dilling[2], Marik Dombsky[2], Gordon Drake[5], Stefan Götte[1], Reinhard Kirchner[1], Thomas Kühl[1], Jens Lassen[2], Phil Levi[2], Wilfried Nörtershäuser[1,6], Matthew Pearson[2], Erika Prime[2], Vladimir Ryjkov[2], Rodolfo Sanchez[1], Agnieszka Wojtaszeck[1], H.-Jürgen Kluge[1], Zong-Chao Yan[7] und Claus Zimmermann[6] — [1]GSI Darmstadt — [2]TRIUMF, Vancouver, Kanada — [3]PNNL, Richland, USA — [4]PSI, Villingen, Schweiz — [5]Univ. Windsor, Kanada — [6]Univ. Tübingen — [7]Univ. New Brunswick, Kanada

Am TRIUMF in Vancouver wurden die Ladungsradien der gesamten Lithium-Isotopenkette, einschließlich des Halokerns ^{11}Li vermessen. Damit wurde bei ^{11}Li ein letzendlicher direkter Beweis über das Maß der Trennung von Halo und innerem Kern erbracht. Der Ladungsradius wurde über die Isotopieverschiebung im $2S \rightarrow 3S$-Zweiphotonen-Übergang bestimmt. Dieser Ansatz ist bei leichten Elementen mit mehr als 2 Elektronen das erste Mal durch eine Kombination von hochgenauer Atomtheorie [1] und Experiment möglich. Am ISAC-Online-Massenseparator (TRIUMF) wird das kurzlebige ^{11}Li-Isotop mit einer Rate von etwa 50 000 s^{-1} hergestellt, woraufhin die Ionen gestoppt, neutralisiert, spektroskopiert, ionisiert und nachgewiesen werden. Die Ergebnisse liefern den Verlauf der Ladungsradien der Lithium-Isotopenkette in Vergleich zum verwendeten Referenzisotop ^{6}Li.
[1] Yan and Drake, PRA 61 022504 (2000), PRA 66 042504 (2002)

HK 22.21 Mo 16:30 TU MA141

Towards 2n Transfer Reactions around the Island of Inversion — •W. Schwerdtfeger[1], B. Bruyneel[2], T. Faestermann[3], R. Gernhäuser[3], D. Habs[1], T. Kröll[3], R. Krücken[3], M. Lauer[4], R. Lutter[1], H.J. Maier[1], T. Morgan[1], M. Münch[3], O. Niedermaier[4], P. Reiter[2], O. Schaile[1], H. Scheit[4], P. Thirolf[1], W. von Oertzen[5], N. Warr[2], and H. Wolter[1] for the MINIBALL collaboration — [1]Sektion Physik, Ludwig Maximilians Universität München — [2]Institut für Kernphysik, Köln — [3]E12, Technische Universität München — [4]Max Planck Institut, Heidelberg — [5]Hahn Meitner Institut, Berlin

Transfer reactions enable to investigate the shape coexistence of e.g. super deformed and spherical 0^+ states in Mg isotopes around the island of inversion at $N \approx 20$, because the transfer to first order is shape conserving. Two neutron transfer reactions from a radioactive ^{10}Be target provide a distinct trigger via the two α particles ejected from the intermediate ^{8}Be reaction product. In order to estimate the cross section of the two neutron transfer ^{10}Be(^{30}Mg,^{32}Mg)^{8}Be, which is intended to be performed at REX-ISOLDE CERN, the preparatory reaction ^{9}Be(^{26}Mg,^{27}Mg*)^{8}Be (E_{lab} = 57 MeV) has been studied at the MINIBALL γ-spectrometer in Cologne. First results of this measurement will be presented together with coupled channel DWBA calculations using the code FRESCO[1] for the one neutron as well as for the two neutron transfer reaction.
[1] I.J. Thompson, Comp. Phys. Rep. **7** (1987) pp 167-212

HK 22.22 Mo 16:30 TU MA141

Kinematically complete experiment with light neutron rich nuclei using knock-out reactions on protons — •H.T. Johansson and H. Simon for the S245 collaboration — Gesellschaft für Schwerionenforschung (GSI), D–64291 Darmstadt

The S245 experiment at GSI, Darmstadt, aims at investigating the cluster structure of the exotic, multi-neutron halo nuclei ^{8}He, ^{11}Li, ^{14}Be. Secondary beams (250-300 MeV/u) of these nuclei were produced at the FRS and knockout reactions induced in a liquid hydrogen target were studied. The momenta of the recoiling proton and of charged projectile fragments are obtained by measuring scattering angles, time-of-flight, energy loss, and, in part, magnetic rigidity. Emitted neutrons are detected with the Large Area Neutron Detector [1].

Halo-neutron removal in heavy-ion induced knockout reactions were observed earlier [2]. In the present experiment, a multitude of charge-changing reactions are observed in addition; first results are presented.

This work is supported by BMBF (06 DA 115) and GSI.
[1] Th. Blaich et al., Nucl. Instr. and Meth. A **314**, 136-154 (1992)
[2] H. Simon et al., Nucl. Phys. A **734**, 323-326 (2004)

HK 22.23 Mo 16:30 TU MA141

Low-energy transfer reactions with a ^9Li beam* — •Thomas Nilsson for the ISOLDE-IS371 collaboration and the REX-ISOLDE collaboration — Institut für Kernphysik, Technische Universität Darmstadt

The recently commissioned post-accelerator for radioactive beams REX-ISOLDE enables the majority of the ∼700 nuclides available at CERN-ISOLDE to be post-accelerated to 0.3-3.1 MeV/u[1]. This permits an unprecedented range of exotic nuclei to be experimentally investigated through low-energy reactions.

The first experimental results of transfer reactions following ^9Li incident on a deuterated polypropylene target at 2.36 MeV/u are presented. ^9Li constitutes the core of the emblematic two-neutron halo nucleus ^{11}Li and its unbound two-body subsystem $^9Li + n$ can be studied through $^2H(^9Li, p)$ reactions. In addition, several further reaction products were observed, d, t, ^4He and ^6He[2]. The $^2H(^9Li, t)^8Li^*$ channel is of special interest in conjunction with new ab-initio[3] and shell-model[4] calculations, both predicting hitherto unobserved excited states in ^8Li. The experimental data are generally well described by population of the ground state and the three first excited states, however, a small discrepancy at ∼4 MeV could offer a first glimpse of additional states.

*This work was supported by the BMBF under the contract 06DA115.

[1] D. Habs *et al.*, Hyp. Int. **129** (2000) 43

[2] H.B. Jeppesen *et al.*, submitted to Nucl. Phys. A

[3] S.C. Pieper and R.B. Wiringa, Annu. Rev. Nucl. Part. Sci. **51** (2001) 53

[4] D. Kurath, Private communication to A. Richter

HK 22.24 Mo 16:30 TU MA141

New Mass Measurements with FRS-ESR at GSI — •L. Chen[1], K. Beckert[2], P. Beller[2], F. Bosch[2], D. Boutin[1,2], L. Caceres[2], J.J. Carroll[3], R. S. Chakrawarthy[4], D. Cullen[5], B. Franzke[2], H. Geissel[1,2], J. Gerl[2], E. Greda[2], G. Jones[6], A. Kishada[5], O. Klepper[2], H.-J. Kluge[2], R. Knöbel[1], C. Kozhuharov[2], E. Kulich[2], N. Kuzminchuk[2], S.A. Litvinov[1,2], Yu.A. Litvinov[1,2], Z. Liu[6], S. Mandal[2], M. Matos[2], F. Montes[7], G. Münzenberg[2], F. Nolden[2], Yu.N. Novikov[8], W. Plass[1], Z. Podolyak[6], R. Propri[3], S. Rigby[5], N. Saito[2], T. Saito[2], C. Scheidenberger[1,2], M. Shindo[9], M. Steck[2], P. Ugorowski[3], G. Vorobjev[2], P.M. Walker[6], H. Weick[2], S. Williams[6], M. Winkler[2], and H.-J. Wollersheim[2] — [1]JLU Giessen — [2]GSI Darmstadt — [3]SU Youngstown — [4]TRIUMF Vancouver — [5]Uni. Manchester — [6]Uni. Surrey — [7]MSU East Lansing — [8]PNPI Gatchina — [9]Uni. Tokyo

First results are reported from a recent experiments with neutron-rich uranium fragments at the FRS-ESR facilities. 670 MeV/u ^{238}U projectiles with an intensity of 1-2*10^{9}particles/spill were fragmented in 4 g/cm^2 ^{9}Be target placed in front of the fragment separator FRS. The FRS was used to separate the fragments in flight and to inject them into the storage-cooler ring ESR. Time resolved Schottky Mass Spectrometry was applied to measure the revolution frequencies of stored and electron-cooled ions. Preliminary results on masses and half-lives of neutron-rich nuclides in the lead area will be presented.

HK 22.25 Mo 16:30 TU MA141

Mass and Lifetime Measurements of Exotic Nuclei — •Helmut Weick for the ILIMA collaboration — GSI Darmstadt, Germany

Precision measurements of nuclear masses and lifetimes of stored exotic nuclei at relativistic energies and studies with isomeric beams are planned [1]. The new international facility FAIR [2] with production and separation of exotic nuclear beams in the new fragment separator Super-FRS [3] will yield access to interesting nuclei near and at the driplines which cannot be accessed with present facilities.

The measurements can be done after fast stochastic cooling in the collector ring (CR) and electron cooling of the exotic ions in the new experimental storage ring (NESR) using Schottky pickups and particle detectors for lifetime measurements. Very shortlived nuclei can be investigated directly in the CR using an isochronous mode of the ring together with a ToF detector or fast resonant pickups. The planned experiments are triggered by the successful experimental program at the present FRS-ESR facilities [4].

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[1] `http://www.gsi.de/documents/DOC-2004-Apr-89-1.pdf`

[2] `http://www.gsi.de/GSI-Future/cdr/`

[3] H. Geissel et al., Nucl. Instr. Meth in Phys Res. **B204** (2003) 71.

[4] see group report 'Mass and Half-Live Measurements at FRS-ESR facilities at GSI' by Yu. Litvinov

HK 22.26 Mo 16:30 TU MA141

Laser spectroscopy and β-NMR measurements on ^{11}Li and on Mg isotopes around $N = 20$ — •M. Kowalska[1], K. Blaum[1,2], D. Borremans[3], P. Himpe[3], P. Lievens[3], S. Mallion[3], R. Neugart[1], G. Neyens[3], N. Vermeulen[3], and D. Yordanov[3] — [1]Universität Mainz, Germany — [2]CERN, Switzerland — [3]K.U.Leuven, Belgium

Measurements of nuclear moments are crucial for a better understanding of nuclear structure, in particular in connection with halo and shell effects. This is demonstrated for recent results on ^{11}Li and ^{31}Mg. Beams from ISOLDE are optically polarised with laser light and implanted into a host crystal. Scans of the optical excitation frequency show the hyperfine structure in the β-decay asymmetry. NMR measurements are performed for the laser frequency at resonance. Radio-frequency is applied and the nuclear g-factor and quadrupole moment are measured.

High-resolution NMR measurements were performed recently on the halo nucleus ^{11}Li. They reveal a quadrupole moment significantly larger than that of the ^{9}Li core, showing the influence of the halo neutrons on the proton core. Similar experiments took place on neutron-rich Mg isotopes, to further explore the "island of inversion". A combined measurement of the hyperfine structure and g-factor of ^{31}Mg reveals an unexpected $1/2^+$ ground state, dominated by 2p-2h intruder configurations, proving a weakening of the $N = 20$ shell closure. These investigations are being extended to ^{29}Mg and ^{33}Mg.

(Supported by BMBF and FWO Vlaanderen)

HK 22.27 Mo 16:30 TU MA141

Anomalous expansion in heavy-ion reactions around Fermi energy — •K. Morawetz[1,2], M. Płoszajczak[3] und V.D. Toneev[4] — [1]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [2]Max-Planck-Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany — [3]Grand Accélérateur National d'Ions Lourds (GANIL), CEA/DSM – CNRS/IN2P3, BP 5027, F-14076 Caen Cedex 05, France — [4]Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980 Dubna, Russia

Central heavy-ion reactions are simulated within the nonlocal kinetic theory. In the Fermi energy domain the expansion velocity profile is found to be non-Hubblean in the surface region scaling proportional to a higher exponent of the radius. This anomalous expansion velocity profile is accompanied by a specific power law nucleon density profile in the surface region. Both these features disappear at higher energies, and the system follows a uniform Hubble expansion. The interpretation is given in terms of Tsallis statistics revealing a critical behavior pointing towards a phase transition.

[1] P. Lipavský, K. Morawetz, and V. Špička; Annales de Physique, Paris, 2001, No. 26, 1, ISBN 2-86883-541-4

[2] K. Morawetz, P. Lipavsk'y, V. Spicka; Ann. Phys. 294 (2001) 135

[3] K. Morawetz, M. Płoszajczak, V.D. Toneev; Phys. Rev. C 62(2001) 64602

[4] K. Morawetz; Physica A 305 (2002) 234-237

HK 22.28 Mo 16:30 TU MA141

Flow due to nonlocal correlations in heavy-ion reactions — •K. Morawetz — Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — Max-Planck-Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany

The flow parameters like squeezing and flow angle are systematically calculated for ALADIN-INDRA data on Au+Au. The nonlocal extension of BUU [1,2] is compared with standard simulations. A visible effect of nonlocal correlations is seen and it is found a better agreement with the data. This underlines the improvement by nonlocal extensions as found earlier when comparing with data of charge density distribution [3] or particle spectra [4].

[1] P. Lipavský, K. Morawetz, and V. Špička; Annales de Physique, Paris, 2001, No. 26, 1, ISBN 2-86883-541-4

[2] K. Morawetz, P. Lipavsk'y, V. Spicka; Ann. Phys. 294 (2001) 135

[3] K. Morawetz, P. Lipavský, J. Normand, D. Cussol, J. Colin, B. Tamain, Phys. Rev. C 63 (2001) 034619

[4] K. Morawetz, V. Špička, P. Lipavský, G. Kortemeyer, Ch. Kuhrts, R. Nebauer, Phys. Rev. Lett. 82, (1999), 3767

HK 22.29 Mo 16:30 TU MA141

Production and decay of charmonium in dense nuclear matter — •Goran Kruzic[1], Elena Bratkovskaya[2], Roman Caplar[3], and Peter Senger[1] — [1]GSI,Darmstadt,Germany — [2]Univ. Frankfurt, Germany — [3]IRB Zagreb, Croatia

Production and absorption mechanisms of charmonium in dense nuclear matter have been studied using the Hadron String Dynamics (HSD) model. The HSD code provides a microscopic way of calculating Pt, rapidity, and invariant mass spectra (taking into account in-medium effects) for particles of interest: J/psi, rho, omega and phi. Additionally, the perturbative treatment of charmed mesons in the HSD model ensures predictions of their multiplicities and differential spectra. In order to optimize the layout of the Compressed Baryonic Matter (CBM) detector facility for future experiments at the Facility for Antiproton and Ion Research(FAIR), we have simulated the electron-positron decay channel of J/psi and various sources of background (Pi0-¿2gamma,Pi0-¿Dalitz,eta-¿2gamma,eta-¿Dalitz,phi¿e+e-,rho-¿e+e-,omega-¿e+e-) in the range of energies from 10 to 45 GeV/ nucleon.

HK 22.30 Mo 16:30 TU MA141

Vorbereitende Untersuchungen zur Laserspektroskopie an Nobelium — •A. Dretzke[1], D. Ackermann[2], H. Backe[1], M. Block[2], H.P. Hessberger[2], S. Hofmann[2], R. Horn[1], H.-J. Kluge[2], T. Kolb[1], P. Kunz[1], W. Lauth[1] und M. Sewtz[1] — [1]Institut für Kernphysik der Universität, D-55099 Mainz — [2]Gesellschaft für Schwerionenforschung, D-64291 Darmstadt

Zur Laserspektroskopie an Trans-Einsteinium-Elementen wurde eine hochempfindliche Methode entwickelt, die auf der Resonanzionisationsspektroskopie in einer Puffergaszelle basiert. Erste Experimente sollen an Nobelium (Z = 102) durchgeführt werden, für das keinerlei atomspektroskopische Daten bekannt sind. Das Nuklid ^{254}No ($T_{1/2}$ = 55 s) soll über die Kernreaktion ^{208}Pb (^{48}Ca,2n)^{254}No am Geschwindigkeitsfilter SHIP der GSI in Darmstadt erzeugt werden. Die erzeugten Ionen werden im Puffergas abgestoppt und neutralisieren teilweise. Die verbleibenden geladenen Reaktionsprodukte werden mit elektrischen Feldern aus der Zelle entfernt, so dass die neutralen Fusionsprodukte in der Zelle gespeichert bleiben und für laserspektroskopische Untersuchungen zur Verfügung stehen. Nach der Resonanzionisation, die über eine zweistufige Anregung geschieht, werden die Ionen mit einem elektrischen Feld auf einen Halbleiterdetektor gesaugt und durch ihren α-Zerfall nachgewiesen. Erste Voruntersuchungen wurden an den Nukliden ^{152,153}Er ($T_{1/2}$ = 10.3 bzw. 37.1 s) und ^{154,155}Yb ($T_{1/2}$ = 0.4 bzw. 1.6 s), für die die atomaren Niveaus bekannt sind, durchgeführt.

Gefördert durch Bundesministerium für Bildung und Forschung (BMBF) (06MZ169I).

HK 22.31 Mo 16:30 TU MA141

Laser cooling of relativistic C^{3+} ion beams at the ESR†. — •U. Schramm[1], M. Bussmann[1], D. Habs[1], M. Steck[2], T. Kühl[2], K. Beckert[2], P. Beller[2], B. Franzke[2], F. Nolden[2], G. Saathoff[3], S. Reinhard[3], and S. Karpuk[4] — [1]LMU München, Department für Physik — [2]GSI, Darmstadt — [3]MPI für Kernphysik, Heidelberg — [4]Universität Mainz, Institut für Kernphysik

We present results of the first laser cooling experiment with relativistic C^{3+} beams at 1.47 GeV energy at the Experimental Storage Ring (ESR) at GSI. A bunched beam of several 10 μA was laser-cooled by a counterpropagating laser beam kept at a fixed wavelength of $\lambda = 257$ nm. With pure laser cooling[1] the regime of a longitudinally space-charge dominated beam with a momentum spread of $\Delta p/p \approx 10^{-7}$ was reached – a value unprecedented at the ESR.
These experiments represent an important intermediate step for the development of laser cooling techniques proposed for beams of highly-charged heavy ions at the future SIS300 synchrotron (GSI-FAIR) in a regime where no other cooling scheme seems feasible.

[†] funded by BMBF (06ML183)
[1] **Poster** M. Bussmann et al. *Probing the structure of crystalline ion beams*

HK 22.32 Mo 16:30 TU MA141

Identification of heavy spallation residues in the Spaladin experiment — •Michael Böhmer for the Spaladin collaboration — Physik Department E12, TU München

To improve our understanding of the spallation mechanism a complete experiment, called SPALADIN, has been performed in 2004 at GSI using the spallation reactions ^{56}Fe + p in reverse kinematics at 1 GeV/A.

The detection in coincidence of all the characteristics (type and energy) of the evaporation particles (including neutrons) and of the heavy residue should permit the reconstruction of the remnant prior to evaporation in mass, charge and excitation energy.

The reconstruction of the heavy residue mass was done using a ring imaging Čerenkov detector for heavy ions with a velocity reolution of $\Delta\beta/\beta < 10^{-3}$ and the GSI ALADIN magnet. We will discuss the method and show first results from the experiment with about 50 different heavy residues identified.

HK 22.33 Mo 16:30 TU MA141

Investigation of the SHIPTRAP gas cell — •Sergey Eliseev for the SHIPTRAP collaboration — GSI,Planckstr.1,64291 Darmstadt

The SHIPTRAP double penning trap mass-spectrometer installed behind SHIP is designed for precision mass measurements of very heavy nuclei. The key component determining the overall efficiency of the spectrometer is the gas stopping cell. The stopping and extraction efficiency as well as the extraction time of the gas cell were examined with a ^{223}Ra-ion source for several pressures of the He stopping gas. The stopping efficiency at the working pressure of 40 mbar amounts to 40% and increases with the pressure. The extraction efficiency was measured to be about 25%. The extraction time was of the order of 15 ms and consistent with the calculations. The influence of the ion diffusion in the stopping gas and of the contamination of the stopping gas on the performance of the gas cell are considered. A further improvement of the gas cell, based on the results of this investigation, is planned.

HK 22.34 Mo 16:30 TU MA141

Stopping and cooling of fusion reaction products with buffer gas cells* — •J.B. Neumayr[1], L. Beck[1], D. Habs[1], S. Heinz[1], J. Szerypo[1], P.G. Thirolf[1], V. Varentsov[1], F. Voit[1], M. Block[2], S. Eliseev[2], H.-J. Kluge[2], M. Mukherjee[2], W. Quint[2], S. Rahaman[2], C. Rauth[2], D. Rodriguez[2], G. Sikler[2], C. Weber[2], W. Plass[3], and Z. Wang[3] for the SHIPTRAP and the MLLTRAP collaboration — [1]Ludwig-Maximilians-Universität München — [2]GSI, Darmstadt — [3]Justus-Liebig-Universität Giessen

High precision measurements of reaction products in trap systems like SHIPTRAP at GSI require an efficient way of stopping and cooling the energetic ions prior to their injection into the trap. This can be achieved with buffer gas cells. The combination of buffer gas cell and extraction RFQ for the SHIPTRAP facility at GSI was designed and characterized at the MLL (Maier-Leibnitz-Labor) in Garching with a stopping and extraction efficiency (4-8%) that enabled first successful high precision mass measurements at SHIPTRAP. An improved buffer gas cell is presently set up at the MLL, representing the base for further optimizations of the cell performance also at SHIPTRAP as well as for experiments at the MLLTRAP facility in Garching [1]. [1] J. Szerypo et al., Nucl. Instr. Meth. B204, 512 (2003)
* Supported by the BMBF and GSI

HK 22.35 Mo 16:30 TU MA141

Physics with exotic nuclei at the Low-Energy-Branch of the Super-FRS — •C. Scheidenberger for the NUSTAR collaboration — GSI Darmstadt

The Low-Energy-Branch of the Super-FRS will provide high-intensity exotic nuclear beams of all elements for experiments with energies in the range (5...200)MeV/u, with stopped beams, and with accelerated beams (10...100)keV. Versatile and advanced instrumentation will provide ideal conditions for a broad experimental physics programme. The high-intensity beams will allow for new astrophysical studies relevant for a deeper understanding of the s-process. High-resolution gamma-ray spectroscopy will explore Coulomb excitations close to the barrier and nucleon transfer, deep-inelastic and compound reactions. Decay spectroscopy with stopped beams (alpha-, beta- and isomer-spectroscopy) of nuclei implanted in thin, active stoppers will benefit from small range straggling and thus allow for new opportunities in x-ray and electron spectroscopy. Accelerated beams will be available due to the use of a new hybrid system (in-flight separation, energy focusing, and stopping in a helium-filled stopping cell). The full experimental spectrum of modern low-energy radioactive-beam facilities, such as Penning traps, charge breeders (EBIS), electron-beam ion traps (EBIT), LASER spectroscopy will be used to study neutron rich nuclei. The opportunity to produce exotic nuclei and antiprotons at the same facility will allow for new ex-

periments using this particular hadronic probe, for instance for the study of formation and properties of antiprotonic exotic nuclei.

HK 22.36 Mo 16:30 TU MA141

A set-up for high-resolution in-flight spectroscopy with rare isotope beams at FAIR — •Jürgen Gerl for the HISPEC collaboration — GSI Darmstadt

The HISPEC project being part of the NUSTAR facility [1] at FAIR/GSI aims to study the structure of exotic nuclei by high-resolution in-flight spectroscopy, taking advantage of the isotopes produced at the Super-FRS facility at FAIR. Mono-energetic beams in the range 3 MeV/u to 100 MeV/u available at the Low Energy Branch of the Super-FRS will be used for gamma spectroscopy employing multiple Coulomb excitation, direct reactions and compound reaction at barrier energies as well as single step Coulomb excitation and fragmentation at inter-mediate beam energies. The set-up will comprise beam particle identification and tracking detectors before an active reaction target surrounded by the 4pi Ge gamma tracking array AGATA. At intermediate energies beam -like particle tracking and identification by a magnetic spectrometer (e.g. ALADIN) is foreseen. For low energies the HYDE heavy particle array for reaction studies and a complete suite of ancillary detectors including a velocity filter added to the magnet separator is planned.

[1] Letters of Intent for the NUSTAR Facility, http://www.gsi.de/nustar

HK 22.37 Mo 16:30 TU MA141

Measurements with an advanced trapping system at the GSI future facility FAIR — •Klaus Blaum[1,2] and Frank Herfurth[2] for the MATS collaboration — [1]GSI Darmstadt, Planckstraße 1, 64291 Darmstadt, Germany — [2]Institute of Physics, Johannes Gutenberg-University Mainz, 55099 Mainz, Germany

Ion traps play an important role not only in high-precision experiments on stable particles but also on exotic nuclei. Besides accurate mass measurements they have recently been introduced to nuclear decay studies and laser spectroscopy as well as to tailoring the properties of radioactive ion beams. This broad usage of trapping devices at accelerator facilities is based on the manifold advantages of a three-dimensional ion confinement in well controlled fields: First, the extended observation time is only limited by the half-life of the radionuclide of interest, yielding very high precisions for instance for mass measurements. Second, stored ions can be cooled and manipulated in various ways, even polarization and charge breeding of the ions are possible, giving a unique tool in order to prepare otherwise impossible experiments. Third, it is possible to create a backing free source of radioactive nuclei and to collect light particles (e^- and e^+) very efficiently, reducing a number of uncertainty in classical spectroscopic experiments. The MATS Collaboration proposes an advanced trapping system at the future GSI facility FAIR for high-precision mass measurements and decay studies on short-lived radionuclides. The proposed setup and the planned experimental program will be presented.

HK 22.38 Mo 16:30 TU MA141

A universal setup for kinematical complete measurements of Reactions with Relativistic Radioactive Beams at FAIR — •Thomas Aumann for the R3B collaboration — GSI, Darmstadt

A versatile reaction setup with excellent efficiency, acceptance, and resolution for kinematically complete measurements of reactions with high-energy radioactive beams is proposed. The setup will be located at the focal plane of the high-energy branch of the SUPER-FRS, an integral part of the new accelerator facility FAIR planned at GSI [1]. The setup will be adapted to the highest beam energies (corresponding to 20 Tm magnetic rigidity) provided by the SUPER-FRS. The combination of a superconducting large-acceptance dipole with high-resolution tracking and time-of-flight detectors will provide significant improvements in momentum resolutions for heavy fragments, light-charge particles, and neutrons retaining full-acceptance measurement. An additional magnetic spectrometer allows highest resolution in momentum analysis of heavy fragments. The technical design of the detectors and magnetic spectrometers is presently performed by an international collaboration [2]. The experimental setup is suitable for kinematically complete measurements for a wide variety of scattering experiments, such as heavy-ion induced electromagnetic excitation, knockout and fragmentation, or light-ion (in)elastic and quasi-free scattering in inverse kinematics.

[1] An International Accelerator Facility for Beams of Ions and Antiprotons, Conceptual Design Report, Publisher GSI (2001), http://www.gsi.de/GSI-Future/cdr/
[2] Letter of Intent of the R3B collaboration, http://www-land.gsi.de/r3b/.

HK 22.39 Mo 16:30 TU MA141

Nuclear Structure Studies on Exotic Nuclei by Light-Ion Induced Direct Reactions with Stored Radioactive Beams — •Peter Egelhof for the EXL collaboration — Gesellschaft für Schwerionenforschung mbH (GSI), D-64291 Darmstadt

The experimental conditions at the future facility FAIR will provide unique opportunities for nuclear structure studies on nuclei far off stability, and will allow reaching new regions in the chart of nuclides of high interest for nuclear structure and astrophysics. In particular, the predicted luminosities will allow for the investigation of direct reactions with stored and cooled radioactive beams at internal H, He, etc. targets of the storage ring NESR. This technique enables high resolution measurements down to very low momentum transfer and provides a gain in luminosity from accumulation and recirculation of the radioactive beams. A brief overview on the research objectives will be given.

The design of a complex detector setup, including a detector for recoiling target-like reaction products and gammas, surrounding the internal target, as well as a forward detector for fast ejectiles and beam-like reaction products, is presently investigated by the EXL collaboration with the aim to provide a highly efficient, high resolution universal detection system, applicable to a wide class of reactions. Results of a design study and the present status of the project are presented.

HK 22.40 Mo 16:30 TU MA141

Electron Scattering off Rare Isotopes — •Haik Simon for the ELISe collaboration — GSI Darmstadt, Germany

The planned international accelerator facility FAIR at Darmstadt [1,2] will provide intense high-quality ion beams. A new double synchrotron ring system will accelerate 10^{12} ions/s up to uranium to an energy of 1.5 GeV/u. A system of storage-cooler rings will be used to reduce the emittance and energy spread of secondary beams created via fragmentation or fission reactions [3] in the Super-FRS.

Two intersecting electron and ion rings (eA collider [4]) will allow [5] to scatter electrons with an energy of 125-500 MeV off exotic nuclei. The eA collider will enable for the first time to perform elastic, inelastic and quasielastic electron scattering off shortlived radioactive isotopes. The collider kinematics has the advantage that it will be possible to detect electrons and target like ejectiles in coincidence. One of the most challenging aspects in this context is the design of a high-resolution electron spectrometer with large acceptance adapted to the specific demands of an in-ring experiment. Charge distributions, transition form factors in giant resonance or electrofission experiments and spectral functions can be measured with a clean electromagnetic probe. The future prospects and feasability of these sophisticated experiments will be shown.

[1] `http://www.gsi.de/zukunftsprojekt/`
[2] `http://www.gsi.de/GSI-Future/cdr/`
[3] H. Geissel et al., Nucl. Inst. Meth. **B204**(2003)71
[4] I.A Koop et al., BINP-GSI Report 2001
[5] L.V. Chulkov et al., Physica Scripta **T104**(2003)144

HK 22.41 Mo 16:30 TU MA141

Decay spectroscopy with implanted beams at FAIR (DESPEC) — •M. Górska for the DESPEC collaboration — GSI Darmstadt, Germany

The access to the first structure information of the most exotic nuclei will be possible with the implanted beams into the active stopper detector. The subsequent α, proton, β, γ and neutron decays of those species will be measured with a compact multi task array consisting of double sided silicon strip detectors, germanium γ-ray detectors and neutron detectors. The main objective of the DESPEC collaboration are the doubly magic nuclei placed at the extremes of the chart of nuclides, as ^{100}Sn, the new magic numbers and shell evolution for the very neutron rich isotopes e.g. ^{120}Zr, and exploration of astrophysical r and rp- process paths. The necessary development of the new detector and electronic and data acquisition techniques will be undertaken within this project.

HK 22.42 Mo 16:30 TU MA141

Development of High Density Cluster-Jet-Targets for Storage Ring Experiments — •Alexander Täschner, Alfons Khoukaz, Hans-Werner Ortjohann, and Tobias Rausmann — Institut für Kernphysik, Universität Münster, D-48149 Münster

Cluster-jet-targets are sucessfully in operation for many years as internal targets for storage ring experiments. Main advantages of this windowless type of target are a density distribution which is homogeneous and constant in space and time, an extreme high purity of the target beams and an easy possibility to adjust the density and therefore the luminosity of the experiment by orders of magnitude.

However, in order to utilize these advantages for new types of detector systems in 4π-geometry like the PANDA detector at the upcoming FAIR at GSI, cluster-jet sources have to be improved with respect to the maximum target density to allow for highest luminosities in combination with larger distances between the cluster source and the interaction region.

For this purpose a cluster-jet target station has been build up at the University of Münster which covers the required spatial requirements of a future 4π-detection system. This target station allows for systematic studies on the production of high-density cluster-jet beams. First results of our studies as well as an outlook on further promising modifications will be presented.

* Work supported by EU

HK 22.43 Mo 16:30 TU MA141

Antriproton-Ion Collider — •L. Fabbietti[1], M. Cargnelli[2], B. Franzke[3], J. Homolka[1], P. Kienle[2], R. Krücken[1], H. Lenske[4], A. Skrinsky[5], K. Suzuki[1], and S. Wycech[6] — [1]Technische Universität, Munich, Germany — [2]S. Meyer Institute for Subatomic Physics, Vienna, Austria — [3]GSI, Darmstadt, Germany — [4]Institute for Theoretical Physics, Giessen, Germany — [5]INP, Novosibirsk, Russia — [6]Soltan Institute for Nuclear Studies, Warsaw, Poland

An antiproton-ion collider is proposed for FAIR at GSI to study antiproton absorption at medium energies in stable and radioactive nuclei, for the determination of both neutron and proton rms radii. To realize this novel method, it is planned to cool and collide antiprotons of 30 MeV energy with 740A MeV ions in the NESR and identify and momentum analyze the recoil nuclei, that circulate in the ring acceptance after the antiproton absorption, via Schottky noise frequency spectroscopy. From the measurement of the exclusive absorption cross-sections on neutrons and protons the rms radii will be derived independently. The expected luminosities of the antiproton-ion collider has been calculated together with the estimation of the annihilation cross-section and the detection technique.

HK 22.44 Mo 16:30 TU MA141

A high-rate GEM based TPC for PANDA — •Quirin Weitzel, Bernhard Ketzer, Igor Konorov, Sebastian Neubert, Stephan Paul, and Lars Schmitt for the PANDA collaboration — Physik Department, TU München, D-85748 Garching

PANDA is a universal detector system to study fundamental questions of hadron physics in $\bar{p}p$ interactions. It is designed as an internal target detector at the antiproton storage ring HESR, which is planned in the context of the future research center FAIR at Darmstadt. In order to fulfill the proposed rich physics program, an excellent 4π charged particle tracking system is required. Minimal material budget, momentum resolution on the $\sim$ % level and good particle identification for a wide momentum range are mandatory. A possible solution for the central tracker of PANDA fulfilling all these requirements is a Time Projection Chamber (TPC). The continuous beam structure at the HESR in combination with interaction rates of the order of 10^7/s, however, poses a big challenge for such a detector. The feedback of ions into the drift region is intrinsically suppressed in a Gas Electron Multiplier (GEM), thus opening the possibility to operate the TPC in an ungated mode without accumulating excessive space charge. The technical design of such a device implemented in PANDA as well as concepts and ideas to cope with the high event rate will be introduced. First simulation results are presented as well as prototype developments.

† supported by Maier-Leibniz-Labor der TU und LMU Muenchen, BMBF and EU

HK 22.45 Mo 16:30 TU MA141

Simulation of a GEM based TPC for PANDA — •Sebastian Neubert, Bernhard Ketzer, Igor Konorov, Stephan Paul, Lars Schmitt, and Quirin Weitzel for the PANDA collaboration — Physik Department, TU München, D-85748 Garching

PANDA is an universal detector system, which is proposed in the scope of the FAIR project at Darmstadt, Germany and is dedicated to high statistics measurements in QCD physics. At the HESR antiproton storage ring the formation of the full charmonium spectrum will be possible, allowing the determination of the observables of these states (e.g. η_c) with an unprecedented precision. Among other topics, valuable information on the quark-confining potential will be extracted from this data.

One key component of modern spectrometer systems is the central tracking device. An interesting option for the PANDA-tracker is to use a TPC, which in combination with the GEM technology makes a 3D-tracking detector with ideal properties: very low radiation length, very good spatial resolution and the ability to provide particle identification (PID) at low momenta.

This talk presents results from monte carlo simulations of such an apparatus. The advantage of PID-capability is demonstrated for the reconstruction of the $\eta_c \to 4K$ decay channel. The basic performances of the TPC-tracker are shown and the problem of space charge accumulation in the high rate environment is tackled.

† supported by Maier-Leibniz-Labor der TU und LMU München, BMBF and EU

HK 22.46 Mo 16:30 TU MA141

Der Micro-Vertex-Detektor des PANDA-Experiments — •Tobias Stockmanns, James Ritman und Andrei Sokolov für die Panda-Kollaboration — IKP I, Forschungszentrum Jülich, D-52425 Jülich

Der PANDA Detektor wird am zukünftigen HESR-Speicherring der GSI in Darmstadt errichtet und soll die Wechselwirkung beschleunigter Antiprotonen an Kernen unterschiedlicher Target-Materialien untersuchen.

Als zentrales Spursystem des Detektors dient ein Silizium-Pixeldetektor, der es erlauben soll, D-Mesonen zu identifizieren und diese Daten zur Triggerung zu verwenden. Daher ist eine gute Vertexauflösung sowie eine schnelle, triggerlose Auslese notwendig bei gleichzeitig geringer Strahlungslänge. Zusätzlich unterliegt die innerste Lage des Detektors einer Strahlenbelastung, die den Einsatz strahlentoleranter Technologien erfordert.

Zur Realisierung des PANDA Micro Vertex Detektors gibt es mehrere unterschiedliche Detektorkonzepte von denen das Pixelmodul des ATLAS Experimentes am ehesten die hohen Anforderungen erfüllt. In diesem Vortrag werden das ATLAS Pixelmodul sowie dessen Alternativen für das PANDA Experiment vorgestellt und die notwendigen Modifikationen erläutert, die notwendig sind, um diese Systeme für PANDA einsetzen zu können. Im zweiten Teil des Vortrages wird ein Design des Micro Vertex Detektors vorgestellt, welches auf dem Einsatz von ATLAS-Pixelmodulen beruht.

HK 22.47 Mo 16:30 TU MA141

Micro-Vertex-Detektordesign für PANDA* — •R. Jäkel, K.T. Brinkmann, H. Freiesleben und R. Kliemt — Technische Universität Dresden

Der PANDA-Detektor soll eine Vielzahl unterschiedlicher Experimente mit einem kontinuierlichen Antiprotonen-Strahl hoher Intensität ermöglichen. Konzipiert als internes Experiment im Antiprotonen-Speicherring HESR (Strahlimpulse zwischen $p = (1,5 \ldots 15)$ GeV/c) und mit einem stationären Target ausgestattet, stellt dies insbesondere große Herausforderungen an den Micro-Vertex-Detektor bezüglich primärer und sekundärer Vertexrekonstruktion.

Eine kurze Ansprechzeit sowie Strahlungsresistenz der Detektorkomponenten sollen den inneren Spurdetektor ebenso auszeichnen wie eine möglichst geringe Materialbelegung der aktiven und passiven Detektorkomponenten. Dies soll durch den Aufbau des Detektors aus einer mehrlagigen Fassstruktur und den Einsatz einer Endkappe im Vorwärtsbereich aus Silizium-Pixel- oder Streifendetektoren erreicht werden.

Verschiedene Optionen für die Realisierung des Vertexdetektors bei PANDA sollen diskutiert und an Hand von Simulationen untermauert werden. Dabei steht die Verwendung von Standardtechnologien (HAPS, Streifendetektoren) im Vordergrund, aber auch ambitioniertere Detektorkonzepte (MAPS) können für den Panda-Vertexdetektor aufgrund ihrer geringen Dicke und hohen Auflösung durchaus attraktiv werden.

[1] GSI-Zukunftsprojekt - Conceptual Design Report 2001, Kapitel 2

* gefördert durch BMBF

HK 22.48 Mo 16:30 TU MA141

Development of the Straw Tube Tracker for the proposed PANDA detector at GSI — •Andrei Sokolov[1,2], James Ritman[1], Peter Wintz[1], and Ucar Aziz[1] for the PANDA collaboration — [1]Institute für Kernphysik I, Forschungzentrum Jülich, 52428 Jülich — [2]II. Physikalisches Institut, Justus-Liebig Universität, Heinrich-Buff-Ring 14, 35392 Giessen

One of the components of the approved extension to the accelerator facility at GSI/Darmstadt is a storage ring for high luminosity phase space cooled antiprotons with momenta between 1.0 and 15 GeV/c. Antiproton annihilation reactions on protons and nuclei will be investigated with a detector system called PANDA. One of the crucial items of the central tracking system is the Straw Tube Tracker (STT). The STT will consist of the 11 double layers, 5 of them are skewed. The straws will have a diameter 8 and 10 mm. The STT needs high position resolution ($\sim 150\mu m$) and high rate capabilities, to handle the high events rate (10^7 events/s). This poster will present an overview of the simulations and prototyping performed to investigate performance of the STT for PANDA.

HK 22.49 Mo 16:30 TU MA141

Detection of $\eta_c \to K^{\pm}\pi^{\mp}K_s^0$ with $\overline{\mathrm{P}}$ANDA — •F. Ottone[1], M.G. Destefanis[1], I. Fröhlich[1], D.G. Kirschner[1], L. Lavezzi[2], J. Ritman[3], A. Sokolov[3], and W. Kühn[1] for the Panda collaboration — [1]Justus Liebig-Universität Gießen — [2]Università degli Studi di Pavia — [3]Institut für Kernphysik, Forschungszentrum Jülich

Fundamental questions of hadron and nuclear physics will be studied in interactions of antiprotons and protons, using the $\overline{\mathrm{P}}$ANDA detector at GSI. A benchmark channel that will be taken into account is the $\eta_c \to K^{\pm}\pi^{\mp}K_s^0$, where the η_c is the ground state of charmonium, at 2.979 GeV/c^2. In the past two years there have been five published measurements of the η_c properties which disagree strongly among themselves. By detecting hadronic final states, such as $K\overline{K}\pi$, with branching fractions two orders of magnitude higher than the decay modes studied so far, high statistics samples can be easily collected, thus allowing a study of the mass, width and branching ratios with high precision. In this poster the latest results of the simulation will be presented.

Work supported by BMBF, DFG, EU and GSI.

HK 22.50 Mo 16:30 TU MA141

$\bar{p}\ p \to \Lambda\ \bar{\Lambda}$ simulation with the PANDA detector — •M. G. Destefanis[1], I. Fröhlich[1], D. Kirschner[1], J. Lehnert[2], F. Ottone[1], T. Perez[1], J. Ritman[3], A. Sokolov[3], A. Toia[2], and W. Kühn[1] for the Panda collaboration — [1]Justus Liebig Universität-Gießen, II. Physikalisches Institut — [2]Now at SUNY, Stony Brook, New York — [3]Institut für Kernphysik, Forschungszentrum Jülich

The PANDA experiment which is part of the future FAIR facility at Darmstadt will investigate reactions of antiprotons with hydrogen and nuclear targets. One of the benchmark channels for the simulation and the design of the detector is the $\Lambda\ \bar{\Lambda}$ channel, which has been extensively investigated by the PS185 collaboration. This poster will report on first results of GEANT4 simulations including the full PANDA detector geometry which have been performed to study the detector acceptance, resolution and background suppression as well as the reconstruction of polarization observables. This work was supported in part by BMBF, DFG and GSI.

HK 22.51 Mo 16:30 TU MA141

Response Function of Improved $PbWO_4$ Crystals — •Karoly Makonyi for the PANDA collaboration — 2nd Physics Institute, University Giessen

The development of $PbWO_4$ (PWO) for LHC detectors enabled the mass production of high quality radiation hard crystals. The EM calorimeter of PANDA requires sufficient resolution over a wide range of photon energies down to 10-20 MeV. To select PWO as the appropriate fast and compact material, research started to increase the luminescence yield by quality improvement, reduction of defects, doping and operation below room temperature. Response functions of energy, time and position information to monoenergetic photons up to 800 MeV were measured at MAMI. Arrays of up to 20 cm long crystals with significantly improved light yield, manufactured in Russia and China, are investigated and operated at temperatures down to 25 degree C read-out with photomultipliers. The improvement with respect to CMS-quality crystals as well as the comparison to GEANT4 simulations will be discussed. The work is supported by BMBF, GSI and EU within the I3 Hadron Physics project.

HK 22.52 Mo 16:30 TU MA141

APD-Readout of PbWO4 Scintillator Arrays — •Michaela Thiel for the PANDA collaboration — 2nd Physics Institute, University Giessen

The EM calorimeter of the future PANDA detector, located inside a superconducting solenoid, considers $PbWO_4$ as scintillator material due to its short radiation length, fast response and moderate costs. The readout of the calorimeter modules within the magnetic field (¡2T) can be performed using large area avalanche photo diodes (APD). In spite of the significant improvement of the performance of PWO, the photosensor readout has to cope with a small number of scintillation photons per MeV deposited energy. Therefore, large area APDs have been developed, tested and operated at temperatures well below room temperature. To optimize low energy photon detection, a number of low noise charge sensitive preamplifiers has been developed using discrete components. First experiments have been performed with several arrays of large crystals to measure the energy and time response to monoenergetic photons up to 800 MeV at MAMI. The operation at low temperatures imposes strong requirements on temperature and bias voltage stability. The applicability of alternative photosensors will be discussed in comparison. The work is supported by BMBF, GSI and EU within the I3 Hadron Physics project.

HK 22.53 Mo 16:30 TU MA141

Performance of germanium detectors in high magnetic fields — •Alicia Sanchez[1], P. Achenbach[1], M. Agnello[2], A. Banu[3], E. Botta[4], T. Bressani[4], D. Calvo[4], G. D'Erasmo[5], A. Feliciello[4], F. Ferro[2], A. Filippi[2], E. Fiore[5], J. Gerl[3], F. Iazzi[2], I. Kojouharov[3], S. Marcello[4], A. Pantaleo[5], V. Paticchio[5], J. Pochodzalla[1], G. Raciti[6], T. Saito[3], N. Saito[3], H. Schaffner[3], and C. Sfienti[6] for the PANDA and the FINUDA collaboration — [1]Institut für Kernphysik, Mainz, Germany — [2]Politecnico de Torino, Italy — [3]GSI, Darmstadt, Germany — [4]INFN Torino, Italy — [5]INFN Bari, Italy — [6]INFN Catania, Italy

Future experiments on hypernuclei γ-spectroscopy at FINUDA@DAFNE and PANDA@FAIR require the operation of germanium detectors in high magnetic fields ≈1T. To explore the feasibility of these experiments we studied the performance of high resolution germanium detectors of the VEGA and EUROBALL collaboration in a magnetic dipole field. We will present results on the energy resolution and the pulse shape as a function of the magnitude and the orientation of the magnetic field.

HK 22.54 Mo 16:30 TU MA141

A 2.5 TBit/s Readout Scheme for the ALICE TRD — •Rolf Schneider and Volker Lindenstruth for the ALICE TRD collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

The Transition Radiation Detector (TRD) of the ALICE experiment at CERN serves as trigger, tracking and electron identification detector. All of these functions make particular demands on the readout scheme.

About 65 000 multi chip modules (MCM), each equipped with an amplifier, an ADC and a four-fold processor, preprocess and store the event data. To perform the Level-1 trigger, the preprocessed data has to be shipped off the detector to the next processing stage, the Global Tracking Unit (GTU), within 600 ns. As a result of accurate detector simulations and analyses to qualify the amount of preprocessed data, only a latency of a few clock cycles and a data bandwidth of ∼2.5 TBit/s fulfill these requirements. In contrast the readout of the full event data of ∼30 MByte is less time-critical and a handshaking protocol is used.

Taking into account the specifications like the number of pads, routing area, fault tolerance and power consumption, a readout scheme and corresponding Network Interface (NI) has been developed and tested. The resulting 4-to-1 readout trees which collect the data of 64 MCMs each, end in 1 080 optical links which are connected to the GTU. The NI consists of four 10 Bit wide input ports, one output port, FIFOs, interfaces to the processor, and control logic. The data transfer is performed with 120 MHz DDR. In order to save power the NI is capable of operating stand-alone and dynamically switching off unused LVDS ports. This project is supported by the BMBF (06HD9551).

HK 22.55 Mo 16:30 TU MA141

Hardware-Based Low-Latency Track Reconstruction for the ALICE TRD — •Jan de Cuveland and Volker Lindenstruth for the ALICE TRD collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

The Transition Radiation Detector (TRD) is one of the main detector components of the ALICE experiment at the LHC. One of its primary objectives is to trigger on high momentum electrons.

The trigger complexity is considerable and requires fast event reconstruction. Based on data from 1.2 million analog channels, the reconstruction must be performed within 6 μs to contribute to the Level-1 trig-

ger decision. After preprocessing the analog data and applying pattern-matching algorithms in application-specific chips directly on the detector chambers, the resulting track segments of different chambers must be re-assembled three-dimensionally. From the curvature of the reconstructed tracks, the momentum of the originating particle is calculated to finally make the trigger decision. This part of the online processing must be completed in less than 2 μs.

A hardware architecture has been developed which is able to perform the processing of up to 20 000 track segments in the required time by means of massive parallelism. This presentation focuses on an efficient implementation of the low-latency track reconstruction in hardware using FPGA technology.

This work is supported by the BMBF (06HD9551).

HK 22.56 Mo 16:30 TU MA141

Developments in the simulation of the ALICE Transition Radiation Detector from the analysis of beam test data — •Bogdan Vulpescu for the ALICE TRD collaboration — Physikalisches Institut der Universität, Heidelberg, Germany

The ALICE detector is described and simulated with a modular software at the level of its sub-detectors, with specific geometry design, signal formation, read-out data structure and tracking algorithm. Each module is plugged to an event reconstructor, collecting the summary information necessary for track recognition and particle identification.

The Transition Radiation Detector (TRD) plays an essential role in the high-level trigger of ALICE. By fast tracking of the high momentum particles and by performing a separation of the rare electrons from the more numerous pions in nucleus-nucleus collisions, the TRD will enhance the signals allowing in-depth studies of quarkonia and jets.

We will present the important feedback of the beam test data analysis on the detector simulations, obtained during runs at the CERN PS secondary beam with small chamber prototypes, as well as first conclusions from a practically final configuration of real size, real electronics stack of 6 TRD chambers. The on-line tracking was trained on data at momenta from 2 to 10 GeV/c, in various orientations of the beam relative to the chamber stack, covering to a large extent the incidence of the 540 single chambers of the TRD.

This work is supported by BMBF.

HK 22.57 Mo 16:30 TU MA141

The ALICE TRD detector control system and readout electronics performance under test beam conditions — •Jorge Mercado for the ALICE TRD collaboration — Physikalisches Institut der Universität Heidelberg, Germany

The ALICE experiment incorporates a transition radiation detector (TRD) designed to provide electron identification in the central barrel at momenta in excess of 2 GeV/c as well as fast (6 μs) triggering capability for high transverse momentum ($p_t \geq 3$ GeV/c) processes. With a total of 540 individual detectors (drift chambers) arranged in 6 radial layers, the TRD implements about 1.2 million analog channels which are digitised during the 2 μs drift time by the front-end electronics (FEE) mounted directly on the back of the detectors.

During late autumn 2004, a 6-layer stack equipped with final chamber prototypes as well as final FEE, was set up at the CERN PS secondary beam and tested up to 10 GeV/c in various orientations (relative to the beam) and momenta. For the first time, the whole FEE was configured and *monitored* via its devoted detector control system (DCS) under such conditions. Besides this, some features of the final upper communication layers were used successfully; namely, PVSS (Prozessvisualisierungs- und Steuerungs-System) running as DIM (Distributed Information Management) client and being able to provide dedicated commands. An overview of both, the TRD DCS and FEE performance during this beam time is given.

HK 22.58 Mo 16:30 TU MA141

Experimental Evaluation of the ALICE TPC Front-End Electronics Cooling Strategy — •U. Frankenfeld, P. Braun-Munzinger, H.R. Schmidt, and J. Wiechula — Gesellschaft für Schwerionenforschung, Darmstadt

The Time Projection Chamber (TPC) is the main tracking detector of the ALICE Experiment at the CERN Large Hadron Collider (LHC). A gas-filled, cylindrical volumen of 88 m^3 composes the sensitive region of the TPC. The maximal drift length is 2.5 m. The readout chambers are arranged in 18 trapezoidal sectors at both ends of the cylinder. The electron drift velocity changes by $\sim$ 0.3%/K for the nominal gas mixture of Ne (90%) and CO_2 (10%) and a drift field of 400 V/cm. This leads to the requirement for the temperature stability and homogeneity within the TPC drift volume of ΔT$<$ 0.1°C. The main heat source is the Front-End Electronics (FEE) of the detector itself, with a total heat dissipation of $\sim$ 30kW. The FEE is connected with kapton cables to the readout chambers. A cooling strategy has been worked out to fulfill the thermal requirement. To verify the cooling strategy tests with a readout chamber module in a thermal controlled environment have been carried out. Results of actual measurements of the heat transfer and cooling efficiencies will be presented.

HK 22.59 Mo 16:30 TU MA141

SAPIS - Stored Atoms Polarized Ion Source — •R. Emmerich, R. Schulze, G. Tenckhoff, C. Weske, and H. Paetz gen. Schieck — Institut für Kernphysik der Universität zu Köln, Zülpicher Strasse 77, 50937 Köln

In 1995, improved varieties of the colliding-beams type polarized ion sources, some of which are used successfully in different laboratories such as COSY, have been proposed independently by three participants of the Cologne Polarized Beams and Targets Workshop [1]. An intensity gain factor has been predicted of at least ten without considerable loss of polarization. The main design feature is the use of a T-shaped storage cell for the charge-exchange region. A source of this type has been built. Its setup and first operational results will be presented.

Supported by BMBF

[1] International Workshop on Polarized Beams and Polarized Gas Targets (1995), World Scientific, pp. 155, 208, and 231

HK 22.60 Mo 16:30 TU MA141

The Frankfurt Funneling Experiment — •Jan Thibus, Ulrich Bartz, Dariusz Ficek, Norbert Müller, Holger Zimmermann, and Alwin Schempp — Institut für Angewandte Physik, J.W. Goethe-Universität, Robert-Mayer-Str. 2-4, D-60325 Frankfurt am Main

At low energies funneling is a technique to multiply beam currents of rf-accelerators. In ideal case the beam current can be multiplied in several stages without emittance growth. The Frankfurt Funneling Experiment consists of two ion sources, a Two-Beam RFQ accelerator, two different funneling deflectors and a beam diagnostic equipment system. To facilitate beam operation and beam diagnostics the whole set-up is scaled for He^+ instead of Bi^+ for the first funneling stage of a HIIF driver. The progress of our experiment and the results of the simulations will be presented.

HK 22.61 Mo 16:30 TU MA141

Simulations for the Frankfurt Funneling Experiment — •Jan Thibus and Alwin Schempp — Institut für Angewandte Physik, J.W. Goethe-Universität, Robert-Mayer-Str. 2-4, D-60325 Frankfurt am Main

Beam simulations for the Frankfurt Funneling Experiment are done with *RFQSim* and *FUSIONS*. *RFQSim* calculates macro particle bunches in the 6D phase space through a RFQ accelerator. To optimise beam transport of existing and new funneling deflector structures the simulation software *FUSIONS* is presently being developed (formerly *DEFTRA*). Neighbour bunch and channel interaction is planned to be integrated in the software. The progress of the development and the results will be presented.

HK 22.62 Mo 16:30 TU MA141

Status des elektrostatischen Speicherringes in Frankfurt — •Christian Gläßner, Kai-Uwe Kühnel, Simone Maul und Alwin Schempp — Institut für Angewandte Physik, J.W. Goethe-Universität, Robert-Mayer-Str. 2-4, D-60325 Frankfurt am Main

Am Stern-Gerlach-Zentrum in Frankfurt-Niederursel wird vom IAP-Frankfurt in Zusammenarbeit mit dem IKF-Frankfurt ein elektrostatischer Speicherring für Teilchen mit einer Gesamtenergie von bis zu 50 keV aufgebaut. Die benötigten strahlführenden Elemente wurden optimiert, um eine größtmögliche Flexibilität in Bezug auf durchführbare Experimente zu erreichen. Die daraus resultierenden Ergebnisse werden vorgestellt. Darüber hinaus wurde das gesamte Layout des Ringes mehrfach geändert, um allen Anforderungen gerecht zu werden. Das aktuelle Layout, sowie der momentane Status des Aufbaues werden dargestellt.

HK 22.63 Mo 16:30 TU MA141

Design eines 352 MHz-Protonen-RFQ fuer die GSI — •Lutz Brendel, Benjamin Hofmann, Alwin Schempp und Markus Vossberg — Institut fuer Angewandte Physik, JWG-Universitaet Frankfurt, Robert-Mayer-Strasse 2-4, 60325 Frankfurt am Main

Ein Teil des zukuenftigen Projekts der GSI, ist ein neuer Protonen-LINAC, um Antiprotonen zu erzeugen. Der 4-Rod-RFQ, welcher mit 352 MHz betrieben wird, beschleunigt den Protonenstrahl einer ECR-Quelle (bis zu 100mA) auf eine Energie von 3MeV. Es wurden Modellmessungen und Simulationsrechnungen mit RFQsim und Microwave Studio durchgeführt, um die Strahldynamik und Feldverteilungen zu optimieren.

HK 22.64 Mo 16:30 TU MA141

Ein CW - RFQ Beschleuniger für Deuteronen — •P. Fischer[1], J. Häuser[2], A. Schempp[1], N. Mueller[1] und H. Vormann[1] — [1]J.-W.-Goethe - Universitaet, Institut f. Angewandte Physik, Robert-Mayer-Str. 2-4, 60325 Frankfurt am Main — [2]NTG Neue Technologien GmbH & Co KG, Im Steinigen Graben 12, 63571 Gelnhausen

Es wird der Aufbau eines four-rod-λ/2-RFQ Beschleunigers mit 176 MHz beschrieben. Ziel ist die Beschleunigung eines CW-Deuteronenstrahls von 20 keV auf 3 MeV. Kritisch ist die hohe Leistungsaufnahme des Resonators von 250 kW bei einer Gesamtlaenge von 3.8 m. Experimente zur Frequenzabstimmung und die Einstellung der Feldverteilung werden beschrieben.

HK 22.65 Mo 16:30 TU MA141

Nachweissystem zur Elektronenstreuung unter extremen Vorwärtswinkeln am S–DALINAC* — •K. Zimmer, Y. Kalmykov, P. von Neumann-Cosel, A. Richter und G. Schrieder — Institut für Kernphysik, Technische Universität Darmstadt

Am S–DALINAC soll ein Aufbau zur Elektronenstreuung bei extremen Vorwärtswinkeln realisiert werden, um Messungen bei sehr kleinen Impulsüberträgen durchführen zu können. Ähnlich wie bei der Streuung unter 180° dominiert auch nahe 0° der transversale kinematische Faktor. Der Aufbau stellt daher ein Instrument zur selektiven spektroskopischen Messung von transversalen Anregungen mit kleinem Drehimpuls dar. Die Trennung von Primärstrahl und gestreuten Elektronen durch einen Separationsmagneten ähnelt dem bereits realisierten Aufbau zur Messung unter 180° [1]. Interesse an diesem Projekt besteht außerdem von seiten der GSI, bei der sich ein neuer Elektronen-Ionen-Kollider in Planung befindet. Hier wird ein vergleichbares System zur Messung der Strahlluminosität benötigt.

* Gefördert durch die DFG im Rahmen des SFB 634.

[1] C. Lüttge et al., Nucl. Instr. and Meth. **A 366** (1995) 325.

HK 22.66 Mo 16:30 TU MA141

Röntgen- und Feldemission in supraleitenden Beschleunigungskavitäten des S-DALINAC* — •W. Bayer, M. Brunken, M. Gopych, H.D. Gräf, J. Hasper, U. Laier, A. Richter und A. Zilges — Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt

Die Feldemission in den supraleitenden Beschleunigungsstrukturen des Darmstädter Elektronenbeschleunigers S-DALINAC und damit verbundene Leuchterscheinungen im optischen Bereich sind seit längerem bekannt [1]. Eine neue, zusätzliche Methode, die Feldemission zu untersuchen, besteht in der Analyse der gleichzeitig emittierten Röntgenstrahlung.

Die Ergebnisse dieses neuen Messverfahrens und Vergleiche mit herkömmlichen Untersuchungsmethoden [2] werden vorgestellt.

* Gefördert durch die DFG (SFB 634 und Graduiertenkolleg 410)

[1] M. Gopych *et al.*, to be published in Nucl. Instr. and Meth. **A**
[2] Ph. Bernard *et al.*, Nucl. Instr. and Meth. **190**, 257 (1981)

HK 22.67 Mo 16:30 TU MA141

Design eines Niederenergie-Photonen-Tagger am S-DALINAC* — •J. Hasper, K. Lindenberg und A. Zilges — Institut für Kernphysik, TU Darmstadt, D-64289

An der TU Darmstadt wird am supraleitenden Elektronenbeschleuniger S-DALINAC ein Niederenergie-Photonen-Tagger aufgebaut, der Photonen im Energiebereich zwischen $E_\gamma = 10$ bis 20 MeV mit einer Energieauflösung von $\Delta E = 25$ keV und einer Zeitauflösung von $\Delta t = 5$ ns taggen soll. In diesem Energiebereich wird ein Photonenstrom von bis zu $5 \cdot 10^4$ keV^{-1}s^{-1} angestrebt.
Der Beitrag erläutert das Design des Taggers mit der Geometrie des Clam-Shell-Magneten, den Detektoren für die Fokalebene und einem geeigneten Bremstarget. Dies umfasst auch Magnetfeldsimulationen mit dem Toolkit CST EM Studio [1], so wie Bremsstrahlungssimulationen und das Tracking der Elektronen mit Geant4 [2].

* Gefördert durch die DFG (SFB 634)

[1] CST EM Studio, CST GmbH, Darmstadt
[2] Geant4 - A Simulation Toolkit, S. Agostinelli et al., NIM A 506 (2003) 250-303

HK 22.68 Mo 16:30 TU MA141

Status of the S–DALINAC Polarized Injector * — •C. Hessler[1], W. Ackermann[2], V. B. Asgekar[1,3], K. Aulenbacher[4], M. Brunken[1], J. Enders[1], H.-D. Gräf[1], G. Iancu[1], S. Khodyachykh[1], W. F. O. Müller[2], Y. Poltoratska[1], M. Roth[1], B. Steiner[2], T. Weiland[2], and J. Zwarych[1] — [1]Inst. für Kernphysik, TU Darmstadt, Germany — [2]Inst. Theorie elektromagnetischer Felder, TU Darmstadt, Germany — [3]Dept. of Physics, University of Pune, India — [4]Inst. für Kernphysik, Universität Mainz, Germany

Recent developments for a source of polarized electrons at the superconducting electron linear accelerator S-DALINAC at the Technische Universität Darmstadt will be presented. The polarized electron beam will be produced by photoemission from a 'strained-layer' GaAs/GaAsP cathode. The results of detailed simulations of the cathode geometry and of the beam dynamics will be shown. A 'load-lock' chamber for the preparation of GaAs photocathodes has been adapted from the source of polarized electrons at the MAMI accelerator at Mainz [1] and has been assembled. A semiconductor laser system is presently under development; pulsed operation of the seed laser with a repetition rate of 3 GHz has been achieved. A compact Mott polarimeter based on the design of a device developed for MAMI is presently under construction.

[1] K. Aulenbacher *et al.*, Nucl. Instrum. Meth. A 391, 498 (1997)

*Supported by DFG through SFB 634 and GRK 410.

HK 22.69 Mo 16:30 TU MA141

Hochauflösende γ-Spektroskopie am Big-Bite-Spektrometer* — •K. Ramspeck[1], M. Harakeh[2], J. Hasper[1], S. Rakers[3], D. Savran[1], A. van den Berg[2], H. Wörtche[2] und A. Zilges[1] — [1]Institut für Kernphysik, TU Darmstadt, D 64289 Darmstadt — [2]KVI, NL 9747 Groningen — [3]Institut für Kernphysik, Universität Münster

Ein selektives Instrument zur Untersuchung des Isospincharakters elektrischer Dipolanregungen unterhalb der Teilchenschwelle sind (α,α'γ)-Koinzidenzexperimente. Das Big-Bite-Spektrometer[1] am AGOR-Zyklotron des KVI wurde dazu um einen Array von sechs hochauflösenden HPGe-Detektoren mit BGO-Shields ergänzt. Die gute Auflösung der Ge-Detektoren ermöglicht es, energetisch dicht beieinander liegende Zustände zu trennen. Der Aufbau und erste Testexperimente werden vorgestellt. *gefördert durch die DFG (SFB 634) [1] A.M. van den Berg, Nucl. Instr. Meth. Phys. Res. B 99 (1995) 637

HK 22.70 Mo 16:30 TU MA141

A set up for High-Resolution γ - spectroscopy of Odd-N Fission Isomers* — •T. Morgan[1], B. Bruyneel[2], D. Habs[1], R. Hertenberger[1], H. Hübel[3], O. Koschorreck[4], H.-J. Maier[1], P. Reiter[2], W. Schwerdtfeger[1], T. Striepling[2] und P. G. Thirolf[1] für die MINIBALL-Kollaboration — [1]Ludwig Maximilians Universität München — [2]Universität zu Köln — [3]Rheinische Friedrich-Wilhelms Universität Bonn — [4]Max-Planck-Institut für Kernphysik, Heidelberg

While so far spectroscopic studies of fission isomers concentrated on even - even nuclei, high - resolution γ - spectroscopy of odd - N fission isomers will allow to identify Nilsson orbitals in heavy actinide nuclei. In order to prepare for the investigation of ^{237}Pu, following the ^{235}U(α,2n) reaction, the small population cross section (ca. 2 μb), requires a large solid angle coverage both for the γ - rays as well as for the fission fragments. A very compact 4π parallel plate detector array will be used for the fission fragment detection. Design and characteristics of the array will be presented. The excellent time resolution of the PPAC's will allow to distinguish between the dominant prompt fission products and the rare isomeric fission events ($t_{1/2} = 110$ ns ; 1.1 μs). The extremely rare γ - rays from the second potential energy minimum are planned to be investigated with eight EUROBALL Ge CLUSTER - detectors (56 Ge crystals) arranged in a highly efficient set up. A self supporting thick metallic ^{235}U target will be used, where the ^{237}Pu reaction products will be stopped and fission products will be emitted in opposite directions into the PPAC array.

*Supported the DFG under Contract number HA1101/12-1

HK 22.71 Mo 16:30 TU MA141

Simulation of RICH with achromatic and short-focused optics. — •Peter Vlasov[1,2], Anatoly Povtoreyko[2], James Ritman[1], Boris Morozov[2], and Anrei Nikitin[2] for the PANDA collaboration — [1]Institute für Kernphysik, Forschungzentrum Jülich, 52428 Jülich — [2]Joint Institute for Nuclear Research, Joliot-Curie 6, 141980 Dubna, Russia

A concept for a RICH detector for the PANDA experiment at the future GSI facility (Darmstadt, Germany) was proposed by the LHE JINR experimental group. This detector consists of a disk shaped fused silica radiator that is 12 mm thick, has a 2160 mm diameter, and is arranged perpendicular to the beam axis. This choice of radiator material has a long absorption length for Cherenkov photons with 250 to 700 nm wavelength. An optical scheme constisting of three different media lithium fluoride, fused silica and methanol compensates dispersion effects in this wavelength range. A torus shaped mirror focusses the photons to a surface containing the photosensors. This report will present simulation results of the optical scheme using the Geant4 package, that demonstrates the high velocity resolution for charged kaons with polar angle $1^o < \theta_{lab} < 22^o$ and momentum $> 0.6 GeV/c$.

HK 22.72 Mo 16:30 TU MA141

Single Crystal CVD Diamond Particle Detectors for Hadron Physics Experiments — •Michal Pomorski, Eleni Berdermann, Mircea Ciobanu, Alexander Martemyianov, Peter Moritz, and Bernd Voss — Gesellschaft für Schwerionenforschung, Darmstadt, Germany

Due to its remarkable physical properties Single-Crystal CVD diamond is one of the most promising wide band-gap materials for particle detection in present and future hadron physics experiments, where radiation hardness and speed is the crucial requirement. First results from a Single-Crystal CVD diamond detector are reported, which is under development for heavy-ion particle identification and minimum-ionizing particles timing as well. The charge-collection efficiency is about 100% , never obtained from poly-crystalline CVD-diamond detectors. An energy resolution of 20 keV ($\Delta E/E \approx 0.0035$) is achieved using mixed nuclide α -sources, which is comparable to the energy resolution of silicon detectors. Using low impedance broadband electronics and a ToF technique, where holes or electrons drift separately inside the diamond bulk, the saturation velocity, mobility and lifetime of both charge carriers are estimated. The influence of the electric field on both, the material parameters and the signal shape is discussed regarding the timing properties of the detectors.

Supported by the 6th European Frame Program (FP6, I3 Hadron Physics, JRA NoRHDia)

HK 22.73 Mo 16:30 TU MA141

The Magnetic Field Configuration of the Neutron Decay Spectrometer *a*SPECT — •Raquel Muñoz Horta[1], Fidel Ayala Guardia[1], Stefan Baessler[1], Michael Borg[1], Jim Byrne[2], Ferenc Glück[1], Werner Heil[1], Igor Konorov[3], Marius Orlowski[1], Gerd Petzoldt[1], Yuri Sobolev[1], Maurits van der Grinten[2], Hans-Friedrich Wirth[3], and Oliver Zimmer[3] — [1]Institut für Physik, U. Mainz — [2]University of Sussex, Falmer, Brighton, UK — [3]Physik Department E18, TU München

In this poster the spectrometer *a*SPECT is presented. Its working principle – *a*SPECT is a retardation spectrometer and will measure the proton spectrum in the decay of the free neutron – is explained. Better knowledge of the proton spectrum provides information about the unitarity of the Cabbibo-Kobayashi-Maskawa-Matrix. More specifically, a detailed description of the superconducting coil system and its magnetic field configuration is given.

HK 22.74 Mo 16:30 TU MA141

Development of a novel high-resolution TOF spectrometer with tracking capabilities for photo-fission fragments and beams of exotic nuclei* — •K.M. Kossev[1], N. Nankov[1,2], A. Wagner[1], E. Grosse[1], A. Hartmann[1], A.R. Junghans[1], K.D. Schilling[1], and M. Sobiella[1] — [1]FZ-Rossendorf e.V., Dresden, Germany — [2]INRNE, Sofia, Bulgaria

An advanced double-arm TOF spectrometer is under development. The spectrometer is designed to have high time resolution ($\sigma < 100$ ps) and tracking capabilities[1]. It is proposed to be used for high-precision identification of exotic nuclei for the planned photo-fission experiments at the ELBE radiation source in Rossendorf and for experiments with beams of exotic nuclei at GSI. Recently, the position sensitivity of the TOF detector has been optimized and a spatial resolution better than 1 mm in both x-and y-directions has been achieved. We present the results for the optimized imaging properties of the TOF detector.

[1] H. Sharma, K. Kosev, A. Wagner, K. D. Schilling, M. Sobiella, FZR Anual Report 2002.

*Supported by GSI, Darmstadt under contract DR-DÖN

HK 22.75 Mo 16:30 TU MA141

A photoneutron source for time-of-flight experiments at the radiation source ELBE — •A.R. Junghans[1], E. Altstadt[1], R. Beyer[1], H. Freiesleben[2], V. Galindo[1], M. Greschner[2], E. Grosse[1,2], K. Noack[1], A. Rogov[1], A. Wagner[1], and F.P. Weiss[1] — [1]Forschungszentrum Rossendorf, Dresden, Germany — [2]Technische Universität Dresden, Dresden, Germany

The radiation source ELBE at Research Center Rossendorf can deliver electron beam energies between 12 MeV and 40 MeV with a wide variability of the beam intensity and pulse structure (1 mA at 13 MHz repetition rate [and at 1 MHz after completion of the photo-gun injector under developement at FZR], pulse width <10 ps). This electron beam is ideally suited to produce intense sub-ns neutron pulses from (γ,n)-reactions with bremsstrahlung photons in a small-volume liquid-Pb radiator circuit. Because of the excellent time structure of the electron beam, a comparably short flight path (<4 m) can be used to make high-resolution time-of-flight measurements with fast neutrons. An energy resolution of $\Delta E/E \approx 1\%$ can be reached up to $E_{kin} \approx 3$ MeV with a differential neutron flux of $\approx 10^6 (\mathrm{cm}^2\ \mathrm{s\ MeV})^{-1}$. The physics objectives are to measure reactions induced by fast neutrons important for construction materials of advanced reactor systems and transmutation of nuclear waste. For studies of (n,γ) reactions of relevance to the cosmic nucleosynthesis a differential neutron flux of $\approx 10^4 (\mathrm{cm}^2\ \mathrm{s\ 10\ keV})^{-1}$ in the energy range of ≈100 keV is expected.

HK 22.76 Mo 16:30 TU MA141

A Versatile Program for the Analysis of COSY-TOF Measurements* — •K. Ehrhardt, K. Haug, H. Clement, E. Doroshkevich, A. Erhardt, and G. J. Wagner for the COSY-TOF collaboration — Physikalisches Institut, Universität Tübingen

A frequent problem in collaborations is the situation that analysis programs start to develop differently at different places due to individual improvements. In order to facilitate the comparability of different versions of analysis packages, we have started to develop a program, which is versatile enough to implement, test and compare different options/modules for specific purposes in a well-defined environment. The analysis is based on the ROOT package. It uses a graphical user interface based on the Qt package (by Trolltech) for an online definition of the analysis. First applications will be demonstrated.

* supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg), FZ Jülich (FFE) and Landesforschungsschwerpunkt (Quasiteilchen)

HK 22.77 Mo 16:30 TU MA141

RESULTS OF THE COSMIC-RAY TRACKING WITH STRAW DETECTOR PROTOTYPE — •Aziz Ucar, K. Kilian, R. Nellen, J. Ritman, T. Sefzick, and P. Wintz for the COSY-TOF, Forschungszentrum Juelich collaboration — Forschungszentrum Juelich, 52425 Juelich

A new straw tube tracking detector for the COSY time of flight (TOF) detector system is under construction. The detector will consist of more than 3000 straws with 1 cm diameter and 30 micron Mylar wall thickness. The active area of the tracker is 1 m^2 with a depth of 30 cm. Using gas overpressure to provide mechanical stability eliminates the necessity of a massive surrounding frame, the final tracker will have a total weight less than 15 kg. A prototype of the straw tracker, consisting of four double planes, is constructed for 3 dimensional tracking and testing some detector elements. The electronic part of the prototype is studied to get rid of oscillations caused by the ASD-8 chip. By modifying some passive elements (capacitors, resistors) on the input board to the ASD-8 chip, a stable and oscillation free state in electronic part is obtained. First spatial resolution and efficiency values of the tracker from cosmic-rays will be presented.

HK 22.78 Mo 16:30 TU MA141

Ein 10 GHz Elektronen-Spin-Resonanz-Spektrometer — •J. Dahmen, J. Heckmann, C. Hess, W. Meyer, E. Radtke und G. Reicherz — Ruhr-Universität Bochum, Institut für Experimentalphysik, D-44780 Bochum

Elektronen-Spin-Resonanz-Messungen (ESR) sind nützlich, um das Verständnis der Polarisationsmechanismen zu erweitern. In der Forschung des Polarisierten Targets (PT) werden ESR-Messungen durchgeführt, um polarisierte Targetmaterialien zu untersuchen. Dabei spielen die paramagnetischen Zentren der Radikale eine wichtige Rolle - auch in Bezug auf die Dynamische-Nukleonen-Polarisation (DNP). Umgebende Kerne wechselwirken mit den Elektronen und beeinflussen dadurch die

Linienform. Ein ESR-Spektrometer zur Untersuchung von Radikalen in polarisierten Festkörpertargets wird dokumentiert, der Aufbau der Apparatur wird beschrieben und verschiedene Messergebnisse werden vorgestellt (Ammoniakisotope, in Butanol und Propandiol gelöste Radikale, sowie neue Trityl-Radikale). Abschließend wird noch ein kurzer Ausblick auf zukünftige Entwicklungen und Perspektiven der ESR-Messungen für die PT-Forschung gegeben. Außerdem kann man mit der Apparatur auch noch die Größe der Spindichte einer Probe bestimmen.

HK 22.79 Mo 16:30 TU MA141

Ein hardwarebasiertes Computer Cluster Kontrollsystem — •Ralf Panse und Volker Lindenstruth — Kirchhoff-Institut für Physik der Universität Heidelberg

Zukünftige LHC Experimente benötigen enorme Rechenleistung um die anfallenden Daten zu analysieren und Triggerentscheidungen zu treffen. Diese Rechenleistung wird in Zukunft von PC Farmen zur Verfügung gestellt werden. Diese Farmen bestehen aus mehreren hundert handelsüblichen PCs. Jeder PC ist fehleranfällig, was besondere Anforderungen für den zuverlässigen Betrieb einer PC Farm stellt. Die Konfiguration, Überwachnung und Kontrolle eines Clusters ist sehr zeitintensiv und erfordert einen hohen Verwaltungsaufwand. Um diesen Aufwand zu minimieren, wurde ein kostengünstiges und einfache Hardware Lösung für dieses Problem entwickelt. Das Kernstück unseres Clusterkontrollsystem ist eine PCI Erweiterungskarte, der sogenannte Cluster Interface Agent (CIA). Die Karte verfügt über einen Prozessor und eigene Netzwerkanbindung und arbeitet dadurch unabhängig vom zu überwachenden Rechner. Der PC kann mittels dieser Karte überwacht und kontrolliert werden, selbst dann, wenn das Betriebssystem des PCs eine solche Fernkontrolle nicht unterstützt. Desweiteren kann man mit ihr Betriebssysteme installieren, den Host-Rechner ausschalten und die PC Hardware testen.

HK 22.80 Mo 16:30 TU MA141

Development of new Crystal-Barrel forward detectors: I. The forward plug crystal readout and the Mini-TAPS detector. — •Volker Hannen[1], Philipp Hoffmeister[2], Vahe Sokhoyan[1], and Ulrike Thoma[1,2] — [1]II. Phys. Inst. der Universität Giessen, Heinrich-Buff-Ring 16, 35392 Giessen — [2]HISKP, Universität Bonn, Nussallee 14-16, 53115 Bonn

The structure of hadrons is investigated by the Crystal-Barrel experiment at ELSA using electromagnetic probes. Due to its setup as a fixed target experiment the coverage of forward angles is of special importance. Here two new forward detectors will be installed for the planned double polarisation measurements. The so-called Forward Plug, consisting of 90 CsI crystals, which covers forward angles from 30° to 11° and the Mini-TAPS detector, consisting of 60 TAPS BaF_2 crystals, which completes the angular coverage down to 2°. The readout of the Forward Plug crystals is done by photomultipliers, unlike the rest of the barrel, where photodiodes are used. In addition, plastic scintillators will be mounted in front of each crystal for both detector systems. Their signals can be used together with the ones from the crystals to provide an efficient trigger for charged and neutral particles. In addition to the setup, we will present test results of the new photomultiplier readout of the Forward Plug crystals, discuss its newly designed backend electronics and provide an overview of the readout electronics to be used with the Mini-TAPS detectors.
Supported within the Emmy-Noether-program and the SFB/TR16 by the DFG.

HK 22.81 Mo 16:30 TU MA141

Development of new Crystal-Barrel forward detectors: II. A charged particle detector, fast clustering triggerlogic and Flash-ADC readout — •Christian Funke, Torge Szczepanek, and Christoph Wendel — Helmholtz-Institut für Strahlen- und Kernphysik der Universität Bonn, Nussallee 14-16, 53115 Bonn

The Crystal-Barrel experiment at ELSA is used to investigate the structure of hadrons with electromagnetic probes. The 4π-geometry of this electromagnetic calorimeter is particularly suited to study multiphoton final states. Due to it's setup as a "fixed target" experiment an efficient trigger for particles and their energy determination under forward angles is important. For the upcoming data-taking period a new set of forward detectors is being developed. The focus of this poster is the new charged particle detector, the new clustering (pre-)trigger for the Crystal-Barrel calorimeter and the fast Flash-ADC CsI-Crystal-Readout using FPGAs. These systems will cover the angle of $12 - 30°$ in the forward direction. Charged particle detection is achieved by two layers of szintillating material with a combined angular resolution of 6°. Each of the 180 plastic szintillator plates is, due to spatial constraints, read out by wavelength-shifting fibres. The trigger system for the 90 CsI crystals of the given forward segment has to be able to deliver a multiplicity count of incident hadronic showers in a timeframe of 250ns. To achieve this a fast SRAM-based solution is build. The Flash-ADC will provide additional data for particle identification and event selection.
Supported within the SFB/TR16 by the DFG.

HK 22.82 Mo 16:30 TU MA141

2nd Level Trigger Performance in HADES — •Camilla Gilardi, Ingo Fröhlich, and Tiago Pérez for the HADES collaboration — II. Physikalisches Institut, University of Gießen, Heinrich-Buff-Ring 16, 35392 Gießen

The main purpose of the HADES spectrometer at GSI Darmstadt is the measurements of dilepton decays of light vector mesons. Since the amount of unbiased data would be relatively high, it could not be stored without the employ of an online selective mechanism which allows an enhancement of the signal-to-background ratio. The first level trigger system (LVL1) selects the most central collisions, while the second level trigger (LVL2) searches signatures of dilepton decays first as leptons candidates in the RICH, TOF and Pre-shower detector. In order to select events with lepton pairs, the LVL2 trigger performs pattern recognition to find lepton signatures (through the Image Processing Units - IPUs), and combines the position and angle information for each of these signatures into tracks (through the Matching Unit - MU). In the last year, a lot of progress has been achieved to increase the performance of the LVL2 trigger. In particular the distribution system of the LVL1 and LVL2 signals has been reimplemented. Furthermore, the time-of-flight IPU was improved to gain in speed and flexibility, allowing to read out generic modules like scaler and latches. This work has been supported by BMBF, GSI and the DFG.

HK 22.83 Mo 16:30 TU MA141

Alignment of the HADES Spectrometer — •Alexander Schmah[1], Geydar Agakichiev[2], Yvonne Pachmayer[3], Vladimir Pechenov[2], and Anar Rustamov[1] for the HADES collaboration — [1]Gesellschaft für Schwerionenforschung, Planckstrasse 1, 64291 Darmstadt, Germany — [2]II. Physikalisches Institut, University of Gießen, Heinrich-Buff-Ring 16, 35392 Gießen — [3]Institut für Kernphysik, Johann Wolfgang Goethe-Universität Frankfurt 60486 Frankfurt, Germany

Varios alignment methods for the HADES detector system have been investigated. Data from measuring straight tracks (without magnetic field), cosmic rays as well as proton - proton elastic scattering are used. A new approach has been developped using the hit information of the multi wire drift chambers (MDC). For each iteration of the MDC geometry the full tracking procedure is performed. This allows to modify and correct not only the position of chambers in space but also the internal geometry of the chambers. A simultaneous fit of tracks in all chambers is employed which has the potential to significantly enhance the accuracy of alignment. This method allows to align the chambers not only with respect to each other but also with respect to the target point. This work has been supported by BMBF and GSI.

HK 22.84 Mo 16:30 TU MA141

Teilchenidentifikation im HADES Experiment* — •T. Christ[1], T. Eberl[1], L. Fabbietti[1], J. Friese[1], R. Gernhäuser[1], M. Jurkovic[1], K. Kanaki[2], R. Krücken[1], J. Mousa[3], V. Pospisil[4], B. Sailer[1], M. Sudol[5], P. Tlusty[4] und T. Wojcik[6] für die HADES-Kollaboration — [1]Physik-Department E12 der Technischen Universität München — [2]Forschungszentrum Rossendorf, Dresden — [3]University of Cyprus, Nicosia, Zypern — [4]Czech Academy of Sciences, Rez, Tschechische Republik — [5]Gesellschaft für Schwerionenforschung, Darmstadt — [6]Jagiellonian University, Krakau, Polen

Mit dem HADES-Spektrometer wird bei der GSI, Darmstadt, in protonen- und schwerioneninduzierten Kernreaktionen Produktion und e^+e^- Zerfall von leichten Mesonen und baryonischen Resonanzen untersucht. Für die zuverlässige Identifikation der gemessenen Reaktionsprodukte (p, $\pi^\pm$, $e^\pm$, usw.) sowie eine ausreichende Unterdrückung des Untergrunds haben wir verschiedene Analysemethoden entwickelt. Ein einfaches, aber robustes Verfahren verwendet Datenschnitte auf Detektorsignale (ΔE, TOF, RICH-Ring, etc.) und Spureigenschaften (P, $\Delta\Theta$, $\Delta\Phi$). Ein komplementäres Verfahren benutzt statistische Methoden in der Detektorsignalanalyse zur Gewinnung von Wahrscheinlichkeitsaus-

sagen über die zu einer gemessenen Spur gehörende Teilchensorte. Wir berichten die Ergebnisse eines Vergleichs der beiden Methoden für die Reaktion C + C (E_{kin} = 2 AGeV) im Hinblick auf Effizienz, Reinheit und Untergrundunterdrückung. * gefördert durch BMBF (06MT190) und GSI (TM-KR2).

HK 22.85 Mo 16:30 TU MA141

Status von MAFF — •Martin Gross[1], Dieter Habs[1], Reiner Krücken[2], Walter Assmann[1], Ludwig Beck[3], Thomas Faestermann[2], Sophie Heinz[1], Philipp Jüttner[4], Oliver Kester[1], Hans-Jörg Maier[1], Peter Maier-Komor[2], Florian Nebel[2], Matteo Pasini[1], Michael Schumann[1], Jerzy Szerypo[1], Peter Thirolf[1], Franz Tralmer[4] und Ernst Zech[2] — [1]Department f. Physik, Ludwig-Maximilians-Universität München — [2]Physik-Department E12, Technische Universität München — [3]Maier-Leibnitz-Labor f. Kern- u. Teilchenphysik, Garching — [4]ZWE FRM-II, Garching

Das Projekt des Münchner Spaltfragmentbeschleunigers MAFF (**M**unich **A**ccelerator for **F**ission **F**ragments) am nunmehr in Betrieb befindlichen Forschungsreaktor FRM-II hat als Ziel die Erzeugung hochintensiver Ionenstrahlen neutronenreicher Isotope.
Im letzten Jahr waren Fortschritte insbesondere auf dem Gebiet der Berechnung der zu erwartenden Aktivitätsverteilung im System, des Aktivitätshandlings, der Ionenquelle und der Strahlführung zu verzeichnen.
Es wird ein Überblick über den aktuellen Stand der Planung des Gesamtsystems gegeben.

HK 22.86 Mo 16:30 TU MA141

Radioactivity distribution in the MAFF beamline — •Jerzy Szerypo — Department für Physik, Universität München (LMU), D-85748 Garching, Germany

The MAFF facility (Munich Accelerator for Fission Fragments [1]) planned at the research reactor FRM-II in Munich is dedicated to produce, cool and accelerate high-intensity neutron-rich radioactive beams. The primary radioactive beam consists of fission fragments, which result from bombarding a uranium target by the thermal neutrons emerging from the reactor. The fragments are produced in the target/ion source unit. Part of the nuclides are ionized (1+) and accelerated to 30 keV energy. A considerable portion of fission fragments will leave the target without being ionized. In order to retain the noble radioactive gases in a well-shielded place and also to provide good vacuum conditions in the reactor beam tube, helium-cooled cryopanels (T=15 K) will be installed close to the ion source. This contribution is concerned with simulating the properties of the MAFF beamline cryopumping system. The calculations are performed with the help of the computer program MOVAK3D [2]. This program simulates, in 3 dimensions, the trajectories of single particles (atoms, molecules) in an arbitrary vacuum system, in a Monte Carlo approach. Preliminary results show that the fraction of non-ionized radioactivity at the experimental area amounts to about 10-7 only.

[1] D. Habs et al., Nucl. Instr. Meth. B204 (2003) 739 [2] G. Class, Report 4292, Institut IRS, Kernforschungszentrum Karlsruhe GmbH (1987)

HK 22.87 Mo 16:30 TU MA141

Der 101.28 MHz IH-RFQ für MAFF* — •O. Kester[1], M. Pasini[1], T. Sieber[1], D. Habs[1] und A. Schempp[2] — [1]Department für Physik der LMU München, Am Coulombwall 1, D-85748 Garching — [2]Institut für Angewandte Physik, Uni Frankfurt, Robert-Mayer-Str. 2-4, D-60325 Frankfurt

Für die Nachbeschleunigung radioaktiver isotope ist ein 101.28 MHz IH-RFQ entwickelt worden in Hinblick auf optimierte Shuntimpedanz und Strahldynamik. Dieser ist neben dem Einsatz am Münchner Spaltfragmentbeschleuniger eine zukünftige Option für EURISOL in Verbindung mit einem Ladungsbrüter. Die Resonanzfgrequenz des IH-RFQs stellt das obere Limit solcher Strukturen dar und ist daher eine Herausforderung für das Tuning der Struktur. Die mit den REX-ISOLDE Strukturen identische Resonanzfrequenz bietet jedoch die einmalige Möglichkeit eines Vergleichs mit einem 4-Rod-RFQ. Der aktuelle Status des Aufbaus und das Design sollen vorgestellt werden.

*Unterstützt durch DFG (HBFG 132-825)

HK 22.88 Mo 16:30 TU MA141

The active stabilization of the laser system of the A4-Compton-Backscattering-Polarimeter — •Jürgen Diefenbach for the A4 collaboration — Institut für Kernphysik, Universität Mainz

The A4 collaboration measures single-spin asymmetries (e.g. parity violation) in the elastic scattering of polarized electrons off the nucleon at the MAMI accelerator facility in Mainz. To perform an online monitoring of the electron beam polarization a new type of laser backscattering compton polarimeter are used. Due to the intracavity design of the backscattering polarimeter an active stabilization of the 7.8m long laser resonator is unavoidable to achieve stable overlap of laser and electron beam and to optimize the polarimeter's luminosity. The design ideas and first results from the operation of the stabilization will be presented.

HK 22.89 Mo 16:30 TU MA141

Umbau des A4 Kalorimeters für die Messung unter Rückwärtswinkeln — •Boris Gläser für die A4-Kollaboration — Institut für Kernphysik Johannes Gutenberg Universität Mainz, J.J. Becherweg 45, 55099 Mainz

Es ist geplant, die Paritätsverletzung in der elastischen Elektron-Nukleon-Streuung unter Rückwärtswinkeln an Wasserstoff und Deuterium mit dem A4-Kalorimeter zu messen. Zu diesem Zweck wird der Detektor auf eine rotierbare Plattform gestellt, so daß Messungen sowohl unter Vorwärts- als auch unter Rückwärtswinkeln möglich sein werden. Der neue experimentelle Aufbau und die besonderen Anforderungen werden erläutert.

HK 22.90 Mo 16:30 TU MA141

The internal cavity Compton polarimeter of the A4 experiment — •Yoshio Imai for the A4 collaboration — Institut für Kernphysik, Universität Mainz, D-55128 Mainz, Germany

The A4 experiment at the MAMI facility in Mainz is investigating single-spin asymmetries in the electron-nucleon-scattering with polarized beams. In order to control the beam polarization, a Compton backscattering polarimeter has been installed into the beamline. This polarimeter implements for the first time the internal cavity-concept. In July 2004, first Compton asymmetries have been measured. This contribution will present the principle of operation and the results achieved so far, and discuss the next steps towards quantitative results on the beam polarization.

HK 22.91 Mo 16:30 TU MA141

Wire Scanner Analysis and Emittance Measurement in the A4 Compton Polarimeter — •Jeong Han Lee — Institut fuer Kernphysik,Universitaet Mainz, D-55099 Mainz, Germany

The A4 collaboration investigate the structure of the proton by measuring parity-violating asymmetry for elastic electron scattering off an unpolarized proton. To extract the physics asymmetry, it is crucial to determine the polarization of the electron beam to high accuracy. The Compton Polarimeter has been installed in the new beamline and has been operational. There are three wire scanners in the polarimeter. The purpose of these are to determine transverse positions of the electron and photon beam and measure an emittance and beam size in the Compton Polarimeter.

This poster will present the result of the wire scanner analysis and progress of the emittance measurement.

HK 22.92 Mo 16:30 TU MA141

A new polarised He3 gas target for the Crystal Ball at MAMI — •Patricia Aguar Bartolome for the A2 collaboration — Institut für Kernphysik, Becherweg 45, 55099 Mainz

This poster will show the status of the development of the new polarised ^{3}He gas target for the Crystal Ball on the Mainz A2 tagged photon facility.

The simulation results for the solenoid necessary to provide the homogeneous magnetic field for this new target will be presented.

The preparation of the setup and the results of an ^{4}He feasibility test carried out in October 2004 will be illustrated.

HK 22.93 Mo 16:30 TU MA141

A new bremsstrahlung tagging system for the CBELSA experiment* — •Kathrin Fornet-Ponse, Susanne Kammer, and Andre Süle for the CBELSA/TAPS collaboration — Physikalisches Institut Universität Bonn

For future double polarisation experiments at CBELSA with real photon beams and polarised proton and neutron targets, a new photon tagging system has been designed. It enables accurate flux determination and the control and measurement of both linear and circular beam polarisation. The tagger consists of a dipol magnet for momentum selection

of the decelerated electrons. Using standard focal plane hodoscopes a photon energy resolution of 0.2-2.2% over the tagging range of 4-82% of the electron beam energy is achieved. The photon flux is determined from geometrically overlapping scintillator channels. Control of the linear polarisation of the photon beam is provided by adequate orientation of a diamond radiator using a commercial goniometer. The measurement of the circular photon beam polarisation requires Møller polarimetry of the longitudinally polarised electron beam. This shall be realised by using polarised ferromagnetic radiator foils and the coincident measurement of the symmetric Møller pairs in a dedicated focal plane detection system.

* supported by DFG (SFB/TR 16).

HK 22.94 Mo 16:30 TU MA141

Method for (n,γ)-cross section measurements of unstable isotopes — •Stephan Walter[1], Michael Heil[1], Franz Käppeler[1], Ralf Plag[1], and René Reifarth[2] — [1]Forschungszentrum Karlsruhe, Postfach 3640, D-76021 Karlsruhe — [2]LANL, Los Alamos, New Mexiko, 87545, USA

Quantitative studies of s-process nucleosynthesis in Red Giant stars require reliable cross sections for the unstable branching point isotopes. Such data are important with respect to explosive nucleosynthesis in the r- as well as in the p-process. Currently, time of flight (TOF) measurements are limited by the available neutron fluxes, which require target masses in the milligram region, implying severe backgrounds caused by the self activity of the target. We propose to increase the sensitivity of the TOF technique such that target masses of a few micrograms can be used. This is achieved by shortening the flight path to a few centimetres, along with the use of a 4π calorimeter for the detection of neutron capture events.

HK 22.95 Mo 16:30 TU MA141

The ^{14}N(p,γ)^{15}O reaction at energies of astrophysical interest — •Daniel Bemmerer — Istituto Nazionale di Fisica Nucleare, Sezione di Padova, Italy, and Institut für Atomare Physik und Fachdidaktik, Technische Universität Berlin, Germany

The ^{14}N(p,γ)^{15}O reaction is the bottleneck of the hydrogen-burning CNO cycle. At the LUNA 400 kV accelerator deep underground in the Gran Sasso laboratory, its cross section has been measured in the $E_{\rm CM}$ = 130 – 370 keV energy range using a TiN solid target and germanium detectors [1]. The resulting astrophysical S-factor extrapolated to zero energy is only half the previously accepted value, with interesting consequences for the age determination of globular clusters [2].

The present talk reports on the subsequent measurement [3] of the total cross section of this reaction in the $E_{\rm CM}$ = 70 – 230 keV energy range using a windowless gas target and a 4π BGO detector at the LUNA accelerator. The results are consistent with [1] and extend the data to energies that lie within the Gamow peak for some stars.

[1] A. Formicola *et al.*, Phys. Lett. **B 591** (2004), 61 - 68.
[2] G. Imbriani *et al.*, Astronomy & Astrophysics **420** (2004), 625 - 629.
[3] http://edocs.tu-berlin.de/diss/2004/bemmerer_daniel.htm

HK 22.96 Mo 16:30 TU MA141

Measurement of the ^{3}He(α,γ)^{7}Be cross section with ERNA — •Antonino Di Leva for the ERNA collaboration — Institut für Experimentalphysik III, Ruhr-Universität Bochum

The ^{3}He(α,γ)^{7}Be reaction plays an important role in the interpretation of the results of the solar neutrino experiments, since the estimate of the oscillation parameters relies on the solar neutrino spectrum, calculated by solar models. The high energy component in this spectrum is mainly produced by the decay of ^{7}Be and ^{8}B.

However uncertainty in the ^{3}He(α,γ)^{7}Be cross section is also one of the largest contributions to the uncertainty on primordial ^{7}Li abundance in Big Bang Nucleosynthesis calculations. The latter can constrain the universe initial baryon density and the number of light neutrino flavors.

Measurements of the ^{3}He(α,γ)^{7}Be cross section have been performed detecting the capture gamma rays or measuring the activity of the synthesized ^{7}Be. While the results of the two different approaches agree on the energy dependence of the astrophysical S factor, they disagree in the extrapolated $S_{34}(0)$ value at a 3σ level, that suggests the presence of systematic errors in one or both techniques, or a non radiative component in the cross section.

A novel approach uses the European Recoil separator for Nuclear Astrophysics (ERNA), that can provide the simultaneous detection of both the capture gamma rays and the ^{7}Be ions produced in the reaction. In this talk the experiment and results of preliminary measurements are discussed.

Supported by DFG(Ro 429/35-3), BMBF(05CL1PC1/1) and INFN

HK 22.97 Mo 16:30 TU MA141

Eine kondensierte ^{83m}Kr-Konversionselektronenquelle für das KATRIN-Experiment — Matthias Prall, Beatrix Ostrick, •Matthias Prall und Beatrix Ostrick für die KATRIN-Kollaboration und die KATRIN-Kollaboration — Institut für Kernphysik Münster

Das KATRIN-Experiment wird $m^2_{\bar{\nu}_e}$ aus dem β-Zerfall von Tritium mit einer Signifikanz von 5 σ für eine Masse von 0,35 eV/c^2, bzw. 3 σ für eine Masse von 0.3 eV/c^2 messen. Für kleinere Neutrinomassen wird es möglich sein, eine Obergrenze von 0,2 eV/c^2 bei 90% CL anzugeben. Hierfür wird der sogenannte MAC-E (magnetic adiabatic collimation followed by electrostatic filter) Filter eingesetzt.

Für die Messung wird der MAC-E Filter mit einer Retardierungsspannung im Bereich von 18,6 kV versorgt. Man muss in der Lage sein, Fluktuationen σ dieser Spannung im Bereich unter 60 meV zu erkennen, da eine unerkannte Fluktuation über die Relation $\Delta m^2_{\bar{\nu}_e} = -2\sigma^2$ die Neutrinomasse verfälschen würde. Uns dienen K-Konversionselektronen von ^{83m}Kr bei 17,8 keV mit einer Breite von 2,9 eV als nuklearer/atomarer Standard zur Langzeitüberwachung der Retardierungsspannung, die parallel an einem Monitor-Spektrometer angelegt wird. Das ^{83m}Kr ist hierbei auf einem Graphitsubstrat aufgefroren. Da die Halbwertszeit von ^{83m}Kr nur 1,8 Stunden beträgt, muss der ^{83m}Kr-Film auf dem Substrat immer wieder erneuert werden. Dies muss so geschehen, dass die Energie der Konversionselektronen reproduzierbar ist.

Wir stellen das zugehörige Gaseinlasssytem und die verschiedenen Filmpräparationsmethoden vor, welche dazu dienen, Reproduzierbarkeit zu erreichen.

HK 22.98 Mo 16:30 TU MA141

Untersuchungen zum p-Prozess radioaktiver Kerne: Mo Isotope als Testfall — •S. Müller[1], M. Babilon[1], K. Sonnabend[1], M. Zarza[1], A. Zilges[1], M. Erhard[2], E. Grosse[2], A. Junghans[2], N. Nankov[2], A. Wagner[2], M. Heil[3], F. Käppeler[3], R. Plag[3], T. Aumann[4], H. Emling[4], H. Simon[4], K. Sümmerer[4] und U. Datta Pramanik[4] — [1]Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt — [2]Institut für Kern- und Hadronenphysik, FZ Rossendorf — [3]Institut für Kernphysik FZ Karlsruhe — [4]GSI Darmstadt

Es gibt 35 neutronenarme, stabile Kerne welche nur im p-Prozess [1] durch eine Reihe von (γ,n), (γ,p) und (γ,α) Reaktionen erzeugt werden können. Am LAND Aufbau der GSI können die (γ,n) Wirkungsquerschnitte von stabilen und instabilen Kernen durch Coloumbaufbruch in inverser Kinematik untersucht werden [2,3]. In einem ersten Experiment sollen die (γ,n) Wirkungsquerschnitte der Kerne ^{100}Mo, ^{93}Mo und ^{92}Mo gemessen werden. Die Ergebnisse der neuen Methode werden verglichen, indem die Kerne ^{100}Mo und ^{92}Mo zusätzlich mit reellen Photonen [4] an den Strahlungsquellen S-DALINAC und ELBE untersucht werden.

Gefördert durch das BMBF (06 DA 115)

[1] M. Arnould, S. Goriely, Phys. Rep. 384 (2003) 1
[2] G. Baur *et al.*, Prog. Part. Nucl. Phys. 51 (2003) 487
[3] R. Palit *et al.*, Phys. Rev. C 68 (2003) 034318
[4] K. Sonnabend *et al.*, Phys. Rev. C 70 (2004) 035802

HK 22.99 Mo 16:30 TU MA141

Theoretical Description of a Quenching of the Neutron Channel observed in d+d Reactions within some Host Metals — •Tatiana Dorsch, Konrad Czerski, Peter Heide, and Armin Huke — Institut für Atomare Physik und Fachdidaktik, Technische Universität Berlin, Berlin, Germany

Angular distributions and the neutron-proton branching ratio of the mirror reactions ^{2}H(d,p)^{3}H and ^{2}H(d,n)^{3}He have been investigated using different deuterized metallic targets the projectile energies ranging from 5 to 60 keV. Whereas the experimental results obtained for Al, Zr, Pd and Ta targets do not differ from those known from gas-target experiments, an enhancement of the angular anisotropy in the neutron channel and a quenching of the neutron-proton branching ratio have been observed for Li and Sr targets at deuteron energies below 20 keV. A theoretical analysis of the experimental results has been performed using a parameterization of all possible channel-spin matrix-elements. Assuming an induced polarization of reacting deuterons, the observed asymmetry effects between the neutron and proton channels could be explained within an adiabatic approximation.

HK 23 Hauptvorträge

Zeit: Dienstag 10:15–12:15 Raum: TU MA001

Hauptvortrag HK 23.1 Di 10:15 TU MA001

Investigation of triple shape coexistence in ^{188,186}Pb using transition probabilities — •A. Dewald[1], O. Möller[1], B. Melon[1], B. Saha[1], K.O. Zell[1], T. Pissulla[1], S. Christen[1], J. Jolie[1], T. Grahn[2], P. Greenlees[2], S. Eeckhaudt[2], P. Jones[2], R. Julin[2], M. Leino[2], J. Pakarinen[2], P. Rahkila[2], C. Scholey[2], J. Uusitalo[2], P. Petkov[3], R. Krücken[4], T. Kröll[4], P. Maierbeck[4], C.W. Beausang[5], D.A. Meyer[5], W. Korten[6], A. Görgen[6], and Y.Le Coz[6] — [1]IKP, Universität zu Köln, Köln — [2]University of Jyväskylä, Finland — [3]INRE, Sofia, Bulgaria — [4]E12, TU München, München — [5]WNSL, Yale University, USA — [6]Dapnia/SPhN, CEA Saclay, France

The phenomenon of triple shape coexistence, established in the neutron deficient lead isotopes, is still one of the most exciting topics in nuclear structure physics. Despite of large theoretical and experimental effort devoted to that interesting phenomenon the knowledge on absolute transition probabilities in the nuclei of interest is very limited. Therefore we performed two recoil distance lifetime measurements using the ^{106,108}Pd(^{83}Kr,3n)^{186,188}Pb reactions at the JYFL Jyväskylä. The Köln plunger device was employed with the JUROGAM spectrometer and the gas-filled separator RITU. For ^{188}Pb recoil gated γ spectra were used to separate the weak reaction channel from a dominant fission. We determined four lifetimes from which the deformation of the prolate band was experimentally deduced for the first time. In case of ^{186}Pb α-tagging was applied for the first time in combination with a plunger measurement. First results will be presented. Supported in part by BMBF No. 06K167 and the EU-FP5 projects HPRI-1999-CT-50017 and HPRI-CT-1999-00044.

Hauptvortrag HK 23.2 Di 10:45 TU MA001

Exploring the Driplines: First Observation of ^{60}Ge and ^{64}Se — •Andreas Stolz — National Superconducting Cyclotron Laboratory, Michigan State University, East Lansing, MI 48824, USA

The discovery of nuclei along the proton dripline is crucial for the understanding of the nuclear forces. The knowledge of lifetimes of these nuclei puts significant constraints on the mass models, which yield important information to nuclear structure and nuclear astrophysics. The closer one approaches the dripline the harder it is to produce new isotopes. It has been over three years that the last new isotope below mass 100 has been observed. This paper will present the first observation of the neutron-deficient nuclei ^{60}Ge and ^{64}Se.

These isotopes have been produced by fragmentation of a 140-MeV/u ^{78}Kr primary beam at the Coupled Cyclotron Facility at Michigan State University. The neutron-deficient fragments were separated by the A1900 fragment separator and identified by a measurement of energy loss, total energy, and time-of-flight.

^{60}Ge is the last nucleus along the proton dripline lighter than cadmium which is predicted to be bound by the latest atomic mass evaluation and which has not yet been observed. Theoretical calculations predict ^{60}Ge to be bound with respect to two-proton emission, while ^{64}Se is predicted not to be bound. No events of ^{59}Ga and ^{63}As were observed confirming that these nuclei are unbound with respect to proton emission.

This work was supported by NSF grant No. PHY-01-10253.

Hauptvortrag HK 23.3 Di 11:15 TU MA001

Feinstruktur von Riesenresonanzen, Waveletanalyse und Skalen* — •A. Shevchenko[1], T. Adachi[2], J. Carter[3], R.W. Fearick[4], S.V. Förtsch[5], H. Fujita[3], Y. Fujita[2], Y. Kalmykov[1], K. Langanke[6], G. Martínez-Pinedo[7], P. von Neumann-Cosel[1], V.Yu. Ponomarev[1], A. Richter[1], Y. Shimbara[2], F.D. Smit[5] und J. Wambach[1] — [1]IKP, TU Darmstadt — [2]University of Osaka, Japan — [3]University of the Witwatersrand, Johannesburg, Südafrika — [4]UCT, Südafrika — [5]iThemba LABS, Südafrika — [6]University of Arhus, Dänemark — [7]ICREA, Barcelona, Spain

Jüngste hochauflösende Experimente zeigen, daß die Feinstruktur von Riesenresonanzen ein globales Phänomen ist. Besonders eindrückliche Beispiele sind eine systematische Untersuchung der isoskalaren Quadrupolriesenresonanz über einen weiten Massenbereich mit Protonenstreuung am iThemba LABS und eine Studie der Gamow-Teller Stärke in ^{90}Nb mit Hilfe der (^{3}He,t) Reaktion am RCNP. Elektronenstreuexperimente am S-DALINAC belegen dies auch für die isovektorielle Dipolriesenresonanz und die magnetische Quadrupolresonanz. Es wird eine neuartige Methode, basierend auf einer Waveletanalyse, vorgestellt, die es erlaubt, charakteristische Skalen der Feinstruktur zu extrahieren. Der Vergleich mit mikroskopischen Rechnungen belegt, daß die Feinstruktur durch Kopplung von Phononen an die Doorway-Zustände entsteht. Eine diskrete Waveletanalyse erlaubt weiterhin eine weitgehend modellunabhängige Extraktion von spin- und paritätsaufgelösten Niveaudichten im Bereich überlappender Zustände. *Gefördert durch DFG unter SFB-634, 445 SUA-113/6/0-1 und 446 JAP 113/267/0-1.

Hauptvortrag HK 23.4 Di 11:45 TU MA001

Präzisions-Studien von relativistischen nuklearen Stößen — •Karl-Heinz Schmidt für die CHARMS-Kollaboration — GSI, Planckstraße 1, 64291 Darmstadt

Motiviert durch technische Anwendungen und astrophysikalische Fragestellungen wurden in letzter Zeit nukleare Stöße bei relativistischen Energien mit den Schwerionenstrahlen und einem hochauflösenden magnetischen Spektrometer der GSI systematisch untersucht. Im Gegensatz zu früheren selektiven Experimenten bei sehr peripheren oder sehr zentralen Stößen geben diese Experimente ein umfassendes Bild der Bildungsquerschnitte und Geschwindigkeitsverteilungen aller Reaktionsprodukte im gesamten Stoßparameter-Bereich. Die Ergebnisse zeigen überraschende Abweichungen von bisherigen globalen empirischen Beschreibungen und begründen ein verbessertes Verständnis verschiedener fundamentaler Eigenschaften der Kernmaterie.

HK 24 Elektromagnetische und Hadronische Proben

Zeit: Dienstag 14:00–16:00 Raum: TU MA001

Gruppenbericht HK 24.1 Di 14:00 TU MA001

First observation of in-medium modifications of the omega meson in photonuclear reactions — •David Trnka for the CBELSA/TAPS collaboration — II. Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

One of the exciting topics in nuclear physics is the modification of experimentally observable properties of vector mesons such as mass and width, when embedded in a medium. A variety of theoretical models predict a mass shift of the ω-meson in the order of $-140MeV < m^* - m_V < -15MeV$ and a broadening of the width within a range of 20 to 50 MeV at normal nuclear densities (i.e. :[1]). A promising approach is to study the decay $\omega \to \pi^0 + \gamma$ in photonuclear reactions. This mode accounts for $9 \cdot 10^{-2}$ of the total width, while for the ρ it is only $6 \cdot 10^{-4}$. Consequently it provides an exclusive probe to study the ω-meson properties in matter. Simulations prove that distortions due to FSI of the pions can be strongly suppressed ([2]) . The experiment was carried out at the ELSA accelerator facility in Bonn using the Crystal Barrel/TAPS detector array. C, Ca, Nb and Pb have been used as targets while the LH2 target was used as a reference measurement. An ω mass shift by about 10 % has been observed in the fully inclusive invariant mass spectra as well as after applying kinematical constraints to suppress rescattered pions. Furthermore, the dependence on the ω-momentum has been studied. Mass changes are only observed for ω-mesons with momenta less than 500 MeV/c.

[1] T. Renk et al. , Phys. Rev. C 66, (2002) 014902
[2] J. G. Messchendorp et al. , Eur. Phys. J. A. 11, 95-103 (2001)

HK 24.2 Di 14:30 TU MA001

Neutron Polarizabilities from Deuteron Compton Scattering — •Robert P. Hildebrandt, Harald W. Griesshammer, and Thomas R. Hemmert — Institute for Theoretical Physics (T39), TU München, Germany

Due to the lack of stable single neutron targets for Compton scattering, experimental access to the neutron polarizabilities is much harder than in the proton case. One possible way to determine the neutron polariz-

abilities is Compton scattering off the deuteron. Therefore, an accurate description of the Chiral Dynamics inside the deuteron is needed, as one has to correct for the proton polarizabilities and binding effects.

In this work, we extend Chiral Effective Field Theory calculations of Compton scattering off the deuteron by including explicit $\Delta(1232)$ degrees of freedom [1], finding very good agreement with experimental data, including the often discussed SAL-data measured at a photon energy of 95 MeV. We further discuss the well-known problem to recover the correct Thomson-limit in ChEFTs and show how to solve it [2]. This leads us towards a consistent description of deuteron Compton scattering below the pion mass and enables us to perform high-precision fits of the isoscalar nucleon polarizabilities to deuteron Compton data. Work supported in part by DFG and BMBF.

[1] R.P. Hildebrandt, H.W. Grießhammer, T.R. Hemmert, D.R. Phillips, nucl-th/0405077, accepted for publication at Eur. Phys. J. A.

[2] R.P. Hildebrandt, H.W. Grießhammer, T.R. Hemmert, in preparation.

HK 24.3 Di 14:45 TU MA001

Deuteron Electro-Disintegration at Very Low Energies — •Stefan Christlmeier and Harald W. Griesshammer — T39, Technische Universität München, D-85747 Garching

We consider the deuteron break-up $^2H(e,e'p)n$ at very low momentum transfer ($q < 100$ MeV) and close to threshold in the low-energy nuclear Effective Field Theory without dynamical pions. The result is model-independent, analytic, simple, manifestly gauge-invariant and does not suffer from ambiguities in treating off-shell effects or meson-exchange currents. There are no free parameters, and the reaction is determined by simple, well-known observables on the 1%-level. Decomposing the doubly differential cross-section into the longitudinal-plus-transverse ($L+T$), transverse-transverse (TT) and longitudinal-transverse interference (LT) terms, we compare to a Bonn-potential calculation by Arenhövel et al. and to experimental findings at S-DALINAC. There is no space on the theory-side for the 30%-discrepancy between theory and experiment in σ_{LT}, with un-determined short-distance contributions that could affect σ_{LT} entering only at very high orders. Further observables with relevance to big-bang nucleo-synthesis are commented upon.

HK 24.4 Di 15:00 TU MA001

Chiral symmetry and resonances in QCD — •Matthias F.M. Lutz[1] and Evgueni E. Kolomeitsev[2] — [1]GSI, Planck Str. 1, D-64289 Darmstadt — [2]The Niels Bohr Institute, Blegdamsvej 17, DK-2100 Copenhagen

We study the formation of resonances in terms of the chiral SU(3) Lagrangian. At leading order parameter-free predictions are obtained for the scattering of Goldstone bosons off any hadron once we insist on approximate crossing symmetry of the unitarized scattering amplitude. A wealth of empirically established resonances are recovered and so far unseen resonances are predicted.

HK 24.5 Di 15:15 TU MA001

Electroproduction of Nucleon Resonances — •Lothar Tiator[1], Dieter Drechsel[1], Sabit Kamalov[2], Mauro M Giannini[3], Elena Santopinto[3] und Andrea Vassallo[3] — [1]Institut für Kernphysik, Universität Mainz — [2]Laboratory of Theoretical Physics, JINR Dubna, 14980 Moscow Region, Russland — [3]Dipartimento di Fisica dell' Universita di Genova and INFN, Sezione di Genova, Genova, Italy

The Mainz unitary isobar model MAID has been extended and used for a partial wave analysis of pion photo- and electroproduction in the resonance region $W < 2$ GeV. Older data from the world data base and more recent experimental results from Mainz, Bates, Bonn and JLab for Q^2 up to 4.0 $(\mathrm{GeV/c})^2$ have been analyzed and the Q^2 dependence of the helicity amplitudes have been extracted for a series of four star resonances. We compare single-Q^2 analyses with a superglobal fit in a new parametrization of Maid2003 together with predictions of the hypercentral constituent quark model. As a result we find that the helicity amplitudes and transition form factors of constituent quark models should be compared with the analysis of bare resonances, where the pion cloud contributions have been subtracted. Finally, we will compare our results with recent lattice QCD calculations for the $N \to \Delta$ transition. The quenched calculations of Alexandrou et al. can describe the E/M and S/M ratios for $Q^2 < 1.5$ GeV^2 reasonably well but overestimate the dominant magnetic G_m^* form factor by nearly a factor of 2 at large Q^2.

HK 24.6 Di 15:30 TU MA001

The Fubini-Furlan-Rosetti Sum Rule — •Barbara Pasquini[1], Dieter Drechsel[2], and Lothar Tiator[2] — [1]Dipartimento di Fisica Nucleare e Teorica, Universita degli Studi di Pavia and INFN, Sezione di Pavia, Pavia, Italy — [2]Institut für Kernphysik, Universität Mainz

The Fubini-Furlan-Rossetti sum rule for pion photoproduction on the nucleon is evaluated by dispersion relations at constant t, and the corrections to the sum rule due to the finite pion mass are calculated. Near threshold these corrections turn out to be large due to pion-loop effects, whereas the sum rule value is closely approached if the dispersion integrals are evaluated for sub-threshold kinematics. This extension to the unphysical region provides a unique framework to determine the low-energy constants of relativistic chiral perturbation theory by global properties of the excitation spectrum. In a further extension of this work the unitary isobar model MAID will be constrained by fixed-t dispersion relations. This will considerably improve the description of the non-resonant background contribution and will directly satisfy the requirements of crossing symmetry.

HK 24.7 Di 15:45 TU MA001

Relativistic treatment of the $N^*(1520)$ and its decay channels — •Lukas Jahnke and Stefan Leupold — Institut für Theoretische Physik, Universität Giessen, Germany

It has turned out that the $N^*(1520)$ is rather important to study in-medium changes of hadronic properties [1]. The analysis of elementary reactions provides here an important ingredient. The presented approach aims at a description of the pion-induced production of dileptons on the nucleon in the $N^*(1520)$ region. A brief introduction to the relativistic treatment of free and interacting spin-3/2 particles is presented paying special attention to the issue of how to maintain the correct number of degrees of freedom [2]. Consistent couplings of the $N^*(1520)$ to pion-nucleon and rho-nucleon are presented. The corresponding self energies are determined to obtain the full $N^*(1520)$ propagator.

[1] M. Post, S. Leupold and U. Mosel, Nucl. Phys. A 741, 81 (2004)
[2] V. Pascalutsa and R. Timmermans, Phys. Rev. C 60, 042201 (1999)

HK 25 Physik mit schweren Ionen

Zeit: Dienstag 14:00–16:00 Raum: TU MA144

Gruppenbericht HK 25.1 Di 14:00 TU MA144

Thermalization of gluons at RHIC including gg<−>ggg interactions in a parton cascade — •Zhe Xu and Carsten Greiner — Robert-Mayer-Str. 8, 60325 Frankfurt

We develop a new 3+1 dimensional Monte Carlo cascade solving the kinetic on-shell Boltzmann equations for partons including the inelastic $gg \leftrightarrow ggg$ pQCD processes, where the back reaction channel is treated fully consistently. The stochastic method is very efficient especially for high gluon interaction rates. The cascade is applied to simulate parton evolution and to investigate thermalization of gluons for a central Au+Au collision at RHIC energy. The initial conditions are assumed to be generated by independent minijets with $p_T > p_0 = 1,3-2$ GeV. It is demonstrated that overall kinetic equilibration is driven mainly by the inelastic processes and is achieved on a scale of $1-2$ fm/c. The further evolution of the expanding gluonic matter then shows almost an ideal hydrodynamical behaviour. Full chemical equilibration of the gluons follows on a longer timescale of about $1-3$ fm/c. Also results employing color glass condensate initial conditions will be presented.

HK 25.2 Di 14:30 TU MA144

Multi-strange Hyperon Production at CERN SPS* — •M. Mitrovski[1], C. Alt[1], C. Blume[1], P. Dinkelaker[1], D. Flierl[1], V. Friese[2,3], M. Gazdzicki[1], F. Kramer[1], M. Kliemant[1], S. Kniege[1], I. Kraus[2], B. Lungwitz[1], C. Meurer[1], R. Renfordt[1], A. Richard[1], A. Sandoval[2], T. Schuster[1], R. Stock[1], C. Strabel[1] und H. Ströbele[1] für die NA49-Kollaboration — [1]Institut für Kernphysik, Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Fachbereich Physik der Universität, Marburg

A study of the energy dependence of Ω and Ξ

(preliminary) production in central Pb+Pb collisions at CERN SPS energies are presented.

These measurements are performed using the large acceptance NA49 hadron spectrometer at the SPS which allows for precise determination of particle momenta and decay topologies.

Fully corrected rapidity and m_t spectra for Ξ at 40, 80 and 158 A·GeV and Ω at 40 and 158 A·GeV are obtained. From these spectra the total multiplicities can be derived and the results will be compared to various model predictions. It is found that the measured yields are close to the expectation of a statistical hadron gas model (grand canonical approximation) [1].

* Supported by BMBF and GSI.

[1] F. Becattini et al., Phys.Rev. C69 (2004) 024905.

HK 25.3 Di 14:45 TU MA144

Resonance Absorption and Regeneration in Heavy Ion Collisions — •Sascha Vogel and Marcus Bleicher — Institut für Theoretische Physik, Johann Wolfgang Goethe Universität Frankfurt am Main, 60054 Frankfurt am Main

We show that the regeneration of hadronic resonances plays an important role in heavy ion collisions at SPS and RHIC energies. We investigate the time evolution and Δ, ρ and Φ resonances after chemical freeze-out and explore at which time the resonances the experiment detects decay. Since detailed experimental studies of these resonances became recently available, this will contraint the modeling of hadronic interactions and provides new insights into the decoupling stage of massive nuclear collisions.

HK 25.4 Di 15:00 TU MA144

Teilchenzahlverhältniss in relativistischen Schwerionekollisionen und Fluktuationen — •Detlef Zschiesche, Adrian Dumitru und Licinio Portugal — Institut für Theoretische Physik Johann Wolfgang Goethe-Universität 60054 Frankfurt am Main

Wir untersuchen die Bedeutung von Dichte- und Temperaturfluktuationen in relativistischen Schwerionenkollisionen. Diese Fluktuationen werden in Nichtgleichgewichtshydrodynamik Rechnungen vorhergesagt, falls das System während der Evolution einen Phasenübergang durchläuft. Die bei den verschiedenen Einschussenergien am CERN-SPS und BNL-RHIC gemessenen Teilchenzahlverhältnisse stellen eine Observable dar, in der sich die Fluktuationen nachweisen lassen sollten und damit Rückschlüsse auf das Durchlaufen eines Phasenübergangs gezogen werden können. In einem ersten Ansatz benutzen wir ein nichtwechselwirkendes Gas mit einem angenommenen globalen chemischen "Freezeout", wie es schon recht erfolgreich zur Beschreibung von Teilchenzahlverhältnissen benutzt wurde. Jedoch erlauben wir das Auftreten von Dichte- und Temperaturfluktuationen. Durch Anpassen der verschiedenen Parameter können wir untersuchen, ob endliche Fluktuationen zu einer statistisch signifikant verbesserten Beschreibung der gemessenen Teilchenzahlverhältnisse bei bestimmten Einschussenergien führen oder nicht.

HK 25.5 Di 15:15 TU MA144

High p_t spectra of K^0_S and Λ produced in Pb+Pb collisions at 158 A· GeV* — •Tim Schuster[1], C. Alt[1], C. Blume[1], P. Dinkelaker[1], D. Flierl[1], V. Friese[2,3], M. Gazdzicki[1], M. Kliemant[1], S. Kniege[1], F. Kramer[1], I. Kraus[2], B. Lungwitz[1], C. Meurer[1], M. Mitrovski[1], R. Renfordt[1], A. Richard[1], A. Sandoval[2], R. Stock[1], C. Strabel[1], and H. Ströbele[1] for the NA49 collaboration — [1]Institut für Kernphysik, Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Fachbereich Physik der Universität, Marburg

Studying the production of hadrons with transverse momenta in the range of $2 < p_t < 4$ GeV/c in ultrarelativistic heavy ion collisions can answer questions about the hadron production mechanisms involved. The comparison of baryon and meson spectra is of particular interest in this context to tell when fragmentation and when recombination is the predominant origin of produced hadrons. Recent results from RHIC concerning elliptic flow and baryon / meson ratios might lead to the assumption that recombination is favoured in the region $2 < p_t < 4$ GeV/c.

In the NA49 large acceptance hadron spectrometer, K^0_S and Λ are identified via their V0 decay-topology. This allows for unambiguous particle identification up to the required range of p_t.

Preliminary p_t-spectra for K^0_S and Λ produced in central Pb+Pb reactions at 158 A· GeV will be presented, reaching $p_t = 3.8$ GeV/c (K^0_S) and $p_t = 4.4$ GeV/c (Λ) respectively.

* Supported by BMBF and GSI

HK 25.6 Di 15:30 TU MA144

Analyse von Mesonen mit offenem Charm-Anteil bei 158 AGeV Pb-Au Kollisionen — •Wilrid Ludolphs für die CERES-Kollaboration — Physikalisches Institut der Universität Heidelberg

Die QCD sagt die Existenz des Quark-Gluon-Plasmas bei hoher Dichte und/oder Temperatur voraus. Die Untersuchung dieses neuartigen Zustandes ist Ziel ultra-relativistischer Schwerionen Kollisionen. Die am CERN SPS gemessene J/Ψ-Unterdrückung wird als mögliche Signatur interpretiert. Diese Aussage ist jedoch nur sinnvoll, falls die gesamte Produktionsrate von Charm-Mesonen bekannt ist. Indirekte Messungen deuten auf eine mögliche erhöhte Ausbeute von Mesonen mit offenem Charm Anteil hin.

Die Erweiterung des CERES Experiments durch eine TPC erlaubt die Untersuchung des Zweikörperzerfalls $D^0 \to K\pi$ ($B = 3.8\%$, $c\tau = 123.4\mu$m). Die Analyse basiert auf der Rekonstruktion des Zerfallsvertex. Dies ermöglicht eine Trennung der Zerfallsprodukte von dem hohen Untergrund aus Targetspuren.

Im Rahmen dieses Vortrages werden die einzelnen Analyseschritte vorgestellt. Unter Berücksichtigung anderer Zerfallkanäle, die zu dem invarianten Massenspektrum beitragen (z.B. $D^0 \to K\pi\pi^0$), wird eine obere Grenze für die Ausbeute der D^0-Mesonen angegeben.

HK 25.7 Di 15:45 TU MA144

Quarkonia measurements with the ALICE TRD — •Wolfgang Sommer for the ALICE TRD collaboration — Institut für Kernphysik, J. W. Goethe Universität Frankfurt, August-Euler-Str. 6, 60486 Frankfurt/M., Germany

The ALICE experiment is designed to measure a large variety of heavy ion and proton proton reactions at the LHC. One major component is the Transition Radiation Detector (TRD), which will provide electron/pion separation in the high p_t region. The central barrel consisting of Inner Tracking System (ITS), Time Projection Chamber (TPC) and the TRD will enable detailed studies on different Quarkonia states by measuring high p_t electrons.

We present the latest performance studies on detecting dilepton pairs, done within the framework of the ALICE simulation package ALIROOT.

HK 26 Theorie

Zeit: Dienstag 14:00–16:00 Raum: TU MA004

Gruppenbericht HK 26.1 Di 14:00 TU MA004

The Phase Diagram of the Quark-Meson Model — •Bernd-Jochen Schaefer[1] and Jochen Wambach[1,2] — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI, Darmstadt

A renormalization group (RG) analysis of the chiral phase diagram of a two-flavor quark-meson model is presented. Using the proper-time RG approach in the chiral limit two transition lines in the phase diagram at finite chemical potential and small temperatures are observed. The sensitivity and cutoff dependence of this novel result on the approximation used are discussed and compared with an so-called Exact RG approach. The influence of a finite (realistic) pion mass on the phase diagram is discussed.

Gruppenbericht

HK 26.2 Di 14:30 TU MA004

Phenomenology of Hot QCD at Finite Quark Chemical Potential — •Michael Thaler, Claudia Ratti, and Wolfram Weise — Physik Department, Technische Universität München, 85747 Garching, GERMANY

We investigate two- and three-color QCD thermodynamics at finite quark chemical potential by means of an extended Nambu-Jona-Lasinio model including the scalar diquark channel. A background temporal gauge field couples the chiral and diquark condensates to the Polyakov loop. The model includes the features of deconfinement and chiral symmetry restoration. The parameters of the Polyakov loop potential are fixed in the pure gauge sector by comparison with lattice results. The chiral and diquark condensates and the Polyakov loop expectation value as functions of temperature and quark chemical potential are obtained by minimizing the thermodynamic potential. As an application, the phase diagram, the pion and the scalar diquark masses, the scaled pressure difference $\Delta p(T,\mu)/T^4 = (p(T,\mu) - p(T,0))/T^4$ and the scaled quark number density $n_q(T,\mu)/T^3$ are calculated for two and three colors. Comparison to recent lattice results is discussed.

Work supported in part by INFN and BMBF.

HK 26.3 Di 15:00 TU MA004

The QCD equation of state at finite temperature and baryon density within a quasi-particle model — •Marcus Bluhm[1,2], Burkhard Kämpfer[1], and Gerhard Soff[2] — [1]Forschungszentrum Rossendorf, Dresden, Germany — [2]Institut für Theoretische Physik, TU Dresden, Dresden, Germany

We present a quasi-particle model for the equation of state of QCD matter. The model is compared in detail with lattice QCD calculations at finite temperature and baryo-chemical potential which became accessible only recently. Special focus is put onto the expansion coefficients of the corresponding Taylor series of the thermodynamic potential from which all thermodynamic quantities, like susceptibilities, follow in a thermodynamicly self-consistent way.

Within the Φ functional approach the chain of approximations is outlined which is needed in order to derive our phenomenological model from QCD.

HK 26.4 Di 15:15 TU MA004

Dilepton production from hot hadronic matter in nonequilibrium — •Bjoern Schenke and Carsten Greiner — Institut fuer Theoretische Physik, Johann Wolfgang Goethe Universitaet, Robert-Mayer-Str. 10, 60054 Frankfurt am Main

We investigate medium modifications of low mass vector mesons in heavy ion collisions within a nonequilibrium quantum field theoretical description. In particular the emphasis lies on studying the fundamental question whether an adiabatic, i.e. instantaneous adaption of the dynamic and spectral information to the changing medium, as assumed in schematic model calculations and microscopic transport simulations, is a valid assumption. A significant retardation of the meson's spectral function and the resulting dilepton rate is found, increasing with smaller vacuum widths. This results in remarkable effects on the total dilepton yield, especially within the range where the CERES experiment measured an increased production. Our findings show that an exact treatment of medium modifications requires the consideration of memory effects, and hence is more complicated than commonly assumed.

HK 26.5 Di 15:30 TU MA004

Relativistic Mean Field Model with Momentum Dependent Self Energies — •Stefan Typel — GSI Darmstadt

The relativistic mean field (RMF) model with minimal density dependent meson-nucleon couplings is extended to include couplings of mesons to derivatives of the nucleon field. The basic Lagrangian is presented and the consequences for the nucleon and meson field equations are discussed. In this approach, the nucleon self energies become differential operators with a non-trivial dependence on the medium density. Correspondingly, a momentum dependence of the effective interaction is generated that is absent from conventional RMF models. The effective (Landau) mass of the nucleons (related to the density of states near the Fermi surface) can be freely adjusted in the extended model. Additionally, the Schrödinger equivalent optical potential as extracted from elastic proton-nucleus scattering in Dirac phenomenology can be well described. Parameters of the coupling functions are determined by a fit to properties of finite nuclei. Results for nuclear matter and finite nuclei are compared to conventional models with density dependent couplings or with nonlinear meson self interactions.

HK 26.6 Di 15:45 TU MA004

Correlations in quark matter — •Frank Frömel, Stefan Leupold, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

The spectral functions of light quarks and mesons in quark matter can be investigated in a fully self consistent approach. Using the pointlike interaction of the Nambu-Jona-Lasinio model, relations between quark self energies and spectral functions are the basis for an iterative calculation beyond the usual mean-field and RPA approximations. We consider a full series of RPA type diagrams with dressed quarks for the quark collision rate. These diagrams can be interpreted as dynamically generated mesons (σ, π) coupled to the quarks. To obtain a self consistent scheme, the results are fed back into the quark self energies. This method allows, in particular, to investigate the role of short-range correlations in quark matter. Calculations have been performed for vanishing temperature and finite chemical potential. The results clearly show effects of collisional broadening in the spectral functions of quarks and mesons. Also, other deviations from mean field calculations will be discussed.

HK 27 Theorie

Zeit: Dienstag 14:00–16:00 Raum: TU MA005

HK 27.1 Di 14:00 TU MA005

Volume dependences from lattice chiral perturbation theory — •B. Borasoy[1] and R. Lewis[2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn, Germany — [2]Department of Physics, University of Regina, Canada

The physics of pions within a finite volume is explored using lattice regularized chiral perturbation theory. This regularization scheme permits a straightforward computational approach to be used in place of analytical continuum techniques. Using the pion mass, decay constant, form factor and charge radius as examples, it is shown how numerical results for volume dependences are obtained at the one-loop level from simple summations [1].

Financial support of the Deutsche Forschungsgemeinschaft, the Natural Sciences and Engineering Research Council of Canada, and the Canada Research Chairs Program is gratefully acknowledged.

[1] B. Borasoy and R. Lewis, hep-lat/0410042;
B. Borasoy, R. Lewis and D. Mazur, hep- lat/0408040.

HK 27.2 Di 14:15 TU MA005

Coupled-channel analysis of the associated strangeness production in πN and γN reactions in up to 2 GeV energy region — •Vitaliy Shklyar, Horst Lenske und Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We study the $(\gamma/\pi)N \to K\Lambda, \Sigma$ reactions in the energy region from the reaction threshold up to 2 GeV to investigate the role of the nucleon resonances in the associated strangeness production. The production mechanism is described within a coupled-channel effective Lagrangian approach developed in [1,2] where all rescattering effects in the πN, $2\pi N$, ηN, ωN, $K\Lambda$, and $K\Sigma$ channels are simultaneously treated to describe the experimental data. To account for the resonance contributions to the reaction prosess we include all known nonstrange states [2] with spin-$\frac{1}{2}$,-$\frac{3}{2}$,and-$\frac{5}{2}$ and masses below 2 GeV. The role of the nucleon resonance contributions to the $K\Lambda$ and $K\Sigma$ final states is highlighted and obtained results are discussed. Work supported by FZ Jühlich.

[1] G. Penner and U. Mosel, Phys. Rev. **66**, 055212 (2002).
[2] V. Shklyar, G. Penner, and U. Mosel, Eur. Phys. J. **A21**, 445,(2004).
[2] K. Hagiwara *et al.*, Phys. Rev.**D66**, 010001,(2002).

HK 27.3 Di 14:30 TU MA005

Canonical suppression in microscopic and stochastic transport models — •Oliver Fochler, Sascha Vogel, Marcus Bleicher, and Carsten Greiner — Institut für Theoretische Physik, Johann Wolfgang Goethe Universität Frankfurt am Main, 60054 Frankfurt am Main

It is investigated whether current microscopic transport models are able to reproduce a canonical suppression of conserved quantities for small reaction volumes correctly. A suppression in the yields especially for strange hadrons due to small reaction volumes has been theoretically advocated within thermal hadron gas descriptions over the last twenty years. This might be particularly important to understand the recent experimental results for strange particle production in heavy ion collisions at SIS and for non-central collisions at SPS energies. We have therefore simulated a pion-gas having a volume-limited production and annihilation crosssection for $\pi\pi \leftrightarrow K\bar{K}$ using both a microscopical and a stochastical transport model. The kaons are restricted to a given volume, whereas the pions can diffuse freely within a much larger heat bath. It is found that the microscopic transport description can account for the canonical suppression of U(1)-conserved charges.

HK 27.4 Di 14:45 TU MA005

Hartree-Fock and RPA model based on correlated realistic nucleon-nucleon potentials — •Nils Paar, Panagiota Papakonstantinou, Robert Roth, and Heiko Hergert — TU-Darmstadt

The spherical Hartree-Fock model is formulated in the harmonic oscillator basis, starting from the realistic nucleon-nucleon interactions with explicit treatment of interaction-induced correlations via the unitary correlation operator method (UCOM). The binding energies, charge radii, one-body density distributions, and single-particle energies are evaluated along the nuclide chart, to investigate the utility of the model for a consistent description of the nuclear ground state. It is shown that one can improve the structure properties by extending the model space to include the long-range correlations (e.g. many-body perturbation theory), and by implementing an additional phenomenological two-body correction, which simulates the missing three-body interactions. For the studies of collective excitation phenomena, the fully self-consistent random phase approximation is formulated in the configurational space built from the Hartree-Fock single-particle basis.

Work supported by the DFG (SFB 634).

HK 27.5 Di 15:00 TU MA005

Exclusive two pion production — •Nikolaus Warkentin[1], Dmitri Ivanov[2], and Andreas Schäfer[1] — [1]Institut fuer Theoretische Physik,Universitaet Regensburg, D-93040 Regensburg — [2]Sobolev Institute of Mathematics RAS, Novosibirsk 630090, Russia

The recent HERMES data for the exclusive two pion production are in good agreement with theoretical predictions at leading order. This and the expectation of new data from the COMPASS experiment motivated us to analyze the angular distribution in the process of exclusive electroproduction of pion pairs, using the collinear factorization approach at next-to-leading order.

The project is supported by BMBF.

HK 27.6 Di 15:15 TU MA005

Finite Volume Effects of Baryon Properties — •Tim Wollenweber and Thomas R. Hemmert — Technische Universität München

To compare lattice QCD simulations to chiral extrapolations, we utilize Chiral Effective Field Theory with explicit delta degrees of freedom. We calculate the volume dependence of the nucleon mass at $\mathcal{O}(\epsilon^3)$ in the smale scale expansion extending the work of [1]. We also present a calculation for the difference between the finite and infinite volume of the nucleon axial coupling constant g_A in the same formalism extending the work of [2].

[1]A. Ali Kahn et al.,(QCDSF-UKQCD collaboration), Nucl.Phys.B689:175-194,2004.

[2] T. R. Hemmert, M. Procura and W. Weise Phys. Rev. D68, 075009 (2003).

HK 27.7 Di 15:30 TU MA005

In-medium properties of $N(1535)$ in chiral models probed by η mesic nucleus — •Daisuke Jido[1], Hideko Nagahiro[2], and Satoru Hirenzaki[2] — [1]Phyisik-Department, Technische Universität München,James-Franck-Strasse, D-85747 Garching — [2]Department of Physics, Nara Women's University, Nara 630-8506, Japan

In this talk, we discuss in-medium properties of the $N(1535)$ resonance within two kinds of chiral models, chiral doublet model and chiral unitary model, and investigate the formation of the η-nucleus bound systems (η mesic nuclei) under N^* dominance hypothesis in the η-nucleon system. The two chiral models are based on different physical pictures of the $N(1535)$ resonance and give distinct consequences of the in-medium properties of $N(1535)$. The chiral doublet model suggests a reduction of the mass difference of the nucleon and $N(1535)$ in nuclear medium, and it turns the η optical potential to be repulsive at center of nucleus. On the other hand, $N(1535)$ in the chiral unitary model is insensitive to the medium effect and the η optical potential is to be attractive. In order to see the physical implications of these consequences, we show the formation rates of the η mesic nuclei calculated with the η optical potentials based on these chiral models. We find a clear difference in the global shapes of the formation spectra, which will be distinguished in experiment.

[1] D. Jido, H. Nagahiro and S. Hirenzaki, Phys. Rev. C **66** (2002) 045202; H. Nagahiro, D. Jido and S. Hirenzaki, *ibid.* **68** (2003) 035205.

* *Work of D.J. in Germany is supported by AvH.*

HK 27.8 Di 15:45 TU MA005

Dirac operator for two color QCD at nonzero chemical potential vs matrix models — •Harald Markum[1], Gernot Akemann[2], Elmar Bittner[3], Maria-Paola Lombardo[4], and Rainer Pullirsch[1] — [1]Atominstitut, Technische Universität Wien, Austria — [2]Department of Mathematical Sciences, Brunel University West London, UK — [3]Institut für Theoretische Physik, Universität Leipzig, Germany — [4]INFN - Laboratori Nazionali di Frascati, Italy

We investigate the eigenvalue spectrum of the staggered Dirac matrix in two color QCD at finite chemical potential. The profiles of complex eigenvalues close to the origin are compared to a complex generalization of the chiral Gaussian Symplectic Ensemble, confirming its predictions for weak and strong non-Hermiticity. They differ from the QCD symmetry class with three colors by a level repulsion from both the real and imaginary axis.

HK 28 Instrumentation und Anwendungen

Zeit: Dienstag 14:00–16:00 Raum: TU MA041

Gruppenbericht

HK 28.1 Di 14:00 TU MA041

The Super-FRS project at GSI — •Martin Winkler for the Super-FRS collaboration and the NUSTAR collaboration — GSI Darmstadt

Since more than a decade the GSI projectile fragment separator FRS has successfully demonstrated the research potential of in-flight separators at relativistic energies. To overcome the limitations of this facility the next–generation large scale European in–flight facility is presently planned at GSI. It will provide primary beams of all projectiles up to uranium accelerated up to 2 GeV/u. The maximum intensities of these projectiles beams will be (1-3)$\times 10^{12}$/s depending on the energy, mass and charge state.

The new fragment separator, the Super-FRS, is a super conducting large acceptance device with multiple degrader stages providing spatially separated rare-isotope beams for:

1) the high-energy branch (Bρ_{max} = 20 Tm) including a high–resolution spectrometer to perform reaction studies

2) the low-energy branch (Bρ_{max} = 10 Tm) for spectroscopy with energy-bunched rare isotope beams

3) the ring branch (Bρ_{max} = 13 Tm) for precision experiments with stored and cooled beams,including reactions with light hadrons and electrons.

In this contribution we present the main characteristics of the Super-FRS and the present status of the design studies.

Gruppenbericht HK 28.2 Di 14:30 TU MA041

Towards the HESR at FAIR: Machine experiments at COSY — •Raimund Tölle for the HESR team collaboration — Forschungszentrum Jülich

The synchrotron and storage ring COSY can store protons from 300 MeV/c and deuterons from 535 MeV/c and accelerate to 3700 MeV/c. The possibility to perform experiments with polarized or unpolarized protons / deuterons (in this momentum range) combined with enhancing the beam quality by electron and stochastic cooling is unique in Europe.

The High Energy Storage Ring (HESR) of the Facility for Antiproton and Ion Research (FAIR) which is planned at the GSI in Darmstadt will be equipped with electron and stochastic cooling as well. It shall be contributed to FAIR by a consortium of the COSY group of the Research Center Juelich, Uppsala University, and GSI. To meet the demanding requirements for this 1.5 GeV/c - 15 GeV/c antiproton storage ring with its two user modes (high luminosity mode or high resolution mode) the validity of several theoretical simulation codes has to be checked. The HESR will be described and the feasibility of benchmarking experiments at COSY in the fields of electron cooling, stochastic cooling, high harmonic cavity, polarisation build-up via spin transfer will be discussed.

HK 28.3 Di 15:00 TU MA041

Concept for a RICH detector for the CBM experiment at the future accelerator facility FAIR at GSI in Darmstadt — •Claudia Höhne for the CBM collaboration — GSI Darmstadt

At the future Facility for Antiproton and Ion Research in Darmstadt (FAIR) a dedicated heavy-ion experiment investigating the properties of highly Compressed Baryonic Matter is proposed (CBM). Investigating heavy-ion collisions at beam energies from 15 to 35 AGeV, its goal will be to explore the QCD phase diagram in the region of moderate temperatures but very high baryon densities. A key observable of the physics program will be a precise measurement of low-mass vector mesons in their leptonic decay channel.

The essential experimental tool for identifying the decay electrons will be a gaseous RICH detector positioned after a system of silicon tracking stations which are located inside a magnetic dipole field. The concept of this RICH detector including first simulations will be introduced and discussed.

HK 28.4 Di 15:15 TU MA041

Untersuchungen zur APD-Auslese von Szintillationskristallen — •Helena Nowak für die PANDA-Kollaboration — Ruhr-Universität Bochum, Institut für Experimentalphysik I

Der Entwicklungsstand verschiedener Photodetektoren für die Auslese des elektromagnetischen Kalorimeters des PANDA-Detektors wird vorgestellt. Außerdem werden die Ergebnisse der durchgeführten Testmessungen zur Ermittlung der Energieauflösung sowie der Temperaturabhängigkeit der Lichtausbeute der Kristalle präsentiert. Desweiteren werden Ergebnisse der Untersuchung zur Strahlenhärte der verwendeten APDs (Avalanche Photodioden) diskutiert.

gefördert vom bmb+f (Fördernummer: 06 B0 105)

HK 28.5 Di 15:30 TU MA041

FURIOS - Eine universelle Laserionenquelle für exotische Spezies — •Thomas Kessler[1], Iain Moore[1], Ben Tordoff[2], Juha Äystö[1], John Billowes[2] und Klaus Wendt[3] — [1]IGISOL,Universität Jyväskylä, Finnland — [2]Nuclear Physics Group, Manchester University, England — [3]AG Larissa, Universität Mainz, Deutschland

Der Isotopen-Separator der Universität Jyväskylä (Finnland) bietet die Möglichkeit der On-line-Erzeugung und Untersuchung von Radionukliden. Durch den Einsatz der IGISOL-Technik (Ion Guide Isotope Separator On-Line) in Verbindung mit einem Buncher-Cooler-System kann ein breites Spektrum bis hin zu refraktären, kurzlebigen Elementen abgedeckt werden. Zur Steigerung von Effizienz und Selektivität der Isotopenproduktion ist der Aufbau einer Laserionenquelle (RILIS - Resonance Ionization Laser Ion Source) geplant. Um eine möglichst große Anzahl verschiedener Atome resonant zu ionisieren, wird ein flexibles Lasersystem benötigt. Daher ist für das FURIOS-Projekt (Fast Universal Resonant Ion Source) der Aufbau eines gemischten hochrepetierenden (10 kHz) Lasersystems aus Farbstoff-Lasern und Ti:Saphir-Lasern in der Vorbereitungsphase. Der Vortrag präsentiert nebem dem experimentellen Aufbau die ersten Ergebnisse der Laserionisation und gibt einen Ausblick auf geplante Experimente.

HK 28.6 Di 15:45 TU MA041

Commissioning of TRIμP Separator and Production of ^{21}Na — E. Traykov, G.P.A. Berg, U. Dammalapati, S. De, P. Dendooven, O. Dermois, O. Versolato, K. Jungmann, H.H. Kiewiet, A. Rogachevskiy, M. Sohani, C.J.G. Onderwater, L. Willmann, H.W. Wilschut, •E. Traykov, G.P.A. Berg, S. De, P. Dendo oven, O. Dermois, O. Versolato, K. Jungmann, H.H. Kiewiet, A. Rogachev skiy, M. Sohani, C.J.G. Onderwater, and H.W. Wilschut — Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, The Netherlands

The TRIμP separator is the first part of the TRIμP facility at KVI, the purpose of which is to separate specific rare isotopes that will be produced using the cyclotron AGOR via fragmentation and fusion evaporation and other reactions at energies of 8 - 70 MeV/nucleon. In particular rare isotopes that are needed for high precision studies to search for physics beyond the standard model are of interest. The separator was installed, commissioned and tested in both the "fragmentation mode" and the "gas-filled recoil mode " to allow efficient collection of heavy isotopes with large charge state distributions. After successful commissioning, we produced as a first isotope a very clean ^{21}Na beam using the (p,n) reaction in reverse kinematics. This isotope was used in a first experiment with the purpose of measuring very precisely the β decay branching ratio of ^{21}Na.

HK 29 Instrumentation und Anwendungen

Zeit: Dienstag 14:00–16:00 Raum: TU MA042

HK 29.1 Di 14:00 TU MA042

Beam-Induced Depolarisation in the HERMES Transversely Polarised Hydrogen Target — •Davide Reggiani, Erhard Steffens, and Phil Tait for the HERMES (Target Group) collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg, 91058 Erlangen

The HERMES polarised hydrogen target is situated in the HERA electron storage ring in Hamburg. For the transverse spin program at HERMES, the magnetic holding field of the target is perpendicular to the HERA positron beam. An unwanted consequence is that the beam-induced resonance between hydrogen hyperfine states with $\Delta m_F = 0$, which was previously forbidden, can occur. The shape and spacing of these resonances will be shown. In order to prevent these resonances from reducing the nuclear polarization in the target cell, a pair of correction coils have been added to improve the field homogeneity. The change of the resonance shape and the increase of the target polarization obtained by using these coils will be presented along with an overview of the overall target performance.

HK 29.2 Di 14:15 TU MA042

Ein gepulstes NMR-System zur Polarisationsmessung an Festkörpertargets — •C. Hess, J. Dahmen, J. Heckmann, W. Meyer, E. Radtke und G. Reicherz — Institut für Experimentalphysik I, Ruhr-Universität Bochum, D-44780 Bochum

In Doppelpolarisationsexperimenten wie z.B. COMPASS werden polarisierte Festkörpertargets eingesetzt. Für die Analyse ist die Kenntnis des genauen Polarisationsgrades des Targetmaterials von entscheidender Bedeutung. Die Bestimmung der Polarisation erfolgt dabei über die Messung der NMR-Linie, wozu zur Zeit überwiegend die Methode der cw-NMR (continuous wave nuclear magnetic resonance) genutzt wird. In anderen Anwendungen der NMR (z.B. in der Kernphysik oder Medizin) kommt fast ausschließlich die Technik der gepulsten NMR zum Einsatz, die sich durch bessere Zeitauflösung und vor allem höhere Empfindlichkeit auszeichnet. Es liegt nahe, diese Technik auf ihre Eignung zur Polarisationsbestimmung zu untersuchen.

Mit dem im Aufbau befindlichen gepulsten NMR-System wurden im Bochumer PT-Labor erste Messungen unter Kryo-Bedingungen durchgeführt, deren Ergebnisse präsentiert werden.

HK 29.3 Di 14:30 TU MA042

Elektronenspinresonanz und Polarisationsverhalten von D-Butanol als polarisiertes Festkörpertarget — •J. Heckmann, J. Dahmen, S. Goertz, C. Hess, W. Meyer, E. Radtke und G. Reicherz — Institut für Experimentalphysik AG I, Ruhr-Universität Bochum, Universitätsstr. 150, D-44780 Bochum

An polarisierten Festkörpertargets werden hohe Polarisationswerte mit Hilfe der Dynamischen Nukleonenpolarisation (DNP) erzielt. Dabei werden die Nukleonen über ein paramagnetisches Elektronensystem polarisiert, welches durch Dotierung in das Targetmaterial eingebracht wird und bei DNP-typischen Bedingungen von T=1 K und B=2.5 T nahezu vollständig polarisiert ist. In der Beschreibung der DNP durch die Spintemperaturtheorie ist die Breite der Elektronenspinresonanz dieses Systems paramagnetischer Elektronen ein wichtiger Parameter für die Effizienz des Polarisationsübertrags auf die Nukleonen. Ein im Bochumer PT-Labor entwickeltes 70 GHz-ESR-Spektrometer erlaubt erstmalig die präzise Messung der ESR-Linienbreite polarisierbarer Targetmaterialien bei einem DNP-relevanten Feld von 2.5 T und damit die experimentelle Bestätigung des Zusammenhangs zwischen ESR-Linienbreite und Nukleonenpolarisation. Dieser wird am Beispiel von mit verschiedenen Radikalen dotiertem D-Butanol vorgestellt.

HK 29.4 Di 14:45 TU MA042

A new polarized solid state target for double polarization experiments with the COSY-TOF detector. — •Andrea Raccanelli and Hartmut Dutz for the COSY-TOF collaboration — Physikalisches Institut der Universitaet Bonn, Nussallee 12, 53115 Bonn

We present a new scheme for a polarized solid target to be used in double polarization experiments at COSY. We refer in particular to the planned experiment for the determination of the parity of the Θ^+. We analize the constraints and requirements set on a polarized target that is run in frozen spin mode and discuss the possible experimental solutions.

HK 29.5 Di 15:00 TU MA042

Observation and measurement of hydrogen and nitrogen frozen droplets at the ANKE Pellet Target* — •P. Fedorets[1,2], W. Borgs[2], M. Büscher[2], A. Bukharov[3], V. Chernetsky[1], and V. Chernyshev[1] for the ANKE collaboration — [1]ITEP, Moscow, Russia — [2]Forschungszentrum Jülich, Germany — [3]MPEI, Moscow, Russia

Targets of frozen hydrogen and deuterium droplets ("pellets") have been proposed for high luminosity experiments at internal accelerator beams. Such a pellet target is under construction at COSY-Jülich to study meson production in hadronic interactions. The expected luminosities higher than $L = 10^{32}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ will be offer possibility for investigations in the sub-nb range. To produce nuclear micro targets, inside the cryogenic chamber of the target different gases can be liquefied with the help of liquid nitrogen and helium. Liquid jet with diameter down to $\sim 10\,\mu$m is formed inside a triple-point chamber (TPC), where conditions are kept close to the triple point values (T_{tr}=14 K, $p_{\mathrm{tr}}\sim$100 mbar for hydrogen) with an accuracy of better than 0.1 K (and 5% of pressure). The liquid jet is broken into droplets by acoustic excitation. During flight into the accelerator vacuum the droplets freeze and a continuous flow of frozen pellets with diameters down to $\sim 20\,\mu$m is generated. The status of the ANKE pellet target and the results of tests on pellet production with hydrogen and nitrogen will be presented.

*Supported by FZJ, BMBF, DFG, RFFI, FFI, EU.

HK 29.6 Di 15:15 TU MA042

The Polarized Internal Gas Target of ANKE at COSY* — •K. Grigoriev[1], R. Engels[2], A. Gussen[3], P. Jansen[3], H. Kleines[4], F. Klehr[3], P. Kravtsov[1], B. Lorentz[2], M. Mikirtytchiants[1], M. Nekipelov[1], V. Nelyubin[1], H. Paetz gen. Schieck[5], F. Rathmann[2], J. Sarkadi[4], H. Seyfarth[2], E. Steffens[6], H. Stroher[2], V. Trofimov[1], A. Vassiliev[1], and K. Zwoll[4] for the ANKE collaboration — [1]PNPI, Gatchina, Russia — [2]IKP, FZ Jülich — [3]ZAT, FZ Jülich — [4]ZEL, FZ Jülich — [5]IKP, Univ. zu Köln — [6]Phys. Inst. II, Univ. Erlangen-Nürnberg

For future few-nucleon interaction studies with polarized beams and targets at COSY-Jülich, a polarized internal storage cell gas target is currently being developed and will be implemented at ANKE spectrometer in 2005. Laboratory tests with the Atomic Beam Source and cell prototypes have been carried out. The results of these tests using the Lamb-shift polarimeter indicate that the signal from the polarized atoms can be distinguished from the background. Cell tests at ANKE for the determination of the dimensions of the stored COSY beam have been performed as well. In February 2005 first measurements with unpolarized internal storage cell gas target will be performed and results of these tests will be presented.

* Supported by BNBF, COSY-FFE, FZJ.

HK 29.7 Di 15:30 TU MA042

Gold Finger-hydrogen/deuterium target for COSY-TOF experiment — •Salem Abdel-Samad, M. Abdel-Bary, K. Kilian, J. Ritman, and J. Uehlemann for the COSY-TOF, Forschungszentrum Juelich collaboration — Forschungszentrum Juelich, 52425 Juelich

A very small and light liquid hydrogen/deuterium target has been developed for pp and pd interaction studies at COSY. It is very important is to keep the transversal size of the target very small and the heat conductors, mounting elements and thermal isolation as light as possible. The target has a long thin cooling finger, which was first made from copper, then aluminum and finally we now use extremely light heat pipes from thin stainless steel tube, 0.1 mm wall thickness. Isolation against heat radiation was done by very light aluminized Mylar foil (superisolation). In this work, a drastic reduction of the radiation heat load to the cold parts is achieved by coating the target finger and the heat pipe with a thin polished gold layer. Also the radiation heat load is reduced further from 1.4 Watt to 0.6 Watt on the actually used system by using an aluminum heat shield at 50 K around the cold parts at 15 K. This heat load will be reduced further without changing the geometry to less than 0.1 Watt by coating both sides of the aluminum shield with thin gold layer. The new results concerning the reduction of the heat load and the excellent performance during a six weeks beam time will be shown.

HK 29.8 Di 15:45 TU MA042

The Mainz Frozen Spin Target — •Mauricio Martinez — A2 Collaboration. Institut für Kernphysik Mainz

This talk will explain the basics ideas of how a Frozen Spin Target works. The DNP (Dynamical Nuclear Polarization) technique will be shown.

The different parts needed to create a Frozen Spin Target will be presented: A superconducting magnet is used to create a magnetic field of up to 5 Tesla around the target material. The very low temperatures (50 mK) are achieved by a cryostat using He3-He4 mixing. Microwave power is needed to induce the spin flip of the electron and transfer the polarization to the nucleons. An NMR (Nuclear Magnetic Resonance) circuit is used to measure the polarization of the target. The whole system is controlled and monitored using Simatic modules and Step7, ProTool and LabView software.

HK 30 Elektromagnetische und Hadronische Proben

Zeit: Dienstag 16:30–19:00 Raum: TU MA001

Gruppenbericht HK 30.1 Di 16:30 TU MA001

Transversale Spin Physik bei Hermes — •Ulrike Elschenbroich für die Hermes-Kollaboration — Universiteit Gent, Vakgroep Subatomaire en Stralingsfysica, Proeftuinstraat 86, B-9000 Gent

Das Hermes–Experiment am Hera-Elektronenring untersucht die Spinstruktur des Nukleons mit polarisierter tiefinelastischer Elektron–Nukleon–Streuung an einem internen Gastarget. Für eine komplette Beschreibung der Quark–Gluon–Struktur des Nukleons benötigt man drei Quarkverteilungen: die spin–gemittelte (unpolarisierte) $q(x)$, die longitudinal spinabhängige $\Delta q(x)$ und die transversale spinabhängige Quarkverteilung $h_1^q(x)$, auch *transversity* genannt. Da letztere ein chiral ungerades Objekt ist, kann sie nicht in inklusiver aber beispielsweise in semi–inklusiver tief inelastischer Streuung (SIDIS) in Verbindung mit einer chiral ungeraden Fragmentationsfunktion, der sogenannten *Collins* Funktion $H_1^{\perp q}(z)$, gemessen werden. Diese Verbindung verursacht eine

sinusoidale Abhängingkeit vom azimutalen Winkel des produzierten Hadrons.

Der gleiche Wirkungsquerschnitt beinhaltet zusätzlich die Kombination der bekannten unpolarisierten Fragmentationsfunktion $D^q(z)$ und einer weiteren Quarkverteilung $f_{1T}^{\perp q}(x)$ (*Sivers* Funktion), die eine andere Sinus–Modulation zur Folge hat. Eine Sivers Funktion, die von Null verschieden ist, deutet auf einen vorhandenen Drehimpuls der Quarks im Nukleon hin.

Aktuelle Ergebnisse des HERMES–Experiments und von Monte–Carlo Studien werden präsentiert.

HK 30.2 Di 17:00 TU MA001

First measurements of Collins and Sivers asymmetries at COMPASS — •RICHARD WEBB for the COMPASS collaboration — Physikalisches Institut, Friedrich-Alexander-Universität Erlangen-Nürnberg

The cross-section for deep inelastic lepton scattering off spin 1/2 hadrons is parametrised in leading order in terms of three quark distribution functions: the unpolarised distribution q(x), the longitudinally polarised distribution $\Delta q(x)$ and the so-called transversity distribution $\Delta_T q(x)$. This last function is chiral-odd and so can only be measured incombination with a chiral-odd fragmentation function such as the Collins function $H_1^\perp(z)$, requiring the detection of part of the hadronic endproduct (semi-inclusive measurement). An asymmetry is expected in the azimuthal production angle of the hadron in the scattering process which should depend on the Collins angle $\Phi_C = \Phi_h - \Phi'_s$, where Φ'_s is the spin angle of the fragmenting quark. The deep-inelastic cross-section also contains the product of the unpolarised fragmentation function $D_q(z)$ and the Sivers distibution function $f_{1T}(x)$. Here the dependency of the expected asymmetry is on the Sivers angle $\Phi_S = \Phi_h - \Phi_s$, Φ_s being the angle of the quark spin in the initial state. COMPASS is a fixed target experiment on the SPS M2 beamline at CERN. Its ^{6}LiD target can be polarised both longitudinally and transversally with respect to the polarised 160GeV/c μ^+ beam. Approximately 20% of the beam-time is spent in the transverse configuration. Results of the analysis of the Collins and Sivers asymmetries on the basis of the first COMPASS data will be reported here. This work is supported by the BMBF.

HK 30.3 Di 17:15 TU MA001

Sivers effect in semi-inclusive DIS and the Drell-Yan process — •SIMONE MENZEL[1], A.V. EFREMOV[2], K. GOEKE[1], A. METZ[1], and P. SCHWEITZER[1] — [1]Institut für Theor. Physik II, Uni Bochum — [2]Dubna, JINR, Russland

The Sivers parton distribution describes an azimuthal asymmetry of unpolarized quarks in a transversely polarized target. For quite some time this time-reversal odd function was considered to be zero, and only recently it was proved that it may well exist [1, 2]. In ref.[2] it was predicted that the Sivers function in semi-inclusive DIS and Drell-Yan should have opposite signs. An experimental check of this prediction is still missing. The Sivers asymmetry was measured recently in semi-inclusive DIS by the HERMES collaboration[3]. We use these data to fit the Sivers function and present our results. On this basis we make predictions for the Sivers asymmetry in the Drell-Yan process, which can be measured in the future at the GSI and at COMPASS/CERN via the transverse single spin asymmetries $p^\uparrow + \bar{p} \to l + \bar{l} + X$ and $p^\uparrow + \pi^- \to l + \bar{l} + X$, respectively.

[1] S.J.Brodsky, D.S.Hwang, I.Schmidt, Phys. Lett. **B 530**, 99 (2002)
[2] J.Collins, Phys. Lett. **B 536**, 43 (2002)
[3] HERMES, hep-ex/0408013

HK 30.4 Di 17:30 TU MA001

Tranversity signals in two pion correlation at COMPASS — •RAINER JOOSTEN for the COMPASS collaboration — Helmholtz Institut für Strahlen- und Kernphysik,Rheinische Friedrich-Wilhelms-Universität Bonn

The cross-section for deep inelastic scattering off spin 1/2 hadrons can be parametrised in leading order in terms of three quark distribution functions: the helicity averaged distribution q(x), the longitudinal helicity distribution Δq(x) and the transverse spin distribution Δ_Tq(x). This last distribution function, referred to as transversity, is chiral-odd and can only be measured in combination with a chiral-odd function. So far, attempts were made to measure Δ_Tq(x) in combination with the Collins fragmentation-function $H_1^\perp(z)$, requiring the partial detection of the hadronic products (semi-inclusive measurement). Another probe is the measurement of two hadron production introducing the chiral odd interference fragmentation function $H_1^\sphericalangle(z)$. An asymmetry is expected in the azimuthal angle of the hadron plane which should depend on $\varphi_R + \varphi_S$, where φ_S is the angle of the initial quark spin and φ_R the angle of the hadron plane in the lepton scattering plane. Some models even expect an interference term in the region of the ρ-mass. COMPASS is a fixed target experiment on the SPS M2 beamline at CERN. Its ^{6}LiD target can be polarised both longitudinally and transversally with respect to the polarised 160 GeV/c μ^+ beam. 20% of the beam-time is spent in the transverse configuration, allowing the measurement of transversity effects. First results of the analysis of two hadron production will be reported. This work is supported by the BMBF.

HK 30.5 Di 17:45 TU MA001

The Cahn-Effect at COMPASS — •ERIC WEISE, H. FISCHER, J. FRANZ, S. HEDICKE, F.H. HEINSIUS, M. VON HODENBERG, D. KANG, K. KÖNIGSMANN, D. MATTHIÄ, C. SCHILL, D. SETTER, and S. TRIPPEL for the COMPASS collaboration — Physikalisches Institut, Universität Freiburg, Germany

COMPASS is a fixed target experiment at CERN studying nucleon spin structure in polarised deep inelastic muon nucleon scattering and investigating hadron spectroscopy using hadron beams. One of the goals of COMPASS is to analyse the transverse momenta of the quarks in the nucleon. In semi inclusive deep inelastic scattering these intrinsic transverse momenta of the quarks generate an asymmetry in the azimuthal angle ϕ of the hadron, to which the struck quark fragments. This angle is measured with respect to the direction of the virtual photon and the lepton-scattering plane. The asymmetry causes $\cos n\phi$-modulations in the count rates, which has been predicted by Cahn in 1987. The status of the analysis on this subject will be presented. This work is supported by the BMBF.

HK 30.6 Di 18:00 TU MA001

Longitudinal Λ polarization in the COMPASS experiment — •DONGHEE KANG, H. FISCHER, J. FRANZ, S. HEDICKE, F.H. HEINSIUS, M. VON HODENBERG, K. KÖNIGSMANN, D. MATTHIÄ, C. SCHILL, D. SETTER, and S. TRIPPEL for the COMPASS collaboration — Physikalisches Institut, Universität Freiburg

At the COMPASS experiment at CERN Λ and $\bar{\Lambda}$ particles are produced in the deep inelastic scattering process with high statistics. The main focus of the research is the understanding of the longitudinal Λ and $\bar{\Lambda}$ polarization and the spin transfer mechanism through fragmentation processes. The Λ and $\bar{\Lambda}$ polarization can be studied by measuring the acceptance corrected angular distribution of its decay products. The results of the longitudinal polarization and spin transfer will be compared and discussed with further measurements. The project is supported by BMBF.

HK 30.7 Di 18:15 TU MA001

Measurement of Transverse Lambda Polarization at COMPASS — •B. GRUBE, M. BECKER, R. DE MASI, J.M. FRIEDRICH, A.-M. DINKELBACH, S. GERASSIMOV, B. KETZER, I. KONOROV, R. KUHN, T. NAGEL, S. PAUL, L. SCHMITT, Q. WEITZEL, and M. WIESMANN for the COMPASS collaboration — TU München, Physik Department E18

COMPASS has made a first analysis of the transverse Lambda polarization in quasi-real photo-production ($Q^2 < 0.5$ (GeV/c)^2) using a 160 GeV/c muon beam from the CERN SPS.

The transverse polarization with respect to the production plane was measured using the self-analyzing weak decay of the Λ and $\bar{\Lambda}$. We have evaluated the polarization in different kinematic regions using the variables x_F and p_T. Systematic effects were reduced by utilizing the bias-canceling method.

This work is supported by the BMBF and the Maier-Leibnitz-Labor, Garching.

HK 30.8 Di 18:30 TU MA001

Bestimmung der Pion-Polarisierbarkeiten im COMPASS-Experiment * — •ANNA-MARIA DINKELBACH, MATTHIAS BECKER, RITA DE MASI, JAN FRIEDRICH, SERGEI GERASSIMOV, BORIS GRUBE, BERNHARD KETZER, IGOR KONOROV, ROLAND KUHN, STEPHAN PAUL, LARS SCHMITT und QUIRIN WEITZEL — TU-München, Physik Department E18

Das COMPASS Experiment (CERN NA58) hat in einer dreiwöchigen Pilotstrahlzeit Ende 2004 mit einem 190 GeV Hadronstrahl weiche Reaktionen untersucht. Bei der Streuung von Pionen und Kaonen im Coulombfeld von Bleikernen werden die Primakoff-Reaktionen beobachtet.

Im Falle der Produktion eines reellen Photons, welches Comptonstreuung in inverser Kinematik entspricht, hat man hier Zugang zu den elektromagnetischen Polarisierbarkeiten der Strahlteilchen. Wir präsentieren den Messaufbau sowie den Status der laufenden Analyse.

*Diese Arbeit wird unterstützt vom BMBF and dem Maier-Leibnitz-Labor, Garching.

HK 30.9 Di 18:45 TU MA001

Improved radiative corrections for $(e, e'p)$ experiments — •Florian Weissbach, Kai Hencken, Daniela Rohe, Ingo Sick, and Dirk Trautmann — Departement für Physik und Astronomie, Universität Basel, CH – 4056 Basel, Switzerland

$(e, e'p)$ experiments are well-suited to study nuclear structure. However, these experiments are subject to radiative corrections which have to be carefully considered in oder to reach the desired accuracy. Up to now radiative corrections for $(e, e'p)$ experiments have always been approached using the so called 'peaking approximation' which assumes that all the bremsstrahlung is aligned with the particle momenta. We show that this assumption is not applicable to radiation coming from the scattered proton, and that this approach generally underestimates unpeaked bremsstrahlung contributions. We remove the peaking approximation with the effect that we can describe the reconstructed bremsstrahlung photon angular distribution much better than the peaking approximation. This check is done against data from the Thomas Jefferson National Accelerator Facility (TJNAF). Also we gain some insight in the limits of the 'soft photon approximation' which underlies most calculations of radiative corrections.

HK 31 Elektromagnetische und Hadronische Proben

Zeit: Dienstag 16:30–19:00 Raum: TU MA004

HK 31.1 Di 16:30 TU MA004

Total cross section of the $\pi^- p \to \pi^0 n$ charge exchange reaction — •J. Breitschopf[1], M. Bauer[1], H. Clement[1], M. Cröni[1], H. Denz[1], E. Friedman[2], E. Gibson[3], P. Jesinger[1], R. Meier[1], and G. J. Wagner[1] — [1]Physikalisches Institut, Universität Tübingen — [2]Racah Institute of Physics, The Hebrew University, Jerusalem, Israel — [3]California State University, Sacramento, USA

The origin of isospin violation in the strong interaction is the mass difference of the up- and down-quarks. Pion-nucleon elastic scattering and single charge exchange (SCX) offers access to the amount of isospin breaking. Recent analyses of existing data have found unexpectedly large (7%) violations for pion energies around 50 MeV. However, these analyses are probably affected by the limited SCX data base.
Therefore, we have measured total $\pi^- p \to \pi^0 n$ cross sections at PSI in the energy range between 30 and 250 MeV with an accuracy of about 2%. We used a 4π scintillator box to measure the transmission of negatively charged pions through accurately manufactured CH_2 and C targets of about 4 mm thickness. The difference of the transmissions corresponds to reactions on hydrogen with outgoing neutral particles and yields the SCX cross sections. Non-vanishing detector sensitivities for photons and neutrons, effects of detector geometry, radiative pion capture pion decay *etc* lead to corrections of up to 8%. These were determined by extensive Monte Carlo simulations. Data were recorded event by event yielding about 2.5 TB of data. Experiment, data analysis and results will be presented and discussed.
This work is supported by BMBF (06TU201)and DFG (GRK683).

HK 31.2 Di 16:45 TU MA004

In Search of the Nature of the $\gamma\gamma$ Line at $2m_\pi$ in $pp \to pp\gamma\gamma$ and its relation to $\pi\pi$ Production * — •M. Bashkanov, H. Clement, E. Doroshkevich, M. Kaskulov, O. Khakimova, F. Kren, R. Meier, T. Skorodko, and G. J. Wagner for the CELSIUS-WASA collaboration — Physikalisches Institut, Universität Tübingen

At CELSIUS-WASA pp collisions with the emission of $\gamma\gamma$, π, $\pi\pi$, η have been measured exclusively with 4 to 6 overconstraints. In the $M_{\gamma\gamma}$ spectrum a small, narrow line has been observed at $M_{\gamma\gamma} = 2m_\pi$. In search of the nature of this line we have investigated a variety of scenarios. Aside from the possibility that this line is real, the only realistic alternative is a scenario, where γs originating from $\pi^0\pi^0$ production merge into common γ clusters. This merger scenario is only effective if the $\pi^0 s$ move parallel, i.e., $M_{\pi^0\pi^0} \approx 2m_{\pi^0}$. A peculiar enhancement is indeed observed in $M_{\pi^0\pi^0}$ right at threshold. However, reconstruction of the $\pi^0\pi^0$ parent spectrum by MC simulations in the merger scenario leads to the postulate of a threshold enhancement in $M_{\pi^0\pi^0}$, which is an order of magnitude larger than the actual observed one. In order to shed more light onto this problem we have investigated $pd \to {}^3He\pi\pi$ along with its $\gamma\gamma$ channel. In $M_{\pi^0\pi^0}$ we again find a threshold enhancement, which is even much larger than in pp collisions. Since in all cases the $M_{\pi^+\pi^-}$ spectra behave normal, these observations indicate a strong isospin breaking between $\pi^0\pi^0$ and $\pi^+\pi^-$ thresholds. We investigate the possibility that both observations in $M_{\pi^0\pi^0}$ and $M_{\gamma\gamma}$ are related by a dynamic σ.
* supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg) and Landesforschungsschwerpunkt (Quasiteilchen)

HK 31.3 Di 17:00 TU MA004

Two-Pion Production and the Question of Isospin Breaking and/or Bose-Einstein correlations* — •T. Skorodko, M. Bashkanov, H. Clement, E. Doroshkevich, M. Kaskulov, O. Khakimova, F. Kren, R. Meier, and G. J. Wagner for the CELSIUS-WASA collaboration — Physikalisches Institut, Universität Tübingen

The $\pi\pi$ production in pp collisions has been measured at CELSIUS in the energy range $T_p = 775 - 1360$ MeV exclusively using the WASA 4π detector with hydrogen pellet target. At energies close to threshold the data on the $pp\pi^+\pi^-$ channel can be well described by either the Roper resonance concept or a dynamic formation of the σ meson. At higher energy the formation of the $\Delta\Delta$ system becomes increasingly dominant. In particular the data are consistent with the special configuration $(\Delta\Delta)_{0^+}$. The $pp\pi^0\pi^0$ channel basically shows a very similar behavior as expected from isospin invariance. However, $M_{\pi^0\pi^0}$ shows systematically an enhancement at small invariant masses. The deduced correlation function resembles very much that for Bose-Einstein correlations (BEC). two Alternatively the observed enhancements could be indicative of a (dynamic) isospin breaking possibly due to $\pi\pi$ rescattering in the σ channel. In order to discriminate both scenarios we have investigated also $pd \to {}^3He\pi\pi$. In contrast to $M_{\pi^+\pi^-}$, $M_{\pi^0\pi^0}$ exhibits again a strong enhancement at low masses, this time even substantially larger than 2, the BEC limit, favoring thus an isospin breaking scenario for the observed effects.
* supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg), and Landesforschungsschwerpunkt (Quasiteilchen)

HK 31.4 Di 17:15 TU MA004

Kommentare über die Isospinsymmetrie — •Hartmut Machner — Institut für Kernphysik, FZ Jülich

Der Isospin ist in Kernen nur eine ungefähre Symmetrie. Im Gegensatz dazu ist er in der Teilchenphysik eine nahezu erhaltene Symmetrie. Symmetriebrechung erfolgt durch die Coulomb-Kraft und den Massenunterschied zwischen den up- und down-Quarks. Der erste Grund ist dominant in Kernen. Der zweite Grund eröffnet die Möglichkeit den Massenunterschied zu messen. Eine Möglichkeit ist nach Isospin-Verletzungen in Reaktionen zu suchen. Wir diskutieren die Observablen am Beispiel von π^0- und π^+-Produktion in Nukleon-Nukleon- und Nukleon-Deuteron-Wechselwirkungen.

HK 31.5 Di 17:30 TU MA004

Study of the deuteron breakup $pd \to (pp)n$ at high momentum transfer at ANKE/COSY* — •Sergey Yaschenko for the ANKE collaboration — Universität Erlangen–Nürnberg, Germany

The deuteron–breakup reaction $pd \to ppn$ at GeV projectile energies with emission of a fast forward diproton provides a new tool to investigate the pd dynamics at high–momentum transfer. The ANKE spectrometer at COSY–Jülich is well suited to obtain new data, e.g. the cross section and polarization observables in the $\vec{p}\vec{d} \to (pp)n$ reaction, which should allow one to gain more insight into systems composed of more than two nucleons.

Recently, measurements of the unpolarized differential cross section at energies $T_p = 0.6$, 0.7, 0.8, 0.95, 1.35, and 1.9 GeV and the vector analyzing power A_y at $T_p = 0.5$ and 0.8 GeV in the deuteron breakup were carried out. The results were compared with calculations based on a

theoretical model taking into account one–nucleon exchange, single scattering, and Δ excitation in the intermediate state. Employing the high precision CD–Bonn potential this model describes fairly well the energy dependence of the unpolarized cross section and the analyzing power at 0.8 GeV, it fails to reproduce A_y at 0.5 GeV.

At present, data with high statistics at T_p = 0.5, 0.8, 1.1, 1.4, and 2.0 GeV are being analyzed. The current status of the data analysis, preliminary results on differential cross sections in comparison with theoretical predictions and the plans for future measurements are presented.

* supported by FZ–Jülich, BMBF, WTZ.

HK 31.6 Di 17:45 TU MA004

Investigation of the $a_0(980)/f_0(980)$-resonances with ANKE at COSY* — •Alexey Dzyuba[1], Markus Büscher[2], Vera Kleber[3], and Vladimir Koptev[1] for the ANKE collaboration — [1]Petersburg Nuclear Physics Institut, Gatchina, Russia — [2]Institut für Kernphysik, Forschungszentrum Jülich — [3]Institut für Kernphysik, Universität zu Köln

The production of the lightest scalar resonances $a_0(980)$ and $f_0(980)$ in hadronic interaction is being investigated with the ANKE spectrometer, where their decays into $K\bar{K}$ can be observed. Final goal of these studies, which will be later supplemented by measurements of the non-strange decays with the WASA detector, is to learn about the nature of these states, about isospin violating processes in the a_0/f_0 system, FSI effects between antikaons and light nuclei. In this talk results of the data analysis for the reaction $pp \to da_0^+ \to dK^+\bar{K}^0$ measured at a beam energy T_p = 2.83 GeV will be presented. Total cross-sections, invariant-mass and angular distributions will be shown and compared with theoretical predictions. Preliminary results from our beam times aiming at a_0/f_0 production in the reactions $pn \to da_0^0/f_0 \to dK^+K^-$ and $dd \to \alpha f_0 \to \alpha K^+K^-$ will also be discussed. * supported by FZJ, DFG, BMBF, RFFI

HK 31.7 Di 18:00 TU MA004

Exclusive Measurements of the $\vec{p}p \to pp\pi^+\pi^-$ Reaction at COSY-TOF* — •A. Erhardt, K. Ehrhardt, K. Haug, H. Clement, E. Doroshkevich, and G. J. Wagner for the COSY-TOF collaboration — Physikalisches Institut, Universität Tübingen

By use of the COSY vector polarized proton beam the $\vec{p}p \to pp\pi^+\pi^-$ reaction has been measured at COSY-TOF at two different energies, T_p = 750 and 800 MeV, i.e. close to threshold. Time-of-flight information and track reconstruction has been obtained by use of the informations supplied by start, fiber, quirl and ring hodoscopes, whereas particle identification and energy information has been provided by the central calorimeter. In addition, the delayed pulse technique has been utilized for a positive identification of π^+ particles. The dominant part of the extracted data samples consists of completely measured four-prong events, i.e. exclusively measured events with four overconstraints each. The resulting differential spectra for invariant masses, angular distributions and analyzing powers will be presented and discussed with respect to σ meson production and/or Roper excitation and their decay. * supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg), FZ Jülich (FFE) and Landesforschungsschwerpunkt (Quasiteilchen)

HK 31.8 Di 18:15 TU MA004

Deuteron Polarimetry at ANKE-COSY — •D. Chiladze[1,2], A. Kacharava[3,2], F. Rathmann[1], and C. Wilkin[4] for the ANKE collaboration — [1]IKP, FZJ, Germany — [2]HEPI TSU, Tbilisi, Georgia — [3]PI II, Universität Erlangen-Nürnberg, Germany — [4]UCL, London, England

Nuclear reactions induced by beams of 1.2 GeV vector and tensor polarised deuterons incident on a hydrogen cluster target have been studied in a test experiment at the ANKE magnetic spectrometer situated inside the storage ring COSY-Jülich. By measuring precisely the momenta of one or two charged final particles, it was possible to identify clearly the processes $\vec{d}p \to dp$, $\vec{d}p \to dp_{sp}\pi^0$ (with a spectator proton p_{sp}), $\vec{d}p \to {}^3\mathrm{He}\,\pi^0$, and $\vec{d}p \to (2p)n$, which all have large and well determined analyzing powers. The analysis of these data, which allowed us to extract values of the vector and tensor polarisations of the beam, will be presented. The aim of our experimental programme is the direct reconstruction of the spin-dependent amplitudes, including relative phases, of large angle neutron-proton elastic scattering through the study of the $\vec{p}(\vec{d},2p)n$ charge-exchange reaction. This work is supported by the FZJ.

HK 31.9 Di 18:30 TU MA004

Experimental search for Kaonic Nuclear Clusters in p+d @Tp=4.5GeV reaction at FOPI/GSI — •Ken Suzuki[1], Laura Fabbietti[1], Norbert Herrmann[2], Paul Kienle[1,3], Toshimitsu Yamazaki[4], and Johann Zmeskal[3] for the FOPI Collaboration collaboration — [1]Physik Department E12, TU-München — [2]GSI — [3]Stefan Meyer Institut of the Austrian Academy of Sciences — [4]RIKEN

Recently, strongly bound $\bar{K}$ nuclear systems have been predicted, which are shown to have large binding energies about 100 MeV for single-$\bar{K}$ systems and 200 MeV for double- $\bar{K}$ systems, and consequently they have large nucleon densities. Such systems will open a new paradigm for studying unusual quark-gluon structure in dense, cold and microscopic nuclear systems, in context to chiral symmetry restoration, hadron masses, kaon condensation and strange matter. We present here an experimental program and simulation results to search for the most elementary $\bar{K}$ cluster system, ppK$^-$, in a p+d @ Tp=4.5GeV reaction with the FOPI apparatus at GSI, which will take place in the middle of next year. This work is supported by GSI.

HK 31.10 Di 18:45 TU MA004

Produktion von e^+e^--Paaren in pp und pd Reaktionen* — •B. Sailer[1], T. Eberl[1], L. Fabbietti[1], J. Friese[1], I. Fröhlich[2], J. Pietraszko[3], W. Przygoda[4] und S. Spataro[5] für die HADES-Kollaboration — [1]Technische Universität München, Physikdepartment E12 — [2]Justus Liebig Universität Giessen, II. Physikalisches Institut — [3]Gesellschaft für Schwerionenforschung mbH, Darmstadt — [4]Jagiellonian University, Cracow — [5]INFN Laboratori Nazionali del Sud, Catania

Mit dem HADES Detektorsystem wird bei der GSI (Darmstadt) die e^+e^--Paarproduktion im invarianten Massenbereich bis 1.2 GeV/c^2 sowohl in Schwerionenstößen als auch in elementaren Reaktionen untersucht. Die Wirkungsquerschnitte für Mesonen- und Resonanzproduktion in p-induzierten Reaktionen am Nukleon sind z.T. sehr gut bekannt. Die Messung ihrer e^+e^--Zerfälle dient daher sowohl zur Bestimmung der Gesamteffizienz von Detektorsystem und Analysesoftware als auch zum systematischen Vergleich mit Resultaten aus $p+A$ und $A+A$ Reaktionen. Zur Vorbereitung geplanter und Interpretation bereits durchgeführter Messungen mit HADES haben wir ausführliche Simulationen der e^+e^--Produktion für $p+p$ und $p+d$ im Energiebereich zwischen $E = 1.25 - 3.5$ GeV durchgeführt. Wir berichten Ergebnisse für verschiedene Ereignisgeneratoren (BUU, PLUTO++) und vollständiger Nachbildung des Detektorsystems (GEANT). Wir vergleichen dies mit den Ergebnissen erster Experimente. * gefördert durch BMBF (06MT190) und GSI (TM-KR2).

HK 32 Kernphysik/Spektroskopie

Zeit: Dienstag 16:30–19:00 Raum: TU MA005

Gruppenbericht

HK 32.1 Di 16:30 TU MA005

ATRAP - on the way to trapped Antihydrogen — •Dieter Grzonka for the ATRAP collaboration — Institut für Kernphysik, Forschungszentrum Jülich, 52425Jülich, Germany

The ATRAP experiment at the CERN antiproton decelerator AD aims for a test of the CPT invariance by a comparison of the hydrogen to antihydrogen atom spectroscopy. The antihydrogen production is routinely operated at ATRAP [1] in a nested Penning trap configuration, a stack of ring electrodes capturing the charged particles in axial direction within a uniform magnetic solenoid field for the radial confinement. Detailed studies have been performed in order to improve the production efficiency of useful antihydrogen. High precision measurements of atomic transitions requires trapped cold antihydrogen in the ground state. The trapping of neutral antihydrogen atoms should work via the force on the magnetic moment in a magnetic field gradient. To ensure a high antihydrogen trapping efficiency a magnetic trap has to be superimposed on the nested Penning trap. A basic question in such a configuration is the possibility to keep the antiproton and positron clouds in the stabilizing solenoid field which is strongly distorted by the field of the magnetic trap.

Studies on the antihydrogen production and first trapping tests of charged particles within a combined magnetic/Penning trap will be presented.

* Supported by FZ-Jülich and BMBF.

[1] G. Gabrielse et al., PRL 89, 213401 (2002), PRL 89, 233401 (2002), PRL 93, 073401 (2004), P. Oxley et al., Phys. Lett. B595, 60 (2004).

Gruppenbericht

HK 32.2 Di 17:00 TU MA005

Recent mass measurements with ISOLTRAP — •Alexander Herlert for the ISOLTRAP collaboration — Institut für Physik, Ernst-Moritz-Arndt-Universität Greifswald, 17487 Greifswald, Germany — CERN, Physics Department, 1211 Geneva 23, Switzerland

The Penning trap mass spectrometer ISOLTRAP at ISOLDE/CERN is devoted to accurate mass measurements of short-lived nuclides. Recent mass measurements with a relative mass uncertainty of only 1×10^{-8} provide new data for tests of nuclear and astrophysical models as well as new input for fundamental tests of the weak interaction. Examples are the mass determination of ^{22}Mg, where the comparative half-life of the superallowed beta decay has been obtained for a further test of the conserved-vector-current hypothesis and the unitarity of the Cabibbo-Kobayashi-Maskawa matrix [1], and the mass measurement of ^{35}K, which allows a stringent test of the quadratic form of the isobaric multiplet mass equation for isospin quartets.

In addition to the mass measurements a new experimental technique has been tested, where for the first time the daughter ion of a beta-decaying nuclide was stored after the decay in a Penning trap and investigated for mass determination. This in-trap decay mass spectrometry as demonstrated for $^{37}\mathrm{K} \rightarrow {}^{37}\mathrm{Ar}$ offers a new approach to obtain nuclides that are not delivered from a radioactive ion-beam facility. A summary of all recent mass measurements as well as the status of ISOLTRAP will be presented.

[1] M. Mukherjee et al., Phys Rev. Lett. 93, 150801 (2004)

HK 32.3 Di 17:30 TU MA005

Proton Induced Fragmentation of Ni, Nb, and Au Nuclei — •Borys Piskor-Ignatowicz for the PISA collaboration — Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany — M. Smoluchowski Institute of Physics, Jagellonian University, Reymonta 4, 30059 Kraków, Poland

The double differential cross sections $d\sigma/dEd\Omega$ for proton induced fragmentation of Ni, Nb, and Au nuclei have been measured by the PISA (Proton Induced SpAllation) collaboration. Thin ($\sim$ 300 μg/cm^2), self-supporting targets have been irradiated by 1.2, 1.9 and 2.5 GeV internal proton beam of the COSY accelerator of the Forschungszentrum Jülich. Reaction products were registered by Bragg curve detectors, cooled silicon detectors and phoswich detectors. The apparatus enabled to identify the charge and mass of light charged particles (H and He ions) as well as intermediate mass fragments up to Z=6. Heavier ejectiles (with Z $<$ 14) were only Z - identified. Preliminary analysis of the data shows that two contributions can be observed for all scattering angles and all observed reaction products: one of them seems to correspond to evaporation of particles from excited remnant nucleus of the fast intranuclear cascade of nucleon-nucleon collisions whereas another one is connected with isotropic emission of fragments from the fast, hot source which is significantly smaller than the target nucleus. The latter mechanism becomes increasingly more important for heavier reaction products. The quantitative analysis of the data is expected to give more detailed information on the reaction mechanism, especially as a function of the target mass and incident proton energy.

HK 32.4 Di 17:45 TU MA005

Binary fission-fragment yields from the reaction 251Cf(nth, f) — •S. Oberstedt[1], E. Birgersson[1,2], A. Oberstedt[2], F.-J Hambsch[1], D. Rochman[3], and I. Tsekhanovitsch[4] — [1]EC-JRC Institute for Reference Materials and Measurements, B-2440 Geel — [2]Dept. of Natural Sciences, Örebro University, SE-70182 Örebro — [3]Los Alamos National Laboratory, Los Alamos, New Mexico 87545 — [4]Institut Laue-Langevin, F-38042 Grenoble Cedex

The interpretation of fission-fragment properties in terms of so-called fission modes has been successfully applied to describe mass yield and total kinetic energy distributions as a function of incident neutron energy. There, the asymmetric standard I (S1) and standard II (S2) modes as well as the symmetric superlong (SL) mode have been used. In the case of spontaneous fission of 252Cf the number of traditional fission modes is not sufficient to properly describe the experimental fission-fragment distributions. Additional theoretically obtained fission modes have to be included into the analysis to improve the description of the data. In order to achieve experimental confirmation of the number of fission modes, neutron-induced fission of 252Cf*, using 251Cf as target material, has been investigated at thermal excitation, using the recoil mass-separator LOHENGRIN of the ILL, Grenoble. Light post-neutron fission-fragment kinetic energy distributions were measured for A = 80 to 124 for the first time ever, and relative emission yields together with mean kinetic energies as a function of A have been determined. Data analysis and final experimental results will be presented.

HK 32.5 Di 18:00 TU MA005

New results on the neutron-induced fission cross-section of 231Pa — •A. Oberstedt[1], S. Oberstedt[2], F.-J. Hambsch[2], V. Fritsch[2], G. Vladuca[3], and A. Tudora[3] — [1]Dept. of Natural Sciences, Örebro University, SE-70182 Örebro — [2]EC-JRC Institute for Reference Materials and Measurements, B-2440 Geel — [3]Faculty of Physics, Bucharest University, RO-76900 Bucharest

Our studies of neutron-induced reactions for advanced nuclear applications have recently been extended to the nuclide 231Pa. In accordance with the heavier isotope 233Pa, which we reported about previously, 231Pa is supposed to play an important role for future reactors involving the thorium-uranium fuel cycle. Thus, 231Pa belongs to the isotopes that were pointed out by the IAEA to be investigated with highest priority. Although the neutron-induced fission cross-section has been measured before, the compiled experimental results as well as data in existing evaluated data files exhibit quite some differences. For this reason we have performed new experiments with a quasi mono-energetic neutron beam, provided by the Van de Graaff accelerator at IRMM. The first results, covering the neutron energy range from 0.8 to 3.5 MeV, will be presented.

HK 32.6 Di 18:15 TU MA005

Bremsstrahlung emission in the α decay of ^{210}Po — •Hans Boie, Vinzenz Bildstein, Frank Köck, Martin Lauer, Oliver Niedermaier, Heiko Scheit, and Dirk Schwalm — MPI für Kernphysik, Heidelberg

The emission of bremsstrahlung in the α decay of a nucleus has attracted strong theoretical interest recently (e.g. [1,2]). The emission of bremsstrahlung is usually well described by a semi-classical treatment. However, in an α decay the α particle is tunneling through the Coulomb barrier of the nucleus, a process which can only be understood quantum-mechanically. The proposed semi-classical and quantum-mechanical models differ considerably, but, due to poor statistics, the data available so far [3] do not allow to distinguish between these models.

Therefore, a new experiment has been conceived at the MPI-K Heidelberg, measuring the emission probability of bremsstahlung in the α decay of ^{210}Po [4]. For the production run two new α sources with improved energy resolution were used. After about 280 days of data taking the experiment has now been completed. The experimental setup, the status of the analysis and preliminary results will be presented.

[1] T. Papenbrock and G. F. Bertsch, Phys. Rev. Lett. **80**, 4141 (1998).
[2] M.I. Dyakonov, Phys. Rev. C **60**, 037602-1 (1999).
[3] J. Kasagi et. al., Phys. Rev. Lett. **79**, 371 (1997).
[4] H. Boie et. al., DPG Frühjahrstagung 2002, Vortrag HK 45.6

HK 32.7 Di 18:30 TU MA005

Bimodality and charge (mass) splitting in fission of actinides — •A.V. Andreev[1,2], G.G. Adamian[2,3], N.V. Antonenko[1,2], S.P. Ivanova[2], and W. Scheid[1] — [1]Institut für Theoretische Physik der Universität Giessen — [2]Joint Institut for Nuclear Research, Dubna, Russia — [3]Institute of Nuclear Physics, Tashkent, Uzbekistan

Fission of actinides is described within the scission-point model. Scission configurations are interpreted as dinuclear systems (DNS). The potential energy surfaces of scission configurations are analyzed as functions of deformations of the DNS fragments by considering mass and charge asymmetries as independent variables. It is demonstrated that bimodality in fission of actinides at fixed mass splitting is related to different charge splittings. Experiments are suggested to prove this interpretation of bimodality.

HK 32.8 Di 18:45 TU MA005

Mass Measurements of Radionuclides around the Proton Shell Closure $Z = 82$ — •C. Weber[1,2], G. Audi[3], D. Beck[1], K. Blaum[1,2], G. Bollen[4], F. Herfurth[1], H.-J. Kluge[1], D. Lunney[3], and S. Schwarz[4] for the ISOLTRAP collaboration — [1]GSI, D - 64291 Darmstadt — [2]University of Mainz, D - 55099 Mainz — [3]CSNSM, F - 91405 Orsay — [4]NSCL, Michigan State University, USA

The Penning trap mass spectrometer ISOLTRAP allows for the precise mass determination of exotic nuclides far from stability with uncertainties $\delta m/m$ of about 10^{-8}. The mass of an ion stored in a strong magnetic field is determined by a measurement of its cyclotron frequency. In this contribution recent results from mass measurements of heavy radionuclides around the proton shell closure $Z = 82$ are presented. Since the mass represents one of the most basic nuclear properties, precise systematic studies allow to conclude on the resulting size and shape of a given nuclide, as it manifests itself *e.g.* in the appearance of shape coexistence. With the advent of high-precision mass measurements using the ISOLTRAP spectrometer, in some cases requiring isomeric resolution, it is possible to see a structure in the neutron pairing energy and to examine the relationship between masses and radii for correlations.

HK 33 Kernphysik/Spektroskopie

Zeit: Dienstag 16:30–18:45 Raum: TU MA041

Gruppenbericht HK 33.1 Di 16:30 TU MA041

Electromagnetic Strength in Single-Particle Halo Nuclei — •Stefan Typel[1] and Gerhard Baur[2] — [1]GSI Darmstadt — [2]Forschungszentrum Jülich

Nuclei close to the driplines often exhibit a pronounced nucleon+core structure that is well described by single-particle models. For low orbital angular momenta of the lowest bound valence nucleon an extended density distribution, a halo, develops resulting in a large size of the nucleus. Light exotic nuclei were studied extensively in recent years by electromagnetic excitation and a large transition strength was observed at low energies in the continuum that shows universal features when plotted in the appropriately scaled variables. The relevant matrix elements are essentially determined by the asymptotics of the wave functions and simple scaling laws apply for the transition strength [1]. Effects of the interaction in the continumm are conveniently described by the effective-range expansion since details of the interaction are not resolved at the relevant low energies. This is in the spirit of effective field theoretical approaches to halo nuclei. We introduce appropriate dimensionless scaling parameters and find explicit analytical scaling laws for several quantities like radii, probabilities, strength functions and corresponding sum rules. Electromagnetic strength functions are parametrized in terms of the separation energy of the halo nucleon, the asymptotic normalization coefficient of the bound state and the scattering length. A typical example is the neutron halo nucleus ^{11}Be [1]. The present approach provides a framework for future studies of heavier halo nuclei.

[1] S. Typel and G. Baur, Phys. Rev. Lett. 93, 142502 (2004).

Gruppenbericht HK 33.2 Di 17:00 TU MA041

Investigation of nuclear matter distribution of the neutron-rich He isotopes by proton elastic scattering at intermediate energies — •Oleg Kiselev for the S174 collaboration — Institut für Kernchemie, Johannes Gutenberg Universität Mainz, D-55128 Mainz

The study of neutron-rich light nuclei near the drip line has attracted much attention as they exhibit an extended distribution (so-called halo) of the valence neutrons surrounding a compact core. Elastic proton scattering at intermediate energies is known as a very successful technique for exploring the nuclear matter distributions in the stable and also in the exotic nuclei. In order to supplement data taken for small-angle scattering, differential cross-sections for higher momentum transfer were measured at energies near 700 MeV/u for the neutron-rich helium isotopes ^{6,8}He using a liquid hydrogen target. The differential cross sections obtained in both experiments have been evaluated using several phenomenological parameterizations for the nuclear matter distribution within the Glauber multiple scattering theory. In addition, a model-independent analysis with the help of a Sum-Of-Gaussians method has been performed, which is a standard method for the investigation of nuclear charge distributions from electron scattering data. The results on the nuclear sizes and the radial structure of the total nuclear matter, core and halo density distributions in ^{6}He and ^{8}He will be presented. The measured differential cross sections have been also used for probing density distributions as predicted by various theoretical calculations. The comparison of the data with the latest calculations will be shown.

HK 33.3 Di 17:30 TU MA041

Struktur von ^{7}He bei niedrigen Anregungsenergien in der^{7}Li(d,^{2}He) Reaktion[*] — •N. Ryezayeva[1], C. Bäumer[2], A. van den Berg[3], D. Frekers[2], D. De Frenne[4], P. Haefner[2], E. Jacobs[4], H. Johansson[5], Y. Kalmykov[1], A. Negret[4], P. von Neumann-Cosel[1], L. Popescu[4], S. Rakers[2], A. Richter[1], G. Schrieder[1], A. Shevchenko[1], H. Simon[5] und H.J. Wörtche[3] — [1]Institut für Kernphysik, Technische UniversitätDarmstadt, Germany — [2]Institut für Kernphysik,Universität Münster, Germany — [3]KVI Groningen,Netherlands — [4]Laboratorium voor Kernfysica,Universiteit Gent, Belgium — [5]GSI Darmstadt, Germany

Die große räumliche Ausdehnung von Halo-Kernen kann zu einer erhebliche Modifikation der Spin-Bahnwechselwirkung führen. Jüngste Experimente geben widersprechende Aussagen über die mögliche Existenz des $p_{1/2}$-Spin-Bahnpartners des ^{7}He Grundzustands. Zur Klärung dieser Frage wurde die Reaktion ^{7}Li(d,^{2}He)^{7}He am KVI Groningen untersucht.

Bei einer Einschußenergie von 171 MeV wurden Daten im Winkelbereich Θ_{cm}= 0^0 – 11.3^0 genohmen. Die Auflösung betrug 150 keV (FWHM). Die experimentellen Ergebnisse weisen auf eine niedrigliegende Resonanz bei E_x=$(1.2^{+0.5}_{-0.4})$ MeV mit einer Breite Γ=$(1.9^{+0.8}_{-0.4})$ MeV hin. Die experimentelle Gamow-Teller Stärke für die Übergänge zu den niedrigsten Zuständen in ^{7}He stimmen mit theoretischen Vorhersagen des Quantum Monte-Carlo Modells überein.

[*]Gefördert durch die DFG, SFB 634, Land Nordrhein-Westfalen, EU, FOM-OWO, Fund for Scientific Research-Flandres.

HK 33.4 Di 17:45 TU MA041

Density dependent hadron field theory with nuclear matter and finite nuclei. — •Urnaa Badarch and Horst Lenske — Institut für Theoretische Physik, Universität Giessen, Germany

We have studied nuclear interactions by the coupling of nucleons to meson fields using Relativistic field theory for infinite nuclear matter and finite nuclei. In this calculations we used density dependent meson-baryon coupling constants taken from Dirac-Brueckner self-energies and loop diagrams for describing the static polarization effect. Results for infinite symmetric and anti-symmetric nuclear matter are presented. The role of the isovector interactions is investigated and compared to conventional empirical RHF models.The extension of the approach beyond the ladder approximations is discussed. Results of loop calculations are presented.The global properties of newly determined coupling constants are investigated in applications to infinite asymmetric and symmetric nuclear matter and finite nuclei using Relativistic Mean Field theory with Tomas-Fermi approximation. Work supported by DFG. werden,

HK 33.5 Di 18:00 TU MA041

Mass and Half-life Measurements at FRS-ESR Facilities at GSI — •Yu.A. Litvinov for the FRS-ESR collaboration — GSI Darmstadt — JLU Giessen

Progress and perspectives of mass and lifetime measurements of stored exotic nuclei at GSI are presented.

Exotic nuclei were produced via projectile fragmentation and fission and separated in flight with the fragment separator FRS. The spatially separated fragments were injected into the storage-cooler ring ESR. The energies, up to 900 MeV/u, were high enough to produce bare and few-electron projectile fragments for all elements. This allows to investigate nuclear decay properties under conditions which prevail in hot stellar plasmas. Dramatic prolongations of nuclear lifetimes and the open branch of bound-state beta decay for bare ions have been observed.

Masses have been measured with Schottky (SMS) and Isochronous (IMS) Mass Spectrometry for stored fragments. SMS requiring electron cooling has a lower limit for lifetimes of the order of a few seconds. 114 new masses of neutron-deficient isotopes in the lead region have been

measured with time-resolved SMS with an improved accuracy of typically 1.5×10^{-7} (30 μu). Neutron-rich uranium projectile fragments were measured in the element range from neodymium to uranium. New long-lived K-isomers are expected in the A=180 mass region. New masses of short-lived neutron-rich fission fragments have been obtained with IMS which yields access to nuclei with lifetimes down to the sub-millisecond range. The experimental results will be compared with theoretical predictions.

HK 33.6 Di 18:15 TU MA041

Bestimmung von Wirkungsquerschnitt und Tensoranalysierstärke A_{yy} in SCRE-Konfigurationen der Reaktion $^1H(\vec{d},pp)n$ bei 19 MeV — • J. Ley[1], C. D. Düweke[1], R. Emmerich[1], A. Imig[1], H. Paetz gen. Schieck[1] und H. Witała[2] — [1]IKP, Universität zu Köln, Germany — [2]Jagellonian University Cracow, Poland

In der SCRE (**S**ymmetric **C**onstant **R**elative **E**nergy)-Geometrie werden im Schwerpunktsystem alle drei Nukleonen der dp-Aufbruchreaktion unter Relativwinkeln von 120° emittiert, wobei sie alle die gleiche kinetische Energie erhalten. Die beiden Protonen liegen symmetrisch zu einer Fläche, die aus der Strahlachse und dem austretenden Neutron gebildet wird. Der SCRE-Endzustand kann im Schwerpunktsystem durch den Winkel α zwischen der umgekehrten Strahlrichtung und dem ausgehenden Neutron charakterisiert werden. Die Voraussagen von Wirkungsquerschnitten und Tensoranalysierstärken A_{yy} basieren auf dem Dreinukleonen-Faddeev-Formalismus, wobei moderne Präzisions-NN-Mesonenaustauschpotentiale verwendet werden. Ältere dp-Aufbruchdaten bei $E_{\vec{d}} = 94.5$ MeV [1] und $E_{\vec{d}} = 52.1$ MeV [2] hatten für die Tensoranalysierstärke signifikante Abweichungen von theoretischen Vorhersagen gezeigt. Um zu untersuche! n, ob solche Observable auch bei niedrigen Energien Abweichungen zeigen, wurden vier SCRE-Situationen bei $E_{\vec{d}} = 19$ MeV gemessen. Die Ergebnisse werden vorgestellt.
Gefördert durch die DFG.
[1] H. Witała et al., Phys. Rev. C **52** (1995) 2906
[2] L.M. Qin et al., Nucl. Phys. A **587** (1995) 252

HK 33.7 Di 18:30 TU MA041

Fusion of heavy nuclei for the formation of superheavy elements — •Alexis Diaz-Torres[1,2], Carsten Greiner[1], Walter Greiner[1], and Werner Scheid[2] — [1]Institut für Theoretische Physik der Johann Wolfgang Goethe-Universität Frankfurt, Robert Mayer 10, D-60064 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik der Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany

In my talk I would like to discuss the mechanism of formation of the compound nucleus in the fusion of heavy ions leading to superheavy elements. The ideas are based on a quantum-statistical approach that makes use of (i) a master equation for the probability distribution of the nuclear shapes, and (ii) the two-center shell model to obtain the microscopic ingredients of the theory. Some examples of cold and hot fusion reactions will be presented and discussed.

HK 34 Theorie

Zeit: Dienstag 16:30–19:00 Raum: TU MA042

HK 34.1 Di 16:30 TU MA042

Pentaquarks in Neutronensternen — •Mirjam Wietoska und Jürgen Schaffner-Bielich — Institut für theoretische Physik, Johann Wolfgang Goethe-Universität, Robert-Mayer-Str. 8-10, 60325 Frankfurt am Main

Es wurden Neutronensterne unter Verwendung von relativistischen Feldmodellen und verschiedenen Parametersätzen berechnet. Dabei wurde der Einfluss von Pentaquarks auf Neutronensterne und deren Masse-Radius-Beziehungen untersucht und mit astronomischen Beobachtungen verglichen. Anschließend wurden daraus Rückschlüsse auf die Eigenschaften von Pentaquarks in dichter Kernmaterie gezogen.

HK 34.2 Di 16:45 TU MA042

Color superconductivity in neutron and protoneutron stars — •Verena Werth and Michael Buballa — Institut für Kernphysik, TU Darmstadt

It is expected that quark matter at high densities and low temperatures is a color superconductor. Such conditions could be realized in the interior of neutron stars or protoneutron stars. In order to examine this possibility we employ a 3-flavor NJL model, which treats diquark condensates and quark-antiquark condensates on an equal footing. The latter lead to density dependent effective quark masses, which are known to have crucial influence on the phase structure. Special emphasis is put on the constraints imposed by electric and color neutrality which have to be obeyed in neutron stars. For protoneutron stars, where neutrinos are trapped, in addition lepton number conservation must be taken into account. The resulting phase structure and possible consequences for the structure of neutron and protoneutron stars are discussed.

HK 34.3 Di 17:00 TU MA042

Dynamical screening of non-Fermi-Liquid effect at finite temperature — •Kai Hebeler and Bengt Friman — GSI, 64291 Darmstadt, Planckstr. 1

We explore quark matter at high densities and low tempertaures in the Hard Dense Loop approximation. As is well known at zero temperture, due to the lack of screening for transverse gauge bosons, the quasiparticle strength vanishes for states at the Fermi surface. Consequently such a system is formally not a normal Fermi liquid. However, since the corresponding singularity is logarithmic, we show that the normal Fermi-liquid behaviour can be restored by taking finite temperature effects into account.

HK 34.4 Di 17:15 TU MA042

Correlations in many-body systems with two-time Green's functions — H.S. Köhler[1] und •K. Morawetz[2,3] — [1]Physics Department, University of Arizona, Tucson, Arizona 85721 — [2]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [3]Max-Planck-Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany

The Kadanoff-Baym (KB) equations are solved numerically for infinite nuclear matter. In particular we calculate correlation energies and correlation times. Approximating the Green's functions in the KB collision kernel by the free Green's functions the Levinson equation is obtained. This approximation is valid for weak interactions and/or low densities. It relates to the extended quasi-classical approximation for the spectral function. Comparing the Levinson, Born and KB calculations allows for an estimate of higher order spectral corrections to the correlations. A decrease in binding energy is reported due to spectral correlations and off-shell parts in the reduced density matrix [1]. The possibility to reformulate these correlations in terms of nonlocal shifts is presented [2].
[1] H.S. Köhler, K. Morawetz; Phys. Rev. C 64 (2002) 024613
[2] K. Morawetz, P. Lipavsk'y, V. Spicka; Ann. Phys. 294 (2001) 135

HK 34.5 Di 17:30 TU MA042

Double pion production in nuclei — •Pascal Muehlich, Luis Alvarez-Ruso, Oliver Buss und Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

Double pion production in nuclei has been proposed to be a unique method the determine experimentally how the $\pi\pi$ interaction in the σ channel changes in the nuclear medium. Even at low energies, i. e. for average pion energies below the Δ resonance, the final $\pi\pi$ system underlies strong final state interactions due to πN collisions in the nuclear environment. We present a systematic analysis of double pion production in photon-, pion- and proton-induced reactions in nuclei, employing a semi-classical transport approach including the full coupled-channel dynamics of the πN final state interactions. We find a non-negligible effect of quasi-elastic and charge-exchange scattering, which in some cases appears to be sufficient to explain the experimental data without introducing further medium modifications. The aim of our work is to describe simultaneously photon- and hadron-induced reactions in nuclei with the very same physical input, providing a basis for the interpretation of results of ongoing experimental research.
Work supported by DFG.

HK 34.6 Di 17:45 TU MA042

Nuclear density functional constrained by low-energy QCD — •Paolo Finelli[1], Norbert Kaiser[1], Dario Vretenar[2], and Wolfram Weise[1] — [1]Physik Department, Technische Universität München, D-85747 Garching, Germany — [2]Physics Department, University of Zagreb, 10000 Zagreb, Croatia

We have developed a relativistic point-coupling model of nuclear many-body dynamics constrained by the low-energy sector of QCD. The effective Lagrangian is characterized by density-dependent coupling strengths determined by chiral one- and two-pion exchange (with single and double delta isobar excitation) and by large isoscalar background fields that arise through changes of the quark condensate and the quark density at finite baryon density. The model has been tested in the analysis of nuclear ground-state properties (binding energies, root mean square radii, single particle structure) along different isotope chains of medium and heavy nuclei. The agreement with experimental data is comparable with the best purely phenomenological descriptions. The built-in QCD constraints and the explicit treatment of pion exchange restrict the freedom in adjusting parameters and functional forms of density-dependent couplings. It is shown that chiral pionic fluctuations play a prominente role for nuclear binding and saturation machanism, whereas background fields of about equal magnitude and opposite sign generate effective spin-orbit potential in nuclei.

Work supported in part by BMBF and GSI.

HK 34.7 Di 18:00 TU MA042

Chiral SU(3) dynamics, QCD sum rules and Λ-hyperons in the nuclear medium — •Norbert Kaiser, Bernhard Langwallner, and Wolfram Weise — Physik-Department, TU München, D-85747 Garching, Germany

We present a novel approach to the density dependent mean field and the spin-orbit interaction of a Λ-hyperon in nuclear many-body systems, based on flavor-SU(3) in-medium chiral perturbation theory. The leading long-range ΛN-interaction arises from kaon exchange and from two-pion exchange with a Σ-hyperon in the intermediate state. The empirical Λ-nucleus potential depth of about $-28\,\mathrm{MeV}$ is well reproduced with a single cutoff scale, $\bar{\Lambda} = 0.7\,\mathrm{GeV}$, effectively representing all short-distance (high-momentum) dynamics not resolved at scales characteristic of the nuclear Fermi momentum. The smallness of the Λ-nuclear spin-orbit interaction finds a natural (yet novel) explanation in terms of an almost complete cancellation between short-range contributions (properly rescaled from the known nucleonic spin-orbit coupling strength) and long-range terms generated by iterated one-pion exchange with intermediate Σ-hyperons. The small ΣΛ-mass difference figures prominently in this context. We perfom a similar calculation for the complex-valued Σ-nuclear mean field $U_\Sigma(k_f) + i\,W_\Sigma(k_f)$. At saturation density two-pion exchange with Λ-hyperons in the intermediate state gives rise to an imaginary part of $W_\Sigma(k_{f0}) = -21.5\,\mathrm{MeV}$ in good agreement with the value extracted from the width of Σ^- atom states. We also examine connections with in-medium QCD sum rules for hyperons.

HK 34.8 Di 18:15 TU MA042

Low-energy pions in nuclear matter — •Oliver Buss[1], Luis Alvarez-Ruso[1], Ulrich Mosel[1] und Radhey Shyam[2] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Saha Inst. Nuclear Phys., Calcutta, India

We use the the *Boltzmann-Uehling-Uhlenbeck (BUU)* transport model to describe low energy scattering events of pions and nuclei [1]. Our interest in such low energy events has been triggered by recent photoproduction experiments of the TAPS collaboration [2] and π-induced experiments of the CHAOS collaboration[3]. In these experiments the σ-resonance is excited inside different nuclei and it decays already inside the nuclear medium into a two-pion final-state.
We have shown that also in a regime of large wave length the semi-classical BUU model still gives reasonable results for π-nucleus scattering. Hence it is a suitable tool to describe the final state effects of the latter experiments. In addition we exploited the Δ-hole model to investigate the influence of a mean field potential for the pion on parameters like the mean free path and the velocity of the pion inside the medium and observables like π- and γ-induced [4] scattering events. We also compared our results to fully quantum mechanical calculations.
Work supported by DFG.
[1] Oliver Buss, diploma thesis at JLU Giessen, April 2004.
[2] J. G. Messchendorp et al.,*Phys. Rev. Lett.* 89, 222302 (2002).
[3] F. Bonutti et al.,*Nucl. Phys.* A677, 213 (2000).
[4] P. Mühlich,L. Alvarez-Ruso,O. Buss and U. Mosel, *Phys.Lett.* B595, 216-222 (2004)

HK 34.9 Di 18:30 TU MA042

Nambu Goldstone modes in a modified Hartree Approximation to the O(N) Model — •Felix Riek[1], Yuri Ivanov[1,2], and Jörn Knoll[1] — [1]GSI, 64291 Darmstadt, Planckstr. 1 — [2]Kurchatov Institute, Kurchatov sq. 1, Moscow 123182

We present a modified selfconsistent Hartree approximation at the example of the ϕ^4 $O(N)$-model. The modification complies a) with all the desireable features of selfconsistent Dyson resummation schemes base on the 2PI functional formalism (Φ-derivable approximation) like conservation laws and thermodynamical consistency, while b) it simultaneously respects the Nambu-Goldstone theorem in the chirally broken phase. Because of these features our approach allows a scale independent renormalization of the self consistent treatment in the vacuum. However the scale dependence still persists at finite temperature leading to ambiguous results.
In this talk the temperature dependence of the masses of the pion and sigma meson will be presented together with a discussion of the resulting phase structure of the system. The results will be compared to the standard Hartree approximation.

HK 34.10 Di 18:45 TU MA042

Non-linear QCD evolution at fixed and running coupling — •Dennis Dean Dietrich — The Niels Bohr Institute, Copenhagen, Denmark

A relation is presented, which connects results obtained from the Balitsky-Kovchegov equation at fixed and running QCD coupling, respectively. Its implications are discussed.

HK 35 Instrumentation und Anwendungen

Zeit: Dienstag 16:30–19:00 Raum: TU MA144

Gruppenbericht HK 35.1 Di 16:30 TU MA144

The ALICE TPC - An Innovative Device for Heavy-Ion Collisions at LHC — •H.R. Schmidt[1], P. Braun-Munzinger[1], U. Frankenfeld[1], C. Garabatos[1], P. Glässel[2], H. Öschler[3], R. Renfordt[4], J. Stachel[2], H. Stelzer[1], H.K. Soltveit[2], D. Vranic[1], J. Wiechula[1] und B. Windelband [2] — [1]Gesellschaft für Schwerionenforschung, Darmstadt — [2]Universität Heidelberg — [3]Technische Universität Darmstadt — [4]Universität Frankfurt

In 2007, the Large Hadron Collider (LHC) at CERN is scheduled to commence operations. ALICE is the only experiment at the LHC dedicated to the investigation of Pb-Pb collisions at 1248 TeV center-of-mass energy. Large secondary particle multiplicities and high rates set new demands on the design of the ALICE sub-detectors. In this contribution, we will focus on the design strategy of the ALICE Time Projection Chamber (TPC) and its innovative features: i) a high precision field cage consisting of two double-shelled containment vessels with CO_2 insulation gap built of composite materials of very low radiation length; ii) a "cold", low-Z drift gas ($NeCO_2$) with N_2 admixture to improve its stability; iii) a cooling and temperature regulation system, which stabilizes the overall the temperature to $\Delta T \leq 0.1°C$; iv) highly granular readout chambers operated at very high gas gain with 557,568 readout pads; v) highly integrated front-end readout electronics with adaptive baseline restoration. The construction of the TPC components is close to completion. We will present the roadmap of the TPC installation and its commissioning until the LHC startup.

Gruppenbericht

HK 35.2 Di 17:00 TU MA144

ALICE TRD - Report on the first beam test with a real size, 6-layer, series production detector stack — •David Emschermann for the ALICE TRD collaboration — Physikalisches Institut, Universität Heidelberg, Germany

The ALICE Transition Radiation Detector (TRD) consists of 540 individual detector chambers offering close to 1.2 million channels on a total area of roughly 750 m^2. It is arranged in a six layer barrel geometry in the central part of the ALICE detector. Apart from providing charged particle tracking and electron identification, the TRD will give fast electron trigger decisions within 6 μs after the heavy ion collisions.

Series production of TRD chambers has started end of 2003. We report on measurements using a stack of the first six series production chambers partly equipped with final readout electronics. End of October 2004 this stack was installed at CERN for a beam test with particle momenta up to 10 GeV/c. The objectives of this beam test included measurements of : electron identification performance, position resolution with tilted pad geometry and dependence of detector response on variation of incident particle angles and momenta. An overview on the preparation and on results of the beam test will be presented.

HK 35.3 Di 17:30 TU MA144

Transition Radiation Spectroscopy with Prototypes of the ALICE TRD — •Christian Lippmann for the ALICE TRD collaboration — Gesellschaft für Schwerionenforschung mbH, Darmstadt, Germany

The ALICE Transition Radiation Detector (TRD) consists of 540 large-area drift chambers with charge sensitive cathode pad read out. The TRD trigger performs online tracking and electron identification and thus requires excellent position resolution and pion rejection. As signatures to discriminate electrons from pions the different ionization energy loss and the emission of X-ray transition radiation photons by electrons are used.

To optimize the electron identification the knowledge of the spectral distributions of ionization energy loss and of detected transition radiation (TR) in the momentum region of interest are crucial. We carried out extensive measurements of TR spectra produced in our irregular foam/fiber radiators, in regular foil radiators, in pure fiber and in pure foam radiators at 1 to 10 GeV/c. To estimate additional contributions we also replaced the radiators by a dummy with similar radiation length. In all measurements the TR was separated from the beam by a strong magnetic field. The measurements were carried out at a secondary beam at the CERN PS in autumn 2004. To complete the picture, the data are compared to simulations.

HK 35.4 Di 17:45 TU MA144

X-Ray Interferences with Transition Radiation from a Micro-Focused 600 MeV Electron Beam of MAMI — •M. El Ghazaly, H. Backe, N. Clawiter, F. Hagenbuck, W. Lauth, A. Rueda, and T. Weber — Institut für Kernphysik der Universität, D-55099 Mainz

Transition Radiation in the X-ray region has been produced with a 600 MeV electron beam of the Mainz Microtron MAMI in a stack of thin polyimide foils. From the small beam spot of size $\sigma_h = 1.9$ μm (rms) and $\sigma_v = 1.6$ μm (rms) transverse coherent 6 keV X-rays are emitted in a cone with an apex angle of about 2 mrad. The radiation was monochromized by a (111) silicon single crystal in a distance of 7.34 m from the target. Tungsten and polymer wires of various thickness in the region between 10 μm and 200 μm were imaged with both, X-ray films and an open CCD chip. Interference fringes up to the 13^{th} order were observed and quantitatively analyzed. The possibility will be discussed to get information on the structure of objects by this kind of Gabor in-line holograms in the X-ray region.

Work supported by Deutsche Forschungsgemeinschaft DFG under contract BA 1336/1-3

HK 35.5 Di 18:00 TU MA144

Electron/Pion Identification with ALICE TRD Prototypes using a Neural Network Algorithm — •Alexander Wilk for the ALICE TRD collaboration — Institut für Kernphysik, Wilhelm-Klemm-Straße 9, 48149 Münster

The identification of electrons with a momentum p > 1 GeV/c is one of the most important features of the ALICE Transition Radiation Detector (TRD). We present the e/π identification performance using a neural network algorithm (NN).

The likelihood methods, the usual approach based on the integrated energy deposit, use only part of the information measured with the ALICE TRD. In addition, the amplitude measurement of each time bin can be exploited provided the correlations among the amplitudes of a given event are properly taken into account. The usage of a neural network algorithm is the natural choice for the analysis of such data. We present the latest results for pion rejection using a NN, which increases the pion rejection up to about 500 for a momentum of 2 GeV/c, a significant advantage compared to the standard methods where the pion rejection factor is of the order of 100. We investigate different NN topologies and their effect on the e/π identification. The momentum dependence of the pion rejection is studied in the range 2-6 GeV/c.

This work is supported by BMBF.

Gruppenbericht

HK 35.6 Di 18:15 TU MA144

First on-line mass measurements at SHIPTRAP — •M. Block for the SHIPTRAP collaboration — GSI, Planckstrasse 1, D-64291 Darmstadt, Germany

The ion trap facility SHIPTRAP at GSI Darmstadt was set up to enable various experiments on heavy elements produced in fusion evaporation reactions at SHIP. In the first stage SHIPTRAP focuses on precision mass measurements of nuclei not available at ISOL or fragmentation facilities with a Penning trap mass spectrometer. The speciality of SHIPTRAP is the access to the region of the heaviest elements where the majority of masses is only known from extrapolations with a few hundred keV precision. In addition most of the masses in this region are linked to only a few α-decay chains. Hence direct mass measurements from which nuclear binding energies can be deduced are required. The commissioning of SHIPTRAP included extensive off-line tests in order to characterize and optimize all individual components. In on-line experiments the efficiency of the stopping cell was measured with radioactive ions to be 5-8 %. This limits at the moment the overall efficiency of SHIPTRAP. However, mass measurements of radioactive ions with moderate production rates are already feasible. In a beam time in July 2004 radionuclides around ^{147}Ho were produced in the reaction ^{92}Mo(^{58}Ni,xpxn) with a primary beam energy of 4.35 MeV/u. In this run the first mass measurements with the Penning traps were performed. The masses of ^{147}Ho, ^{147}Er and ^{148}Er were measured, the latter ones for the first time.

HK 35.7 Di 18:45 TU MA144

Time-of-flight mass spectrometry at SHIPTRAP and at the FRS-Ion-Catcher — •Wolfgang R. Plass[1], Zhenyu Di[1,2], Timo Dickel[1], Alexander F. Dodonov[3], Sergey A. Eliseev[1,2], Hans Geissel[1,2], Viatcheslav I. Kozlovski[3], Gottfried Münzenberg[2], Martin Petrick[1], Christoph Scheidenberger[1,2], and Zheng Wang[1,2] for the SHIPTRAP collaboration and the FRS-Ion-Catcher collaboration — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt — [3]BINEPCP, Russian Academy of Sciences, Chernogalovka, Russia

The current status of a time-of-flight mass spectrometer system for the SHIPTRAP and FRS-Ion-Catcher facilities at GSI is described. At these facilities, fusion-reaction products and projectile / fission fragments, respectively, are decelerated and thermalized in gas-filled stopping cells and made available to precision experiments performed at energies in the eV range.

The time-of-flight mass spectrometer can be used to obtain broadband, high-resolution mass spectra with cycle times of less than 1 ms. Thus it is ideally suited for the characterization and optimization of the stopping cells as key parts of these facilities, as well as for direct mass measurements on very short-lived exotic nuclei, and for atomic and chemical studies. Recent results from experiments performed at SHIPTRAP and the FRS-Ion-Catcher and developments for chemical studies and ion mobility measurements of transuranium elements will be presented.

HK 36 Hauptvorträge

Zeit: Mittwoch 10:15–12:15 Raum: TU MA001

Hauptvortrag HK 36.1 Mi 10:15 TU MA001

Recent progress in effective field theory — •Stefan Scherer — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

The implementation of a successful effective field theory program requires two main ingredients, namely: (a) a knowledge of the most general effective Lagrangian and (b) an expansion scheme for observables in terms of a consistent power counting method [1]. In Ref. [2] we have proposed a renormalization scheme which provides a simple and consistent power counting for manifestly Lorentz-invariant baryon chiral perturbation theory. Our approach may be used in an iterative procedure to renormalize higher-order loop diagrams and also allows for implementing vector (and axial-vector) mesons as explicit degrees of freedom [3]. As an application we will discuss the electromagnetic form factors of the nucleon. Finally, requiring the consistency of effective field theory with respect to renormalization results in constraints such as, e.g., the universal ρ coupling [4].

[1] S. Scherer, Adv. in Nucl. Phys. 27 (Kluwer Academic/Plenum Publishers, New York, 2003)

[2] T. Fuchs, J. Gegelia, G. Japaridze, S. Scherer, Phys. Rev. D 68, 056005 (2003)

[3] T. Fuchs, M. R. Schindler, J. Gegelia, S. Scherer, Phys. Lett. B 575, 11 (2003); M. R. Schindler, J. Gegelia, S. Scherer, Nucl. Phys. B 682, 367 (2004)

[4] D. Djukanovic, M. R. Schindler, J. Gegelia, G. Japaridze, S. Scherer, Phys. Rev. Lett. 93, 122002 (2004)

Hauptvortrag HK 36.2 Mi 10:45 TU MA001

Effektive Feldtheorie und die Schnittstelle zur Gitter QCD — •Thomas Hemmert — Physik Department T39, TU Muenchen

Die Theorie der Quantenchromodynamik (QCD) beschreibt nach unserem gegenwärtigen Kenntnisstand alle beobachteten Phänomene der starken Wechselwirkung der Materie. Während die QCD bei großem Impulsübertrag auch quantitativ mit hoher Genauigkeit getestet werden konnte, ist sie bei niedrigen Energien auf Grund der starken, nichtlinearen Wechselwirkungen sehr komplex. Für die theoretische Behandlung der QCD in diesem Regime existieren zwei systematische Zugänge: Gitter-QCD Simulationen und (chirale) effektive Feldtheorie (ChEFT).

In diesem Vortrag werde ich im ersten Teil auf die Grundlagen der ChEFT sowie deren Zusammenhang mit der QCD eingehen und den aktuellen Status der ChEFT für Baryonen skizzieren. In einem zweiten Teil diskutiere ich aktuelle Beispiele für die Anwendungen von effektiver Feldtheorie auf das Problem der Quark-Massenabhängigkeit von Baryonobservablen. Diese Anwendung von ChEFTs hat in den letzten 2 Jahren sehr stark an Bedeutung gewonnen, da aktuelle Simulationen von Baryoneigenschaften im Rahmen der Gitter QCD inzwischen in den Quark-Massenbereich vorgestossen sind, in dem auch die ChEFT gültig ist. Mit Hilfe der ChEFT bietet sich daher nun die Möglichkeit, die Simulationsergebnisse der Gitter QCD zu den physikalischen Quarkmassen hin zu extrapolieren und diese nun direkt mit experimentellen Messungen zu vergleichen.

Hauptvortrag HK 36.3 Mi 11:15 TU MA001

Present understanding of single spin asymmetries — •Andreas Metz — Institut für Theoretische Physik II, Ruhr-Uni Bochum

The talk summarizes the intriguing physics of single spin asymmetries in hard scattering processes by focussing on the recent developments. Currently such asymmetries are studied in semi-inclusive lepton-nucleon scattering at DESY (HERMES Collaboration), at CERN (COMPASS Collaboration), and at the Jefferson Laboratory. Measurements in proton-proton collisions are performed at RHIC.

It is known for a long time that socalled time-reversal odd correlation functions (parton distributions and fragmentation functions) can generate single spin asymmetries. But only recently it was shown that T-odd parton distributions don't vanish, where the presence of the Wilson line in the operator definition, which ensures color gauge invariance, plays a crucial role. In addition to this issue we discuss the universality of T-odd correlation functions, the discovery of previously unknown T-odd functions at subleading twist, and an interesting connection between single-spin phenomena and generalized parton distributions.

Hauptvortrag HK 36.4 Mi 11:45 TU MA001

Kovariante ab initio Theorie für Kerne und Hyperkerne — •Horst Lenske, Christoph Keil, Patrick Konrad und Nadia Tsoneva — Institut für Theoretische Physik, Universität Giessen

Ein zukunftsweisender Weg in der modernen Kernstrukturphysik sind *ab initio* Verfahren, die mit wenigen universellen Eingabegrössen viele Kerneigenschaften beschreiben. Hierzu gehört die DDRH Theorie. Inmedium Wechselwirkungen von Nukleonen und Hyperonen werden parameterfrei in der Dirac-Brueckner Theorie hergeleitet und dichteabhängige Meson-Baryon Vertex Funktionale bestimmt. In Mittelfeld-Näherung gelangen wir zu einer kovarianten und thermodynamisch konsistenten Theorie für nukleare Systeme. Anwendungen auf Kernmaterie, Neutronensterne sowie endliche Kerne und Hyperkerne werden vorgestellt. Bindungsenergien und andere Grundzustandseigenschaften von stabilen und exotischen Kernen werden gut beschrieben, wobei die Abweichungen vergleichbar mit denen von empirischen RMF Modellen sind. Als wichtige Erweiterung berücksichtigen wir dynamische Selbstenergien. Ihre Beiträge zu Grundzustandskorrelationen in Kernmaterie und Multiphonon-Anregungen in exotischen Kernen werden vorgestellt. Neue KEK Daten für schwere Λ Hyperkerne ergeben eine unerwartet große Spin-Bahn Aufspaltung. Kürzliche Messungen eines Doppel-Λ Hyperkerns deuten auf wesentlich geringere $\Lambda\Lambda$ Korrelatiosenergien hin als erwartet. Eine interessante Anwendung ist die Augerspektroskopie von Hyperkernen, die in einem geplanten JLAB-Experiment zur Anwendung kommen wird. *Unterstützt von DFG (Le 439/5-1), Europäisches Graduiertenkolleg, GSI, Virtuelles Institut VH-VI-041 und BMBF.*

HK 37 Elektromagnetische und Hadronische Proben

Zeit: Mittwoch 14:00–16:00 Raum: TU MA001

HK 37.1 Mi 14:00 TU MA001

Electromagnetic form factors of the nucleon in the perturbative chiral quark model — •Kem Pumsa-ard, V.E. Lyubovitskij, Th. Gutsche, and Amand Faessler — Institut für Theoretische Physik, Universität Tübingen, D-72076 Tübingen, Germany

We study the electromagnetic form factors of the nucleon in a manifestly Lorentz invariant quark model. In addition, we also include chiral corrections up to fourth order on the quark level as deduced from relativistic baryon chiral perturbation theory. The current approach is an improved version of our previous model, the perturbative chiral quark model (PCQM) [1].

[1] V. E. Lyubovitskij, Th. Gutsche and A. Faessler, Phys. Rev. C **64** (2001) 065203; V. E. Lyubovitskij et al., Phys. Rev. C **65** (2002) 025202; C **66** (2002) 055204; C **68** (2003) 015205; Phys. Lett. B **520** (2001) 204

HK 37.2 Mi 14:15 TU MA001

Form factors of the energy-momentum tensor in the Skyrme model — •Christoph Cebulla[1], Jens Ossmann[1], Peter Schweitzer[1], K. Goeke[1], and M. Polyakov[2,3] — [1]Institute for Theoretical Physics II, Ruhr-University Bochum, 44801 Bochum,Germany — [2]Petersburg Nuclear Physics Institute, Gatchina, St. Petersburg 188300, Russia — [3]Institute de Physique, B5a, Université de Liège au Sant Tilman, B-4000 Liège 1 Belgium

We study the nucleon form factors of the energy-momentum tensor in the framework of the Skyrme model[1]. Based on work done by M.V. Polyakov[2] we obtain model expressions for the form factors as well as for what can be interpreted as radial distributions of "pressure"and "shear"forces and calculate them numerically. We verify the internal consistency of the model and compare with results obtained within other models or methods. The results for the so-called D-term are of interest for phenomenology related to generalized parton distribution functions.

[1] T.H.R. Skyrme. A nonlinear field theory. *Proc. Roy. Soc. Lond.*,

A260:127-138,1961
[2] M.V. Polyakov. Generalized parton distributions and strong forces inside nucleons and nuclei. *Phys. Lett.*, B555:57-62, 2003

HK 37.3 Mi 14:30 TU MA001

Polarisationsobservablen in der $2\pi^0$ Photoproduktion am Proton — •Dirk Krambrich für die CrystalBall@MAMI-Kollaboration — Institut für Kernphysik, Universität Mainz

Mit dem neu aufgebauten 4π Photonenspektrometer am Mainzer Mikrotron MAMI, bestehend aus dem Crystal Ball Detektor (672 NaI Kristalle) und dem TAPS Detektor als Vorwärtswand (510 BaF_2 Kristalle), wurden Daten zur $2\pi^0$ Photoproduktion am Proton von der Erzeugungsschwelle 307 MeV bis 820 MeV genommen. Durch den Einsatz von linear und zirkular polarisierten Photonen konnte neben dem differentiellen Wirkungsquerschnitt auch die Photonasymmetrie und die Helizitätsasymmetrie gemessen werden. Speziell diese Polarisationsobservablen sind über Interferenzterme auf Details des Produktionsmechanismus empfindlich. Erste vorläufige Ergebnisse werden mit verschiedenen Modellvorhersagen verglichen.

HK 37.4 Mi 14:45 TU MA001

Linearly polarised photons at ELSA and Σ beam asymmetry for the η photoproduction off the proton* — •Daniel Elsner for the CBELSA/TAPS collaboration — Physikalisches Institut, Universität Bonn

Using coherent bremsstrahlung on a thin diamond crystal from the electron beam of the ELSA accelerator a tagged photon beam with a high degree of linear polarisation is produced. The required precise alignment of the crystal axis with respect to the beam direction is realised by a commercial goniometer. The coherent bremsstrahlung itself can be used for the calibration of the crystal orientation based upon the Stonehenge technique. From comparison of measured photon spectra with a calculation of bremsstrahlung production including collimation and other experimental constraints, we gain the degree of linear polarisation within a relativ uncertainty of 5%. During the CBELSA/TAPS beamtimes different data sets with maximum polarisation at photon energies between 1.2 and 2.0 GeV were measured. The reaction $\vec{\gamma} + p \rightarrow \eta + p$ was analysed in the two dominant neutral decay modes of the η. The status of the analysis of the photon beam asymmetry, Σ, and the unpolarized cross section will be reported. The comparison to existing data of Σ at photon energies around 1 GeV serves as an independent check of the polarisation determination.

* supported by DFG (SFB/TR 16).

HK 37.5 Mi 15:00 TU MA001

Neutrino Scattering on Nucleons and Nuclei — •Tina Leitner, André Peshier und Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We investigate neutrino scattering on nucleons and nuclei for neutrino energies up to 2 GeV. The two main processes in this energy region are quasielastic scattering and resonance production. Here we concentrate on processes mediated by charged current weak interactions. Quasielastic reactions on nucleons ($\nu + n \rightarrow l^- + p$ and $\bar{\nu} + p \rightarrow l^+ + n$) can be related to electron scattering. Using recent electron scattering data for the parametrization of the vector form factors leads to a more reliable prediction of the neutrino cross section and of the other form factors which contain information on the axial content of the nucleon. Extensions to neutrino reactions on nuclei are calculated in the framework of the BUU transport model [1]. Resonance production is also first calculated for the nucleon and then within the BUU transport model to simulate nuclear effects. The main contribution to the single-pion production cross section at neutrino energies of a few GeV comes from the production and the subsequent decay of the $\Delta(1232)$, but also other low-energy resonances give non-negligible contributions e. g. the N(1440).

[1] M. Effenberger, E. Bratkovskaya and U. Mosel, Phys. Rev. C 60, 044614 (1999)

HK 37.6 Mi 15:15 TU MA001

Simulationsstudien zur Optimierung des PANDA-Detektors — •Bertram Kopf für die Panda-Kollaboration — Ruhr-Universität Bochum

Das PANDA–Experiment, das einen wesentlichen Bestandteil des GSI–Zukunftsprojektes darstellt, soll Antiproton–Annihilationsprozesse am Proton sowie an schweren Kernen bei Strahlimpulsen zwischen etwa 1.5 GeV/c und 15 GeV/c untersuchen.
Ziel ist es, neue Erkenntnisse in der Spektroskopie der Mesonen, in der Hyperonenphysik und auch über Charmonium–Zustände in Kernmaterie zu sammeln.
Die Untersuchung dieses breiten Spektrums der Physik erfordert einen Detektor, der komplexe Anforderungen erfüllen muß. So ist ein präziser Nachweis von neutralen und auch geladenen Teilchen über ein großes Impulsspektrum und über den nahezu gesamten Raumwinkel zwingend notwendig. Hierfür in Betracht kommende alternative Detektorkonfigurationen werden vorgestellt und anhand von Simulationsstudien geeigneter Zerfallskanäle verglichen.

HK 37.7 Mi 15:30 TU MA001

Physics of Hypernuclei - from FINUDA to PANDA — •O.N. Hartmann[1], P. Gianotti[1], J. Pochodzalla[2], A. Sanchez Lorente[2], T. Saito[3], and C. Sfienti[3,4] for the FINUDA and the PANDA collaboration — [1]INFN–LNF, Frascati, Italy — [2]U Mainz, Germany — [3]GSI, Darmstadt, Germany — [4]U Catania, Italy

The FINUDA [1] experiment at the DAΦNE e^+e^--collider („ϕ-factory“, [2]) has completed its first data taking on hypernuclei produced by stopping K^--mesons from the ϕ decay in various target nuclei. The FINUDA apparatus performs studies on hypernuclear spectroscopy and the decay of hypernuclei.

The hypernuclei physics part of the PANDA [3] program at FAIR [4] will be an extension of this type of physics to double hypernuclei. This experiment uses the antiproton beam of HESR [4,3] on a primary heavy target producing a $\Xi\overline{\Xi}$ pair. The Ξ^--hyperon is stopped in a secondary target, captured into the atomic shell of the target nucleus and finally absorbed in the nucleus producing a $\Lambda\Lambda$ pair. This will make the study of the strong interaction strength between Λ-hyperons possible, as well as the investigation of a possibly existing double strange six quark state (H-dibaryon).

In this contribution first results from FINUDA will be presented as well as an overview on the future plans in PANDA.

[1] P. Gianotti *et al.*, NPA691(2001), 483c
[2] C. Milardi *et al.*, hep-ph/0408073
[3] Letter of Intent, PANDA collaboration, 2004
[4] http://www.gsi.de/zukunftsprojekt/index_e.html

HK 37.8 Mi 15:45 TU MA001

Timelike compton scattering and related exclusive processes in proton-antiproton annihilation at PANDA — •Michael Düren, Matthias Hartig, Björn Seitz, George Catalin Serbanut, and Hasko Stenzel for the PANDA collaboration — II. Physikalisches Institut, Uni Giessen, 35392 Giessen

Exclusive proton-antiproton annihilation into two photons at large s and t can be described in terms of the handbag diagram: The process is separated into a 'soft' part (i.e. the formation of a single quark-antiquark pair) and a 'hard' part (i.e. the subsequent annihilation into two photons). The latter can be treated in pertubative QCD. The process is of special interest due to its relation to the timelike formfactor and to Generalized Parton Distributions as measured in electron scattering experiments. It is proposed to measure this and related exclusive annihilation processes with a scalar meson, a vector meson or a lepton pair in the final state at the PANDA experiment at GSI.

HK 38 Kernphysik/Spektroskopie

Zeit: Mittwoch 14:00–16:00 Raum: TU MA004

Gruppenbericht HK 38.1 Mi 14:00 TU MA004

Structure studies of the neutron-rich isotopes ^{17}C, ^{16}C and ^{15}C — •H. G. Bohlen[1], W. von Oertzen[1,2], R. Kalpakchieva[3], T. N. Massey[4], A. A. Ogloblin[5], G. de Angelis[6], M. Milin[7], Ch. Schulz[1], Tz. Kokalova[1], and C. Wheldon[1] — [1]Hahn-Meitner-Institut, Berlin — [2]Freie Universität, Berlin — [3]FLNR, JINR, Dubna — [4]Dept. Phys. Astr, Ohio University — [5]Kurchatov Institute, Moscow — [6]INFN, LNL, Legnaro — [7]RBI, Zagreb

Nothing was known about excited states of ^{17}C above the neutron threshold (S_n= 0.729 MeV). We observed thirteen new states up to 16.3 MeV excitation energy with a resolution of 0.25 MeV using the three-neutron transfer reaction ^{14}C(^{12}C,^{9}C)^{17}C at 231 MeV incident energy (the reaction Q-value is Q_0= -46.930 MeV). The (^{12}C,^{9}C) reaction has also been used on ^{12}C and ^{13}C targets, and excited states of ^{15}C and ^{16}C have been populated up to 19 MeV and 17.4 MeV, respectively. In the comparison of excitation energies, widths and cross sections of states, a striking correspondence of states in the three isotopes is revealed for ten groups of states, when the spectra of ^{16}C and ^{15}C are shifted in excitation energy by a constant value. This behavior could be understood in the weak-coupling model, assuming an almost complete decoupling between cores and $(sd)^3$ neutron configurations populated in the three-neutron transfer. The structure of ^{17}C states is further investigated in shell-model calculations and by comparison to ^{19}O levels. The neutron decay of the observed resonances in the three carbon isotopes could be understood using the parentage between the structure of mother and daughter states as derived in the weak-coupling model.

HK 38.2 Mi 14:30 TU MA004

Ternary Fission from Hyper-deformed States in A=56-60 — •W. von Oertzen[1,2], G. Efimov[1,3,2], V. Zherebchevsky[1,2], D. Kamanin[1,3], B. Gebauer[1], S. Thummerrer[1], Tz. Kokalova[1], H.G. Bohlen[1], C. Schulz[1], C. Beck[4], M. Rousseau[4], P. Papka[4], G. Royer[5], G. de Angelis[6], and C. Wheldon [1] — [1]Hahn Meitner Institut D14109 Berlin, Glienickerstr.100 — [2]Freie Universität, Berlin — [3]FLNR, JINR-DUBNA, Russia — [4]IreS, Strasbourg, France — [5]Subatech, Nantes, France — [6]LNL, Legnaro, Padova, Italy

With a unique charged particle detector set-up for the registration of binary coincidences (BRS, Binary Reaction Spectrometer) we have studied two systems, ^{36}Ar+^{24}Mg, and ^{32}S+^{24}Mg at energies of 195 and 163 MeV, respectively. The BRS measures the reaction angles in and out of plane and gives through Bragg-peak and range spectroscopy a complete coverage of the total charge in the final channels. The yields of the binary and the non-binary (ternary) channels with missing mass up to A=16 are determined. We observe very narrow out-of-plane angular correlations for binary reactions but also for those ternary events, where the third missing charge is a multiple of α-particles. The result is explained by a ternary fission decay at high angular momentum from hyper-deformed shapes. From the energetics of the reaction and from the relative yields of the ternary fission events the formation of highly excited hyper-deformed nuclei ^{56}Ni and ^{60}Zn can be uniquely deduced, as described by the α-cluster model in ref.1, or by the Nilsson-Strutinsky method. 1)J. Zhang, A.C. Merchant and W.D.M. Rae, Phys.Rev. C49(1994) 562.

HK 38.3 Mi 14:45 TU MA004

Spectroscopy of light exotic nuclei using BRS+EUROBALL — •Tz. Kokalova[1,2], C. Wheldon[1], W. von Oertzen[1,2], G. Gebauer[2], S. Thummerer[2], C. Schulz[2], H.G. Bohlen[2], G. de Angelis[3], E. Farnea[3], D.R. Napoli[3], S.M. Lenzi[4], C. Beck[5], M. Rousseau[5], and P. Papka[5] — [1]Freie Universität Berlin, Germany — [2]Hahn-Meitner-Institut Berlin, Germany — [3]INFN-Laboratori Nazionali di Legnaro, Legnaro, Italy — [4]Dipartimento di Fisica and INFN, Padova, Italy — [5]Institut de Recherches Subatomiques, Strasbourg, France

An experiment was performed for the study of properties of neutron-rich beryllium (A=10-12) and carbon (A=13-16) isotopes in the vicinity of the particle-emission threshold, where strong clustering and large deformations are expected to be observed.

Measurements with an ^{18}O beam (E_L=90 MeV) and ^{9}Be- and ^{13}C- targets have been carried out at IReS, Strasbourg using the Binary Reaction Spectrometer (BRS) together with the EUROBALL array of germanium detectors. This combination enabled particle-particle-γ coincidences to be measured and the kinematics of the reaction to be reconstructed. Using this experimental technique light nuclei (Z=3 to 12) have been populated and investigated. A short report of the current analysis will be given.

HK 38.4 Mi 15:00 TU MA004

EUROBALL+BRS as a tool for uniquely identifying weakly populated structures in light nuclei. — •Carl Wheldon[1], Tzany Kokalova[1,2], Severin Thummerer[1], Burckhard Gebauer[1], Wolfram von Oertzen[1,2], Christian Schulz[1], Hans-Gerhard Bohlen[1], Giacomo de Angelis[3], Enrico Farnea[3], Daniel R. Napoli[3], Silvia M. Lenzi[4], Christian Beck[5], Marc Rousseau[5], and Paul Papka[5] — [1]SF7, Hahn-Meitner-Institut, Glienicker Straße 100, D-14109 Berlin, Germany — [2]Freie Universität Berlin, Germany — [3]INFN-Laboratori Nazionali di Legnaro, Legnaro, Italy — [4]Dipartimento di Fisica dell'Università and INFN, Sezione di Padova, Italy — [5]Institut de Recherches Subatomiques, Strasbourg, France

In order to search for highly-deformed nuclear cluster states based on α-particle structures in light nuclei, A<28, a reaction mechanism is required that makes use of pre-clustered target and/or projectile nuclei. Furthermore, the parity doublet structures that characterise asymmetrically deformed states, need to be cleanly extracted from the multitude of competing reaction channels.

To this end, an experiment was performed using the Berlin-Binary-Reaction-Spectrometer (BRS) in conjunction with the EUROBALL array, which in this instance comprised 15 cluster and 26 clover detectors. The 90 MeV D.C. ^{18}O beam was provided by the IReS, Strasburg Vivitron and incident on a thin, 98 $\mu g\,cm^{-2}$, ^{9}Be target. The BRS enables the charge, Z, of both binary products to be uniquely determined, in addition to providing millimetre position and precise energy information.

The $p-\gamma$ coincidence analysis method and results will be reported.

HK 38.5 Mi 15:15 TU MA004

Nachweis des natürlichen Alpha-Zerfalls von Wolfram — •Wolfgang Seidel[1] und Cristina Cozzini[2] für die CRESST-Kollaboration-Kollaboration — [1]Max-Planck-Institut für Physik — [2]University of Oxford

Zum ersten mal wurde der natürliche Alpha-Zerfall von ^{180}W eindeutig in einem Gamma- und Beta- untergrundsfreiem Spektrum nachgewiesen. Dies wurde durch den simultanen Nachweis von Phononen und Szintillationslichtsignalen in den CRESST Tieftemperaturdetektoren erreicht. Die Halbwertszeit wurde zu $T_{1/2} = (1.8 \pm 0.2) \times 10^{18} y$ und die Übergangsenergie zu $Q = (2516.4 \pm 1.1(stat.) \pm 1.2(sys.))keV$ bestimmt.

HK 38.6 Mi 15:30 TU MA004

Measurement of the nuclear matrix elements for $0\nu\beta\beta$ decay — •E.-W. Grewe, C. Bäumer, D. Frekers, S. Hollstein, and S. Rakers — Institut für Kernphysik, WWU Münster

The double beta decay is a rare second-order weak transition. A nucleus can undergo double beta decay with or without emission of neutrinos. The 0ν-mode is only possible if the neutrinos are massive Majorana particles or not purely left-handed. This mode is of great interest for neutrino-mass estimations, however the nuclear matrix element is needed to connect a measured half-life to the neutrino mass.

The nuclear matrix element can be calculated if the complete set of Gamow-Teller (GT) matrix elements for the two virutal transitions in the perturbative description are known. While for the 2ν mode only allowed GT transitions play a role, the 0ν mode rather proceeds through forbidden, i.e. higher multipole, transitions. An elegant way to experimentally obtain GT distributions are charge-exchange reactions. If transitions beyond the allowed GT ones have to be studied, high energy resolution spectra and angular distributions are necessary to precisely identify single excitations. We present new ^{48}Ca(^{3}He,t) data taken at RCNP (Osaka, Japan) [1] which have energy resolutions of 40 keV so that the multipolarity of all low-lying states can be studied. Comparisons with theoretical calculations are presented. The data is combined with high-resolution ^{48}Ti(d,^{2}He) data [2] to obtain $2\nu\beta\beta$ half-lives.

[1] H. Fujita *et al.*, Nucl. Instr. Meth. A 484, 17 (2002).
[2] S. Rakers *et al.*, Phys. Rev. C 70, 054302 (2004).

HK 38.7 Mi 15:45 TU MA004

Dipole-strength distributions below the giant dipole resonance in ^{92}Mo, ^{98}Mo and ^{100}Mo* — •G. Rusev[1], R. Schwengner[1], A. Wagner[1], K.D. Schilling[1], F. Dönau[1], S. Frauendorf[1,2], M. Erhard[1], A.R. Junghans[1], K. Kosev[1], N. Nankov[1], and E. Grosse[1,3] — [1]Institut für Kern- und Hadronenphysik, Forschungszentrum Rossendorf, Dresden, Germany — [2]University of Notre Dame, Notre Dame, USA — [3]Technische Universität Dresden, Dresden, Germany

Photon-scattering experiments with bremsstrahlung were performed on ^{92}Mo, ^{98}Mo and ^{100}Mo at electron energies up to 13.2 MeV. The measurements were carried out at the new bremsstrahlung facility of the Rossendorf ELBE accelerator. The highest end-point energies are above the neutron-separation energies of the three isotopes and allow the determination of the dipole strengths below the giant dipole resonance. The decay to intermediate levels was estimated with the constant-temperature level-density model and the dipole-strength distributions were reconstructed. The obtained results are completed with data from neutron-scattering experiments [1] and compared with predictions of RPA calculations.

[1] H. Beil et al., Nucl. Phys. A227 (1974) 427

* Supported by the DFG under contracts Do 466/1-1 and Do 466/1-2.

HK 39 Physik mit schweren Ionen

Zeit: Mittwoch 14:00–16:00 Raum: TU MA144

Gruppenbericht

HK 39.1 Mi 14:00 TU MA144

Erste Resultate des Myonpaar-Experiments NA60 am CERN SPS — •Sanja Damjanovic und Hans J. Specht — Physikalisches Institut der Universität Heidelberg

Das NA60 Experiment am CERN SPS basiert auf dem Myonpaar-Spektrometer von NA38/NA50, ergänzt durch ein neues ultrakompaktes Präzisions-Spektrometer mit strahlenresistenten Silizium-Pixeldetektoren vor dem Hadronenabsorber. Die Verknüpfung der Myon-Spuren vor und nach dem Absorber ergibt eine Massenauflösung im Bereich der Vektormesonen ω, ϕ und J/ψ von ca. 2 % und erlaubt ferner eine Messung der Myonpaar-Vertices mit einer Auflösung von < 50 μm. In der Datennahme 2003 wurden für Indium-Indium-Kollisionen bei 158 AGeV ca. 1 Mill. Myonpaare im Massenbereich < 1.2 GeV/c^2 sowie 100000 J/ψ aufgenommen; in der Datennahme 2004 mit Protonen auf Targets von Beryllium bis Blei liegen die Werte noch erheblich höher, ca. 0.5 Mill. J/ψ. Wir berichten über erste Resultate zu den Vektormesonen, der Kontinuumsstrahlung sowie zu offenem Charm.

HK 39.2 Mi 14:30 TU MA144

Pionenproduktion in Stößen leichter Kerne bei 40 und 158 GeV pro Nukleon* — •B. Lungwitz[1], C. Alt[1], C. Blume[1], P. Dinkelaker[1], D. Flierl[1], V. Friese[2,3], M. Gazdzicki[1], F. Kramer[1], M. Kliemant[1], S. Kniege[1], I. Kraus[2], C. Meurer[1], M. Mitrovski[1], R. Renfordt[1], A. Richard[1], A. Sandoval[2], T. Schuster[1], R. Stock[1], C. Strabel[1] und H. Ströbele[1] für die NA49-Kollaboration — [1]Institut für Kernphysik, Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Fachbereich Physik der Universität, Marburg

Bei Pb+Pb- Kollisionen hat das Energie- Scan- Programm des NA49-Experiments bei einigen Variablen, z.B. dem K^+/π^+- Verhältnis oder der Zahl der produzierten Pionen pro Wounded Nucleon, eine interessante Energieabhängigkeit im Bereich von $p_{lab} = 30A$ GeV entdeckt, welche bei p+p- Kollisionen nicht beobachtet wurde. Die Frage ist nun, ab welcher Größe des Kollisionssystems sich die Energieabhängigkeit ändert. Dazu werden in diesem Vortrag die neuesten Ergebnisse der Pionenanalyse des NA49- Experiments bei C+C und Si+Si- Kollisionen bei Laborenergien von 40 und 158A GeV vorgestellt. Außerdem wird eine Kompillation der existierenden Daten der Energieabhängigkeit der Pionenproduktion bei verschieden großen Kollisionssystemen sowie der Systemgrößenabhängigkeit der Pionenproduktion bei verschiedenen Kollisionsenergien gezeigt.

* Unterstützt vom BMBF und der GSI.

HK 39.3 Mi 14:45 TU MA144

Charged kaon production in C+C and Si+Si collisions at 40 and 158GeV per nucleon* — •M. Kliemant[1], C. Alt[1], C. Blume[1], P. Dinkelaker[1], D. Flierl[1], V. Friese[2,3], M. Gazdzicki[1], F. Kramer[1], S. Kniege[1], I. Kraus[2], B. Lungwitz[1], C. Meurer[1], R. Renfordt[1], A. Richard[1], A. Sandoval[2], T. Schuster[1], R. Stock[1], C. Strabel[1] und H. Ströbele[1] für die NA49-Kollaboration — [1]Institut für Kernphysik, Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Fachbereich Physik der Universität, Marburg

Within systematic study of hadron production in nuclear collisions at the CERN SPS, the NA49 experiment registred data on C+C and Si+Si interactions at 40 and 158AGeV. The production of charged kaons in these reactions is a subject of this presentation.
The kaons were analysed and identified with the mean enegy loss dE/dx in the detector gas of the TPC's. Fully corrected transverse mass and rapidity spectera of K^+ and K^- meson will be shown. The energy and system size dependence of kaon multiplicity and the K to Pi relatins will be presented and discused.

* Supported by BMBF and GSI.

HK 39.4 Mi 15:00 TU MA144

Produktion von Hadronen bei SPS Energien in Abhängigkeit von der Systemgröße* — •P. Dinkelaker[1], C. Alt[1], C. Blume[1], D. Flierl[1], V. Friese[2,3], M. Gaździcki[1], F. Kramer[1], M. Kliemant[1], S. Kniege[1], I. Kraus[2], B. Lungwitz[1], C. Meurer[1], M. Mitrovski[1], R. Renfordt[1], A. Richard[1], A. Sandoval[2], T. Schuster[1], R. Stock[1], C. Strabel[1] und H. Ströbele[1] — [1]Institut für Kernphysik, Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Fachbereich Physik der Universität, Marburg

Die Energieabhängigkeit der Hadronenproduktion in zentralen Pb+Pb Kollisionen ist stark unterschiedlich zu p+p. Dies wird als mögliches Indiz für einen Phasenübergang der Kernmaterie gesehen. Die Entwicklung dieser Differenz durch Analyse von Pb+Pb Kollisionen mit unterschiedlichen Zentralitäten ist Thema dieses Vortrags.
Die Ergebnisse der NA49 Kollaboration für geladene Pionen, Kaonen und ϕ bei 40 AGeV und 158 AGeV werden in Rapiditäts- und Transversalimpulsspektren präsentiert und mit den Resultaten bei AGS- und RHIC-Energien verglichen. Eine Untersuchung diverser Skalierungsparameter sowie ein Vergleich mit dynamischen und statistischen Modellrechnungen schließt die Präsentation ab.

* Unterstützt vom BMBF und der GSI.

HK 39.5 Mi 15:15 TU MA144

Event-by-event fluctuations of the mean transverse momentum at SPS energy. — •Georgios Tsiledakis[1] and Harald Appelshäuser[1,2] for the CERES collaboration — [1]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [2]Institut für Kernphysik, Universität Frankfurt

Significant non-statistical event-by-event fluctuations and a characteristic centrality dependence have been observed over a wide range of beam energies. These results have been discussed in the context of QGP formation and the possible occurence of the QCD critical point. In this talk, we present recent results from the CERES collaboration on event-by-event fluctuations of the mean transverse momentum in Pb-Au collisions at 158 AGeV/c. Additional information on the origin of the observed fluctuations may be obtained by the study of the scale dependence of the fluctuation strength. Preliminary results on charge-dependent mean p_t fluctuations as a function of the angular pair separation, $\Delta\phi$, and of the separation in pseudo-rapidity, $\Delta\eta$, will be presented as two dimensional maps, for all the combinations of pairs.

HK 39.6 Mi 15:30 TU MA144

Centrality Dependence of π^-– π^--correlations in Pb+Pb collisions at 40 and 160 AGeV at the CERN SPS* — •C. Alt[1], C. Blume[1], P. Dinkelaker[1], D. Flierl[1], V. Friese[2,3], M. Gazdzicki[1], F. Kramer[1], M. Kliemant[1], S. Kniege[1], I. Kraus[2], B. Lungwitz[1], C. Meurer[1], R. Renfordt[1], A. Richard[1], A. Sandoval[2], T. Schuster[1], R. Stock[1], C. Strabel[1], and H. Ströbele[1] — [1]Institut für Kernphysik, Universität Frankfurt — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Fachbereich Physik der Universität, Marburg

In order to analyse the dependence of hadronic observables on centrality in heavy ion collisions the NA49 experiment collected minimum bias data on Pb+Pb collisions at 40 and 160 AGeV.

The investigation of the momentum correlations of identical bosons (HBT) yields information about the spatial and temporal evolution of the particle emitting source in heavy ion collisions. The dependence of the measured HBT parameters on centrality reflects the freeze-out conditions at various impact parameters. We will present HBT radii in different centrality classes at 40 and 160 AGeV and discuss their relation to model parameters describing the freeze-out process. We observe increasing HBT radii with decreasing impact parameter. This is consistent with the naive picture of a larger source at higher centrality.

* Work supported in part by BMBF and GSI.

HK 39.7 Mi 15:45 TU MA144

Λ Elliptic Flow in Pb+Au Collisions at 158 GeV — •Jovan Milošević for the CERES/NA45 collaboration — Universität Heidelberg, Germany

We present Λ elliptic flow (v_2) measurement from Pb+Au collisions at the highest SPS energy. This is the first elliptic flow measurement of Λ particles below RHIC energies. The data were collected by the CERES experiment which covers narrow mid-rapidity region, but it has full (2π) azimuthal coverage and wide p_T range up to 3.5 GeV/c. This measurement, in particular in comparision to pion elliptic flow, could tests hydrodinamical models and the equation of state used. The value of v_2 as a function of rapidity and transverse momentum of Λ particle is presented, as well as of collision centrality. A non-uniform rapidity dependence of v_2 is a consequence of Λ acceptance. v_2 grows with p_T. Up to ≈ 1.3 GeV/c it is comparable with v_2 values observed with STAR at RHIC, but above it is significantly smaller. Λ elliptic flow also shows a typical centrality dependence. Our measurement is compared with hydrodynamical model calculations.

HK 40 Theorie

Zeit: Mittwoch 14:00–16:00 Raum: TU MA005

Gruppenbericht HK 40.1 Mi 14:00 TU MA005

Nuclear structure calculations of nuclei in the p- and sd-shell — •Thomas Neff[1], Alberto Cribeiro[1], Hans Feldmeier[1], Heiko Hergert[2], and Robert Roth[2] — [1]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [2]Institut für Kernphysik, Technische Universität Darmstadt

The structure of nuclei in the p- and sd-shell is studied in the Fermionic Molecular Dynamics (FMD) approach. No a-priori assumptions about single-particle states or cluster features are made. Many-particle states are given by parity and angular-momentum projected Slater determinants. Projection after variation as well as variation after projection and multiconfiguration calculations in the sense of the generator coordinate method is used. An effective interaction derived from the realistic Argonne V18 interactions by means of an explicit treatment of short-range central and tensor correlations is employed for all nuclei.

The evolution of shell- and cluster properties in He, Be and C isotopes is studied. Spectra, radii, densities and formfactors are calculated and compared to experiment. First calculations of resonances within the FMD approach will be presented.

(1) R. Roth, T. Neff, H. Hergert, H. Feldmeier, Nucl. Phys. **A745**, 3 (2004)
(2) T. Neff, H. Feldmeier, R. Roth, Nucl. Phys. **A738**, 357 (2004)
(3) T. Neff, H. Feldmeier, Nucl. Phys. **A713**, 311 (2002)

HK 40.2 Mi 14:30 TU MA005

Nuclear Structure in the UCOM Framework — •Heiko Hergert[1], Robert Roth[1], Thomas Neff[2], Hans Feldmeier[1,2], Nils Paar[1], and Panagiota Papakonstantinou[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI Darmstadt

The Unitary Correlation Operator Method (UCOM) [1] provides a way to use modern NN-interactions in conjunction with simple many-body states by explicitly handling correlations induced by the strong repulsive core and the tensor force. The correlated interaction V_{UCOM} is by construction phase-shift equivalent to the bare V_{NN} and given in a closed operator representation. Conceptual relations and differences to the renormalization group-based approach of V_{low-k} are discussed. Benchmark calculations using V_{UCOM} in the No-Core Shell Model exhibit a significantly improved convergence due to the prediagonalization caused by the correlation operators.

V_{UCOM} is applied to variational calculations using the Gaussian trial states of Fermionic Molecular Dynamics (FMD), covering the whole nuclear chart up to $A = 60$. Angular momentum projection is performed in order to obtain physical ground states and collective rotational spectra. Other collective excitations are accessible via configuration-mixing calculations or explicit time-evolution. Heavier nuclei are addressed in Hartree-Fock-type calculations (HF, HFB, RPA, etc.).

Work supported by the DFG (SFB 634).

[1] R. Roth, T. Neff, H. Hergert, H. Feldmeier, Nucl. Phys. A745 (2004) 3 (e-print: nucl-th/0406021).

HK 40.3 Mi 14:45 TU MA005

Collective excitation phenomena and beta-decays in exotic nuclei — •Nils Paar[1], Tamara Niksic[2], Peter Ring[2], and Dario Vretenar[3] — [1]TU-Darmstadt — [2]TU-Muenchen — [3]University of Zagreb

The excitation phenomena in unstable nuclei are analyzed in the framework of the relativistic quasiparticle RPA which is extended to include new interactions with density-dependent meson-nucleon couplings. The properties of the pygmy dipole resonance (PDR) are examined within isotopic chains, showing that already at moderate proton-neutron asymmetry the PDR peak energy is located above the neutron emission threshold, resulting with important implications for (gama,gama') experiments and r-process calculations. A method is suggested for determining the size of the neutron skin, based on the difference of the excitation energies of the Gamow-Teller resonance and the isobaric analog state. In addition, the present model is also employed in calculations of beta-decay half-lives of nuclei of the relevance for the r-process.

Work supported in part by DFG.

N. Paar et al., Phys. Rev. C 67, 034312 (2003).
D. Vretenar et al., Phys. Rev. Lett. 91, 262502 (2003).
N. Paar et al., Phys. Rev. C 69, 054303 (2004).
N. Paar et al., nucl-th/0404055, submitted to Phys. Lett. B (2004).

HK 40.4 Mi 15:00 TU MA005

Description of the double beta decay within continuum QRPA — •Vadim Rodin and Amand Faessler — Institut für Theoretische Physik, Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Deutschland

Observation of the neutrinoless double beta decay ($0\nu\beta\beta$) can provide important information on the Majorana nature of the neutrinos and on their absolute mass scale [1]. It is crucial that the determination of the effective Majorana mass from experimental data can be only as good as the knowledge of the nuclear matrix elements $M_{0\nu}$ to which the $0\nu\beta\beta$-decay rates are proportional. Thus, to interpret the data accurately one will need to better understand the nuclear structure effects important for the description of the matrix elements.

In the present work a continuum QRPA (CQRPA) approach is applied for the first time to calculate $0\nu\beta\beta$ and $2\nu\beta\beta$ nuclear matrix elements. Correct description of highly excited nuclear states provided by CQRPA is found to have appreciable effect on high-multipole contribution to $M_{0\nu}$. The calculation results are compared with those [2] obtained recently within the standard QRPA.

[1] A. Faessler and F. Šimkovic, J. Phys. G **24** (1998) 2139
[2] V. A. Rodin, A. Faessler, F. Simkovic and P. Vogel, Phys. Rev. C **68** (2003) 044302

HK 40.5 Mi 15:15 TU MA005

Application of the $V_{low\,k}$ Renormalization Group Method to Hyperon-Nucleon Systems — •Mathias Wagner[1], Bernd-Jochen Schaefer[1], Jochen Wambach[1,2], T.T.S. Kuo[3] und G.E. Brown[3] — [1]Institut für Kernphysik, TU Darmstadt, D-64289 Darmstadt,Germany — [2]Gesellschaft für Schwerionenforschung GSI, D-64291 Darmstadt,Germany — [3]Department of Physics and Astronomy, State University of New York,Stony Brook, NY 11794-3800, USA

In this talk we present results of the $V_{low\,k}$ Renormalization Group (RG) method applied to Hyperon-Nucleon systems. Recently this method has been successfully applied to Nucleon-Nucleon (NN) systems by the Stony Book group. They obtained a unique low momentum NN potential.

We start with a brief introduction to $V_{low\,k}$ and explain the basics of the method. In the following we apply the method to the YN-systems, using realistic Nijmegen Hyperon-Nucleon potentials as starting point. Although the Nijmegen models are quite different we also see a convergence to a unique YN $V_{low\,k}$.

HK 40.6 Mi 15:30 TU MA005

Ab initio calculation of the ^{4}He system — •Martin Trini[1], G.M. Hale[2], and H.M. Hofmann[1] — [1]Institute for Theoretical Physics III, University of Erlangen-Nuernberg, 91058 Erlangen, Germany — [2]Los Alamos National Laboratory, Los Alamos, NM 87544, USA

We report on a consistent, microscopic calculation of the bound and scattering states in the ^{4}He system. The calculations are done in the framework of the resonating group model with realistic two- and three-nucleon potentials. We compare the calculated phase shifts to a recent R-matrix analysis and to data. In addition radiative capture reactions leading to ^{4}He are calculated in the long wave-length limit and compared to recent data. The overall agreement is very good. To improve on the three-nucleon forces we call for new experiments.

HK 40.7 Mi 15:45 TU MA005

Eigenschaften des Spektrums entlang der O(6)-U(5) Trajektorie des sd-IBM-1 — •St. Heinze[1], P. Cejnar[2] und J. Jolie[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut of Particle and Nuclear Physics, Charles University

Entlang dieser Trajektorie existiert eine zusätzliche O(5)-Symmetrie. Die zugehörige Quantenzahl ist die Seniorität. Spektren zu verschiedenen O(5)-Quantenzahlen sind sehr einfach Strukturiert. Dies ist überaschend, da auf der O(6)-U(5) Trajektorie ein Phasenübergang zweiter Ordnung zu finden ist. Es werden verschiedene spektrale Eigenschaften gezeigt und die Verteilung der Verzweigungspunkte des Quantenhamiltonians untersucht. Diese Verteilung wird mit der eines Phasenübergangs erster Ordnung verglichen und eine Verbindung zwischen thermodynamischen und Quantenphasenübergängen plausibel gemacht.

HK 41 Instrumentation und Anwendungen

Zeit: Mittwoch 14:00–16:00 Raum: TU MA041

HK 41.1 Mi 14:00 TU MA041

First Front-end Electronics Integration Test Results of the ALICE TRD — •Marcus Gutfleisch for the ALICE TRD collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg, Heidelberg, Germany

The Transition Radiation Detector (TRD) of ALICE incorporates 1.2 million channels which are individually read out and processed. This is accomplished by highly integrated full custom front-end electronics containing an analog preamplifier and shaper (PASA) and a mixed-signal chip performing event buffering and local tracking (TRAP). Both chips are combined on small multi-chip modules (MCM). 65664 of these will be integrated on the detector.

The main task of the TRAP chip is online pattern recognition of segments of particle tracks (tracklet). It contains four CPUs and a tracklet preprocessor. To improve tracking resolution a digital filter is implemented performing nonlinearity, baseline and gain correction, signal symmetrisation (tail cancellation) and crosstalk suppression. The low power 10 Bit 10 MHz ADCs are integrated on the chip.

Tracklet information and raw data is shipped by an 8 Bit 120 MHz double data rate network interface merging its own data and that of neighboring TRAP chips into a common data stream which is organized in a tree structure.

Results of a first integration test under beam conditions using a six layer detector stack with 128 data taking and 11 merging MCMs at the Proton Synchrotron (PS) at CERN are presented.

This project is supported by the BMBF (06HD9551).

HK 41.2 Mi 14:15 TU MA041

New Test Results for the ALICE High Level Trigger — •Timm M. Steinbeck, Heinz Tilsner, and Volker Lindenstruth for the ALICE collaboration — Kirchhoff Institut für Physik, Ruprecht-Karls-Universität Heidelberg, Im Neuenheimer Feld 227, D-69120 Heidelberg, Germany

The ALICE heavy-ion experiment's High Level Trigger (HLT) will consist of a PC cluster with 400 to 500 nodes. Approximately 250 of these will receive data produced by front-end electronics in the detectors via the DAQ system. Further data which is derived by the HLT from its input data can be sent to DAQ in addition to the detectors' data. In the HLT processing cluster the data is transported by a fault tolerant data transport software framework that easily allows to construct different data flow configurations in the HLT. This software and the two interfaces to the DAQ system for receiving and sending have been tested and used in several scenarios. Results will be presented of three of these scenarios: Two testbeam participations as well as one larger scale integration test of TPC and DiMuon detector specific HLT software components. Work on the ALICE High Level Trigger has been financed by the German Federal Ministry of Education and Research (BMBF) as part of its program "Förderschwerpunkt Hadronen- und Kernphysik - Großgeräte der physikalischen Grundlagenforschung".

HK 41.3 Mi 14:30 TU MA041

Cinderella: an Online Filter for the COMPASS experiment † — •Thiemo Nagel, Annemarie Dinkelbach, Jan Friedrich, Roland Kuhn, Stephan Paul, and Lars Schmitt — TU München, Physik Department E18

In the 2004 COMPASS beam time, for the first time the Cinderella Online Filter (2$^{\text{nd}}$-level trigger) was used in production. By partially removing 1$^{\text{st}}$-level trigger impurities, the limited storage and bandwidth are utilized better, allowing to take more physics data. The ability to reconstruct a beam track is demanded when filtering muon data, while for hadron data, track multiplicities in hodoscopes and silicon microstrip detectors are used for event selection.

Data reduction of 25% of undesired events is achieved at loss of less than 1% of useful data. The workload of ∼5000 events per second is processed on a cluster with 26 CPUs in parallel.

† This work is supported by the BMBF and the Maier-Leibnitz-Labor, Garching.

HK 41.4 Mi 14:45 TU MA041

Prototype of a Dedicated Multi-Node Data Processing System for Realtime Trigger and Analysis Applications — •Daniel Kirschner, Marco Destefanis, Ingo Fröhlich, Camilla Gilardi, Wolfgang Kühn, Francesca Ottone, Vladimir Pechenov, and Tiago Perez for the HADES collaboration — II. Phys. Inst. Giessen, Heinrich-Buff-Ring 14, 35392 Giessen

Modern experiments in hadron physics like the HADES detector at GSI-Darmstadt produce a large amount of data that has to be distributed, stored and analyzed. Analysis of this data is very time consuming due to the large amount of data and the complex algorithms needed. This problem can be addressed by a dedicated multi-node and multi-CPU computing architecture interconnected by Gigabit-Ethernet. Dedicated hardware has the advantages over "Grid-Computers" in skaleability, price per computational unit, predictability of time behavior (possibility of real time applications) and ease of administration. Gigabit-Ethernet provides an efficient and standardized infrastructure for data distribution. This infrastructure can be used to distribute data in an experiment as well as to distribute data in a multi-node computing environment. The prototype VME-Bus card has of two major units: a network unit featuring two Gigabit Ethernet over Copper connections and a computational part featuring a TigerSHARC Digital Signal Processor. The discussion will concentrate the real-life performance of Gigabit Ethernet as the main topic. Supported by: BMBF 06 GI 144, BMBF 06 GI 145.

HK 41.5 Mi 15:00 TU MA041

Performance of the HADES Tracking System in experiment and simulation — •Yvonne Pachmayer for the HADES collaboration — Institut für Kernphysik, Univ. Frankfurt, Germany

The High Acceptance Di-Electron Spectrometer (HADES) operational at GSI is designed to study electron pair emission in collisions of heavy ions and elementary reactions in the 1-2 AGeV incident energy range. Good invariant mass resolution or equivalently high momentum resolution require a high precision tracking system. The pair detection efficiency is maximized by covering polar angles from 18^o to 85^o and practically the full azimuth. The tracking system is composed of 24 low-mass, high-granular multiwire drift chambers, which provide an active area of $30m^2$ and are positioned before and after the magnetic field. The low-mass constraint on the active area is ensured by using Helium-based gas mixtures and Aluminum cathode and field wires. It will be demonstrated that the design goal of 150 μm for the intrinsic spatial resolution compares well with the results from in-beam data from C+C and p+p collisions.

HK 41.6 Mi 15:15 TU MA041

FPGA based Pre-/Coprocessors for the ALICE HLT — •Torsten Alt and Volker Lindenstruth for the ALICE collaboration — Kirchhoff-Institute of Physics, University of Heidelberg

The Time Projection Chamber (TPC) of the ALICE experiment is one of its main tracking detectors. It produces up to 75 MByte of compressed raw data per event. If the raw data is stored directly to tape, the tape bandwidth of 1.25 GByte/s limits the event rate to 20 Hz. In order to achieve higher rates or to trigger on specific events the raw data needs to be processed online (compression/selection), thereby reducing the data volume significantly without losing physical information.
This processing is done by a cluster of commodity PCs, the High Level Trigger (HLT). To access the raw data dedicated nodes of the HLT are equipped with PCI-cards which receive the data via optical links, the so called Detector Data Link (DDL). Each of the cards possesses an FPGA, a programmable device, which allows processing of the data in customized hardware. In preprocessor mode the raw data is processed and the result is written directly to the main memory of the node. In coprocessor mode the data is read from the main memory, processed and rewritten to the memory. By using FPGAs the processing logic can be adapted to different requirements and reprogrammed within a few milliseconds. In addition to the physical motivation and the principles of FPGA pre-/coprocessors an ALICE specific algorithm, the ClusterFinder, is introduced.

HK 41.7 Mi 15:30 TU MA041

Improving on FPGA Radiation Tolerance — •Gerd Tröger and Udo Kebschull for the ALICE collaboration — Kirchoff-Institut für Physik, Universität Heidelberg

In recent years, FPGAs have become an alternative to ASICs for experiment electronics due to their computational power, flexibility and cost efficiency. However, SRAM-based FPGAs are even more sensitive to irradiation than other electronics. Several methods for compensation exist (expensive flash technology, redundancy, bit-scrubbing).

We will present results from irradiation tests of Xilinx Virtex-II Pro devices performed at the cyclotrons in Oslo and Uppsala, comparing them to previous tests of Altera APEX devices. Adding a simple repair technique called 'bit-scrubbing', which is using the active partial reconfiguration feature of the Virtex FPGAs, shows promising improvements. In combination with classical redundancy methods we can demonstrate improvements in radiation tolerance by an order of magnitude.

HK 41.8 Mi 15:45 TU MA041

New Pion Beam Detectors for HADES — •B. Spruck for the HADES collaboration — 2. Physikalisches Institut, Universität Gießen

One of the upcoming experiments with HADES will be the study of pion induced reactions. The quality of the secondary π^- beam was investigated in a test beam time in may 2004. A scintillating fiber X/Y array of 1mm granularity was used to measure the beam dimension near the target position. The momentum of an individual pion is determined by its position in the dispersive plane behind the first dipol in the beam line, obtained from two plastic scintillator hodoscopes with 1cm broad rods. With this granularity the hodoscopes will not cope with the expected high secondary beam intensities. Based on the design of the fiber beam monitor two new hodoscopes are being developed consisting of 64 2mm fibers read out with multianode photomultipliers on both sides. The results of the commissioning beam time and the progress on the new pion trackers will be presented.
*This work is supported by BMBF and GSI

HK 42 Instrumentation und Anwendungen

Zeit: Mittwoch 14:00–16:00 Raum: TU MA042

Gruppenbericht HK 42.1 Mi 14:00 TU MA042

Status der Entwicklungen am S-DALINAC* — •M. Brunken[1], A. Araz[1], W. Ackermann[1], W. Bayer[1], J. Enders[1], H. Genz[1], M. Goypch[1], H.-D. Gräf[1], M. Hertling[1], C. Hessler[1], G. Iancu[1], U. Laier[1], M. Kunze[2], W. F.O. Müller[2], C. Nowak[1], O. Pataklakha[1], M. Platz[1], Y. Poltoratska[1], A. Richter[1], M. Roth[1], B. Steiner[2], S. Watzlawik[1], T. Weiland[2] und J. Zwarych[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt, Germany — [2]Institut Theorie Elektromagnetischer Felder, Technische Universität Darmstadt, Schlossgartenstraße 8, 64289 Darmstadt, Germany

Wir werden Ergebnisse der letzten Entwicklungsarbeiten am supraleitenden Darmstädter Elektronenlinearbeschleuniger S-DALINAC präsentieren. Ein neues Kontrollsystem, das auf dem industriellen CAN-Bus Standard basiert, erlaubt eine einfache Ansteuerung der für die Strahlführung benötigten verschiedenartigen Geräte. Zur Erhöhung der Energie und der Intensität des supraleitenden Injektor-Beschleunigers wurden neue HF-Koppler entwickelt. Zurzeit werden Wanderwellenverstärker getestet, die eine Möglichkeit bieten, bisher eingesetzte Klystren zu ersetzen. Darüberhinaus werden Ergebnisse der Entwicklung einer neuen Quelle polarisierter Elektronen diskutiert. * Gefördert durch die DFG im Rahmen des SFB 634 und des GRK 410

HK 42.2 Mi 14:30 TU MA042

Ein Niederenergie-Photonen-Tagger am S-DALINAC — •K. Lindenberg, J. Hasper und A. Zilges — Institut für Kernphysik Darmstadt, D-64289 Darmstadt

Die Feinstruktur der Dipolstärke oberhalb der Neutronenschwelle ist nicht nur für das allgemeine Verständnis zur Kernstruktur nahe des Kontinuums wichtig, sondern auch ausschlaggebend für astrophysikalische (γ,n)-Reaktionsraten bei der Nukleosynthese schwerer Kerne. Am Darmstädter supraleitenden Elektronenbeschleuniger wird ein Photonen-Tagger installiert, der bei einer Primärstrahlenergie von $E_0 = 30$ MeV getaggte Photonen im Bereich von $E_\gamma = 10$ bis 20 MeV liefert. Die geplante Energieauflösung beträgt $\Delta E = 25$ keV bei einer Photonenenergie von $E_\gamma = 10$ MeV. In diesem Vortrag werden die experimentellen Anforderungen und die entsprechenden Realisierungen diskutiert. Es wird auf das erwartete Spektrum der Bremsstrahlung, auf die Fokussiereigenschaften des verwendeten Magneten und auf die Detektorelemente in der Fokalebene eingegangen. * Gefördert durch die DFG (SFB 634)

HK 42.3 Mi 14:45 TU MA042

The feasibility of in-beam PET for therapeutic beams of ^{3}He — •F. Fiedler, K. Parodi und W. Enghardt — Forschungszentrum Rossendorf e. V., Postfach 51 01 19, D-01314 Dresden

At the clinical heavy ion treatment facility, which is under construction in Heidelberg, beams of He will be used for tumor irradiation. These will be monitored by means of in-beam PET for quality assurance. This requires a precise knowledge of the spatial distribution of beam induced positron emitters in the irradiated volume. For this an experiment at the Gesellschaft für Schwerionenforschung (GSI) with three mono-energetic ^{3}He-beams of 130.03 $AMeV$ to 207.92 $AMeV$ and mean intensities varying from $2.0 \cdot 10^8$ to $3.5 \cdot 10^8$ ions/s has been carried out. The beams were stopped in homogeneous thick targets consisting of lucite, graphite and gelatine, which were placed in the center of the field of view of the PET-scanner at the experimental carbon ion therapy at GSI [1]. Results on the production rate and the spatial distribution of ^{3}He ion induced β^+-activity will be presented. From these, the accuracy and resolution for determining the range of the ^{3}He primary beams is deduced. Furthermore, energy dependent cross sections for different reaction channels leading

to positron emitters will be estimated from the experimental data.
[1] W. Enghardt et al., Nucl. Instr. Meth A 525 (2004) 284-288

HK 42.4 Mi 15:00 TU MA042

High Speed Neutron Radiography and Tomography — •H. Ballhausen[1,2], H. Abele[1,2], F. Descamps[2], M. Engelhardt[3,2], R. Gähler[2], and A. Hillenbach[1,2] — [1]Universität Heidelberg, Physikalisches Institut, Philosophenweg 12, D-69120 Heidelberg — [2]Institut Laue Langevin, 6 rue Jules Horowitz, F-38042 Grenoble — [3]Technische Universität München, James-Franck-Strasse, D-85748 Garching

The NEUTROGRAPH experiment offers dynamic neutron radiography and tomography. It is located at one of the highest flux beam lines of the ILL in Grenoble. The setup allows exposure times of a millisecond for real time footage and of some ten microseconds for stroboscopic imaging. With optional collimation, time resolution can be traded for a higher spatial resolution of some ten micrometers. Applications are visualisations of running car engines, fuel injection, hydrogen fuel cells, fossiles, for example.

HK 42.5 Mi 15:15 TU MA042

Untersuchung von Smith-Purcell Strahlung im fernen infraroten Wellenlängenbereich am MAMI — •W. Lauth, H. Backe, H. Mannweiler, H. Rochholz, K. Aulenbacher, N. Clawiter, M. El Ghazaly, K.-H. Kaiser, G. Kube, F. Schwellnus, V. Tioukine, T. Weber und J. Zausch — Institut für Kernphysik der Universität, D-55099 Mainz

Am Injektor-Linac des Elektronenbeschleunigers MAMI wurden Experimente zur Erzeugung von Strahlung mit Wellenlängen zwischen 100 μm und 1 mm durchgeführt mit dem Ziel, einen Freie-Elektronenlaser auf der Basis des Smith-Purcell Effektes zu entwickeln. Smith-Purcell Strahlung wird erzeugt, wenn ein geladenes Teilchen in der Nähe einer periodischen, leitenden Struktur vorbeifliegt. Neuartige intensive Strahlungserzeugung im Infrarotbereich ist wegen des Mangels an kompakten, durchstimmbaren Strahlungsquellen von Interesse. Der experimentelle Aufbau besteht aus einem metallischem Rechteckgitter, an dem ein Elektronenstrahl mit einer Energie von 1.44 MeV und 3.41 MeV vorbeigeführt wird. Das 200 mm lange Gitter steht in einem longitudinalen, homogenen Magnetfeld von 5 T. Die erzeugte Strahlung wird über Spiegel ausgekoppelt und mit einem Si-Bolometer nachgewiesen. Es wurden Experimente mit Gitterperioden von 1.41 mm, 7 mm und 14 mm durchgeführt. Für Wellenlängen größer als 300 μm kann die erzeugte Strahlung mit der kohärenten Emission des Elektronenbunches erklärt werden. Für kürzere Wellenlängen lag die Intensität unterhalb der Nachweisgrenze des Bolometers. Die experimentellen Ergebnisse werden mit theoretischen Berechnungen, die eine spontane Verstärkung der Strahlung (SASE) vorhersagen, verglichen.

HK 42.6 Mi 15:30 TU MA042

Modellierung von Spektrometerabbildungen mit Splines, Bestimmung mit Drei-Körper-Reaktionen — •Jan C. Bernauer für die A1-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, 55099 Mainz

Die 3-Spektrometeranlage der Kollaboration A1 des Instituts für Kernphysik der Universität Mainz ist neben dem Elektronenbeschleuniger MAMI das instrumentelle Herz der durchgeführten Experimente mit virtuellen Photonen. Für eine exakte Messung müssen die Abbildungen der Magnetoptiken sehr gut parametrisiert sein, um von den gemessenen Koordinaten auf die Koordinaten in der Fokalebene der Spektrometer Koordinaten am Reaktionsort zurückschließen zu können.

Der Vortrag beleuchtet im ersten Teil die Theorie einer Spline-basierten Modellierung der Spektrometerabbildung und die Vorteile gegenüber einer Taylorentwicklung. Im zweiten Teil wird eine neuartige Bestimmungsmethode mit Hilfe von Drei-Körper-Reaktionen vorgestellt. Den Abschluß bildet eine kurze Übersicht über die erreichten Verbesserungen.

HK 42.7 Mi 15:45 TU MA042

Investigation of Axial Channelling of 600 MeV Electrons in Silicon Single Crystals at the Mainz Microtron MAMI — •H. Backe, W. Lauth, A. Rueda, M. El Ghazaly, P. Kunz, and T. Weber — Institut für Kernphysik der Universität, D-55099 Mainz

The flux of electrons impinging on a single crystal close to an axial channel is redistributed in transverse energy and impact parameter due to multiple scattering which results either in bound trajectories of spiral type or chaotic unbound motion of the electrons in the two dimensional potential energy surface of the crystal. To study these motions in more detail we initiated experiments at the Mainz Microtron MAMI which are based on the measurements of the 1.74 keV characteristic X-ray yields after K-shell ionization. The small absorption length of 12.2 μm for the K X-rays allows insight into the channelling process directly at the exit interface of the crystal even if the electron traversed a rather thick layer. A surprisingly large enhancement of the K X-ray yield has been observed at channelling of 600 MeV electrons along the [100] strings of silicon indicating small impact parameters and a rapid dechanneling. In addition, a very strong enhancement of intensity at a photon energy of 60 keV was observed with a CdZnTe detector positioned in forward direction which might be explained by synchrotron radiation like emission at deflection of the electrons in their chaotic unbound motion.

Work supported by Deutsche Forschungsgemeinschaft DFG under contract BA 1336/1-3.