HK 9 Elektromagnetische und Hadronische Sonden

Zeit: Montag 16:30–18:45 Raum: G

Gruppenbericht

HK 9.1 Mo 16:30 G

Physics with WASA at COSY — •Magnus Wolke for the WASA-at-COSY collaboration — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany

The physics programme for WASA at COSY focuses on the fate of fundamental symmetries and symmetry breaking patterns in hadronic systems, to extend our knowledge of aspects of QCD in the non–perturbative regime. Precision studies of η and η' decays and dedicated production experiments in isospin filtering reactions provide proper tools, and will be the key experiments of the new experimental facility at COSY Jülich.

Isospin symmetry breaking is probed by pseudoscalar decays that vanish in the chiral limit, i.e. decays $\eta' \to 3\pi$ allow to derive the light *up–down* quark mass difference. Charge symmetry breaking few–nucleon reactions like $dd \to \alpha\pi^0$ involve the same quark mass term, and can be studied exclusively at COSY. Radiative η and η' decays to $\gamma\gamma$ and $\pi^+\pi^-\gamma$ are determined by the anomalous behaviour of the QCD effective action under chiral transformation, reproduced in the Wess–Zumino–Witten Lagrangian. Higher order terms are expected to contribute to the non–resonant part of the $\pi^+\pi^-\gamma$ decay modes, but have not been unequivocally confirmed experimentally. CP symmetry in flavour conserving processes will be probed in the semileptonic decay $\eta \to \pi^+\pi^-e^+e^-$, and a search sensitivity of the Standard Model prediction is aimed at in a test of C violation for $\eta \to \pi^0e^+e^-$.

The physics programme with WASA at COSY is introduced and the road map of the project towards first data taking beginning of 2007 is outlined.

HK 9.2 Mo 17:00 G

Status of Two-Pion Production studies at CELSIUS-WASA* — •F. Kren, M. Bashkanov, H. Clement, E. Doroshkevich, O. Khakimova, T. Skorodko, and G. J. Wagner for the CELSIUS-WASA collaboration — Physikalisches Institut, Universität Tübingen

Data for the $\pi\pi$ production in pp and pd collisions have been taken at CELSIUS using the WASA 4π detector with pellet target in the energy range from near-threshold up to 1.45 GeV. In most cases all ejectives have been detected and identified providing up to 6 kinematical overconstraints.

Wheras the near-threshold data for $pp\pi^+\pi^-$ and $pp\pi^0\pi^0$ channels are consistent with chiral dynamics and Roper excitation and its decay, the data for $T_p > 1$ GeV are dominated by the special $(\Delta\Delta)_{0+}$ configuration - contrary to predictions. In addition the $M_{\pi^0\pi^0}$ spectrum exhibits a suprising enhancement at small masses reminiscent of Bose-Einstein correlations. Preliminary results from the $nn\pi^+\pi^+$ channel, however, are not in favor of such a scenario. First results on the $\pi\pi$ isovector channels $pp\to d\pi^+\pi^0$ and $pp\to pn\pi^+\pi^0$ will be presented.

The first channels analysed in case of pd collisions are $^3He\pi^+\pi^-$ and $^3He\pi^0\pi^0$. We again find a strong enhancement at low $\pi\pi$ masses, in the $\pi^0\pi^0$ channel much more pronounced than in the $\pi^+\pi^-$ channel. In the final run before the shutdown of CELSIUS data for $dd\to{}^4He\pi\pi$ have been taken.

* supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg), Landesforschungsschwerpunkt (Quasiteilchen) and EU FP6 transnational access program

HK 9.3 Mo 17:15 G

π^0 and π^- production in NN collisions at $T_N \geq$ 0.8 GeV — •O. Khakimova, T. Skorodko, H. Clement, M. Bashkanov, F. Kren, and G. J. Wagner for the CELSIUS-WASA collaboration — Physikalisches Institut, Universität Tübingen

As a side aspect of our $\pi\pi$ production program we have measured and analyzed the single pion production reactions $pp \to pp\pi^0$ in the energy range 0.8 GeV $\leq T_p \leq$ 1.1 GeV and $pd \to p_{spectator}pp\pi^-$ at $T_p = 895MeV$. In this energy range the world data base on differential cross sections is still quite sparse. The data have been taken at CELSIUS using the WASA 4π detector with pellet target system. The particle identification in the Forward Detector is done using the energy loss of the charged particles in the different layers of the Forward Trigger and Forward Range Hodoscopes. The π^0 identification in the Central Detector is done by reconstruction the $M_{\gamma\gamma}$ spectrum. The π^- identification in the Central Detector has been made by magnetic field tracking and E-p method using the signal in the Scintilator Electromagnetic Calorimeter(SEC) and in the Mini Drift Chamber(MDC). At the considered beam energies the cms excess energies are very well matched to Δ-excitation in one of the nucleons. Indeed, the $pp\pi^0$ data are in accord with the π^0 production processing exclusively via Δ^+-excitation. In contrast the $pp\pi^-$ data show only a small influence of Δ^0-excitation pointing to a strong dominance of the isoscalar component in the incident channel. * supported by BMBF (06 TU 201), DFG (Europ. Graduiertenkolleg) and EU FPG transnational access program

HK 9.4 Mo 17:30 G

Single Pion Productions at 400 MeV: agreements and disagreements with previous results — •E. Doroshkevich, H. Clement, K. Ehrhardt, A. Erhardt, and G.J. Wagner for the COSY-TOF collaboration — Physikalisches Institut, Uni. Tuebingen

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 950 MeV/c ($T_p = 397MeV$) by using the short version of the TOF spectrometer. Particle identification and 4-momenta of charged particles have been obtained by measurements of ToF, E and pixel coordinates. Neutron detection with an efficiency of about 30% has been achieved by a hit in the calorimeter accompanied with no hits in the preceding fiber and quirl hodoscope layers.

Whereas the $pn\pi^+$ channel is strongly influenced by Δ excitation it is heavily suppressed in the $pp\pi^0$ channel. For the $pn\pi^+$ channel our data agree with previous PROMICE/WASA data [1]. But for the $pp\pi^0$ channel our data for angular distributions, in particular for π^0, disagree substantially from PROMICE/WASA data [2] and from the prediction of IUCF phase shift results [4]. Our data, however, agree with CELSIUS-WASA results [3] as well with predictions of Hanhart et.al. [5], which differ from the IUCF phase shifts in the Δ-dependent Pp waves.

[1] R. Bilger et al., Phys. Lett. **B446** (1999) 179
[2] R. Bilger et al., Nucl. Phys. **A693** (2001) 633
[3] S.Keleta Licentiate Thesis 2004
[4] H.O.Meyer et.al.Phys.Rev. C**63**(2001)064002, C**65**(2002)024003
[5] P.Deepak, J.Haidenbauer, C.Hanhart Phys.Rev.C**72**(2005)024004
* - supported by BMBF(06TU201), Eur.Grad.Kolleg, COSY-FFE

HK 9.5 Mo 17:45 G

Measurement of $pp \to pK^0\pi^+\Lambda$ at ANKE. — •Mikhail Nekipelov for the ANKE collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

A study of the reaction $pp \to pK^0\pi^+\Lambda$ at the incident beam momentum of $p_p = 3.65$ GeV/c has been performed at the ANKE magnetic spectrometer at COSY-Jülich. This channel has received some interest in connection with the presumed pentaquark $\Theta^+(1530)$. At ANKE the analysis of this reaction is based on the coincident detection of four charged particles: two protons, and positively and negatively charged pions. Both K^0 and Λ have been identified and the $\pi^+\Lambda$ missing mass distribution was built. In the talk details of the data analysis will be discussed and the final results will be presented.

HK 9.6 Mo 18:00 G

Study of hyperon and kaon production dynamics and their interaction with nucleons at COSY-11 — •Dieter Grzonka for the COSY-11 collaboration — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany

Results of investigations on the production of Λ and Σ hyperons and kaons in the collisions of nucleons will be presented. These studies aim for the determination of the production dynamics as well as the hadronic YN and KN interaction. Emphasis will be put on recent results of the K^+K^- meson pair and Σ^+ hyperon production.

Conclusions will be based on the comparison of close-to-threshold excitation functions for the reactions $pp \to p\Lambda K^+$, $pp \to p\Sigma^0K^+$, $pp \to nK^+\Sigma^+$, and $pp \to ppK^+K^-$ with predictions assuming the kinematically available phase space to be homogeneously populated. The data indicate that the Σ^0 hyperon interacts with a proton much weaker than the Λ or the Σ^+. The excitation functions for the above mentioned reactions have been determined using the COSY-11 detection system, which permits to study the creation of mesons and hyperons very close to the kinematical threshold: down to a fraction of MeV in the excess energy.

Supported by FZ-Jülich, DAAD, and EU (FP6 HadronPhysics).

HK 9.7 Mo 18:15 G

Hyperonproduktion in *pp*-Stößen bei Überschussenergien von ca. 150 MeV* — •Leonhard Karsch, K.-Th. Brinkmann, J. Dietrich, S. Dshemuchadse, H. Freiesleben, R. Jäkel, M. Schulte-W., W. Ullrich und R. Wenzel für die COSY-TOF-Kollaboration — TU Dresden, Institut für Kern- und Teilchenphysik

Das Flugzeitspektrometer COSY-TOF im Forschungszentrum Jülich zeichnet sich durch seine große Winkelüberdeckung aus. Es erlaubt die Messung von Flugzeit und -richtung aller langlebigen geladenen Teilchen aus *pp*-Reaktionen, die im Laborsystem vorwärts emittiert werden.
In *einer* Strahlzeit wurden die vier Kanäle der assoziierten Strangenessproduktion $pp \to pK^+\Lambda$, $pK^+\Sigma^0$, $pK^0\Sigma^+$ und $nK^+\Sigma^+$ bei zwei Strahlimpulsen (p_{beam}=2,95 und 3,2 GeV/c) untersucht und dafür totale Wirkungsquerschnitte bestimmt. Für die Reaktionen ohne Neutron im Ausgangskanal sind auch differentielle Observablen zugänglich. Ein Vergleich der Daten ist dadurch mit erhöhter Präzision gegenüber unabhängigen Einzelmessungen möglich.
Die Ergebnisse werden mit Aussagen von Mesonenaustauschmodellen verglichen. Es zeigt sich, dass erst die Beschreibung differentieller Observablen, z.B. Winkelverteilungen und die invariante Masse des KΣ-Subsystems, eine Möglichkeit bietet, verschiedene Modelle zu unterscheiden.
* gefördert durch BMBF und FZ Jülich

HK 9.8 Mo 18:30 G

Fermi motion effects in K^+A elastic scattering based on K^+N phase shifts — •Hugo F. Arellano[1] and H. V. von Geramb[2] — [1]Physics Department - FCFM, University of Chile, Av. Blanco Encalada 2008, Santiago, Chile — [2]Theoretische Kernphysik, Universität Hamburg, Luruper Chaussee 149, D-22761, Hamburg, Germany

The role of the nuclear Fermi motion and its implied off-shell effects is discussed within a microscopic description for K^+-nucleus elastic scattering. Emphasis is made on the use of K^+N bare potentials which reproduce the available phase-shift data. To this effect we have generated Gel'fand-Levitan-Marchenko real and local inversion potentials constrained to current K^+N phase shifts analyses from the NDC Data Analysis Center [1]. These potentials, supplemented with a short range non-Hermitian separable term, provide an exact representation of the unitary and non-unitary S matrices. The resulting effective interaction, in the form of the free-space off-shell t matrix, is then convoluted with the target ground state as prescribed by the full-folding optical model approach for K^+A scattering [2]. Applications to elastic collisions of K^+ from light closed-shell nuclei in the 400-1000 MeV/c momentum range are presented and results are discussed.
[1] R. A. Arndt *et. al*, http://gwdac.phys.gwu.edu/
[2] H. F. Arellano and H. V. von Geramb, Phys. Rev. C 72, 025203 (2005)
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