HK 29: Elektromagnetische und Hadronische Sonden

Zeit: Mittwoch 14:15–16:30 Raum: A

HK 29.1 Mi 14:15 A

Precision measurement of the proton charge radius with elastic electron scattering* — •I. Pysmenetska, P.von Neumann-Cosel, S. Rathi, A. Richter, G. Schrieder, and A. Shevchenko — Institut für Kernphysik, Technische Universität Darmstadt

A precise measurement of the proton charge radius is an old, but still open problem. Interest is renewed by extremely precise Lamb Shift measurements [1] requiring higher-order QED corrections for their interpretation depending on the proton charge radius. Existing measurements show a considerable scattering of results. A new precision experiment using elastic electron scattering is now in preparation at the S-DALINAC, where backscattered protons instead of the electrons will be measured. This new method has many advantages. For example, one can measure range of momentum transfers with a single setup, thereby avoiding normalization problems. Recent test measurements demonstrate the feasibility of such a kind of experiment, but at the same time show several problems to be solved first. Preliminary results and conclusions are discussed.

[1] S.G.Karshenboim, Can. J. Phys. 77 (1999) 241

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HK 29.2 Mi 14:30 A

Measurement of the Neutron Electric Form Factor (G_e^n) with polarized ^{3}He at MAMI. — •Brice Alan Ott for the A1-Collaboration — Physikalisches Institut der Universität Tübingen

Polarized ^{3}He can be used as polarized neutron target due to its special spin structure. At an appropriate kinematics both proton spins couple preferentially to zero. The best kinematical choice is the region on top of the quasielastic peak where several neutron form factor (G_e^n) measurements at MAMI were performed. Double polarization experiments with the detection of both, the scattered electron and the knock-out neutron, are particularly sensitive to G_e^n. However, corrections must be applied to extract information about G_e^n at small Q^2, Final State Interaction and Meson Exchange Currents.

Results for G_e^n at Q^2=0.25 and Q^2=0.15 (GeV/c)^2 will be shown.

HK 29.3 Mi 14:45 A

Recent results in the dispersion-theoretical analysis of the nucleon form factors — •Maxim Belushkin, Hans-Werner Hammer, and Ulf Meissner — Helmholz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, Bonn, 53115 Germany

Dispersion relations provide a powerful nonperturbative tool to analyse the form factors of the nucleon for all momentum transfers. Constraints from meson-nucleon scattering, unitarity, and perturbative QCD can be included in a straightforward way. In particular, we include the 2π, $\rho\pi$ and the $K\bar{K}$ continua as independent input in our analysis, and provide errors bands on the results. We have explored two methods for including asymptotic constraints from perturbative QCD, and have analysed the world data on all four form factors in both the space- and the time-like regions simultaneously. Moreover, we have extracted the nucleon radii and the meson-nucleon coupling constants for the ω and the ρ mesons. For the radii, we generally find a good agreement with other determinations, with the exception of the electric charge radius of the proton.

HK 29.4 Mi 15:00 A

Bestimmung der Pion-Polarisierbarkeiten im COMPASS-Experiment $\hat{}$*$ — •Anna-Maria Dinkelbach, Jan Friedrich, Roland Kuhn, Stephan Paul, Sergei Gerassimov, Bernhard Ketzer, Quirin Weitzel, Igor Konorov, Sebastian Neubert, Stefanie Grabmüller, Thiemo Nagel und Florian Haas — TU-M\"unchen, Physik Department E18

Das COMPASS Experiment (CERN NA58) hat in einer dreiw\"ochigen Pilotstrahlzeit Ende 2004 mit einem negativ geladenem 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 pr\"asentieren den Messaufbau sowie den Status der laufenden Analysen. $\hat{}$*$Diese Arbeit wird unterst\"utzt vom BMBF and dem Maier-Leibnitz-Labor, Garching.

HK 29.5 Mi 15:15 A

Pionic deuterium — Dimitrios Anagnostopoulos[1], Daniel Covita[2], Hubert Gorke[3], Detlev Gotta[3], Alexander Gruber[4], Albert Hirtl[4], Paul Indelicato[5], Eric-Olivier Le Bigot[5], Johann Marton[4], Mikhael nekipelov[3], Joaquim dos Santos[2], Philipp Schmid[4], Sophie Schlesser[5], Leopold Simons[6], •Thomas Strauch[3], Joao Veloso[2] und Johann Zmeskal[4] — [1]Univ. Ioannina, Greece — [2]Univ. Coimbra, Portugal — [3]IKP,FZ Jülich — [4]Stefan Meyer Inst., Wien — [5]Lab. Kastler-Brossel, Univ. Paris VI — [6]PSI, Villigen

Data taking of the project PIONIC HYDROGEN has been completed with a high statistics study of the strong–interaction effects by measuring the $K\beta$ X–radiation in πD. The πD hadronic shift will provide a constraint for πN isospin scattering lengths extracted from the πH measurement. In addition, as an outstanding case in charged pion–nucleon interactions the shift is very sensitive to isospin-breaking corrections owing to the almost complete cancellation of the pion–proton and pion–neutron scattering lengths. Secondly, the hadronic width is directly related to pion production processes at threshold, which is subject of continuing theoretical efforts within the framework of Chiral Perturbation Theory. The measurement was performed at the Paul Scherrer Institut, Switzerland, using the cyclotron trap and a high–resolution Bragg crystal spectrometer. By measuring the density dependence cascade effects can be identified and corrected in order to allow an unambiguous determination of the strong–interaction effects. First results of the new πD experiments will be discussed.

HK 29.6 Mi 15:30 A

Electron and pion scattering off nuclei — •Oliver Buss[1], Luis Alvarez-Ruso[2], and Ulrich Mosel[1] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Departamento de Fisica Teorica and IFIC, Centro Mixto Universidad de Valencia-CSIC

We present a treatment of pion and electron scattering off nuclei within the framework of a Boltzmann-Uehling-Uhlenbeck (BUU) transport model. In this approach we realize a full coupled channel treatment and include medium modifications such as mean-field potentials, fermi motion and width modifications. We have applied the GiBUU model to the description of the double charge exchange (DCX) reaction of pions with different nuclear targets at incident kinetic energies of 120-180 MeV [1]. The DCX process is highly sensitive to details of the interactions of pions with the nuclear medium and, therefore, represents a major benchmark for any model of pion scattering off nuclei at low and intermediate energies. We discuss the impact of surface effects and the dependence on the nuclear mass number. We have achieved a good quantitative agreement with the extensive data set obtained at LAMPF. Furthermore, we present a description of electron induced reactions, i.e. pion production, off nuclei. We consider the scattering of electrons off the bound nucleons in an impulse approximation and investigate medium modifications to exclusive particle production cross sections and compare our results to available data.

Work supported by DFG.

[1] O. Buss, L. Alvarez-Ruso, A. B. Larionov and U. Mosel; Phys. Rev. C 74, 044610 (2006).

HK 29.7 Mi 15:45 A

Neutrino induced pion production and nucleon knockout within the GiBUU transport model — •Tina Leitner[1], Luis Alvarez-Ruso[2], and Ulrich Mosel[1] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Universidad de Valencia, Spain

There is an extensive experimental effort aiming at the precise determination of neutrino oscillation parameters. Its success depends critically on a good knowledge of neutrino-nucleus interactions in order to minimize the systematic uncertainties in neutrino fluxes, backgrounds and detector responses. We describe such charged and neutral current neutrino-nucleus interactions at intermediate neutrino energies within the Giessen Boltzmann-Uehling-Uhlenbeck (GiBUU) coupled-channel transport model. We account for in-medium effects such as Fermi motion, Pauli blocking, nuclear binding, and final-state interactions which allows us to study exclusive channels as pion production and nucleon knockout. We find that final-state interactions modify considerably the distributions through rescattering, charge-exchange and absorp-

tion. Side-feeding induced by charge-exchange scattering is important in both cases. In the case of pions, there is a strong absorption associated with the in-medium pionless decay modes of the Delta, while nucleon knockout exhibits a considerable enhancement of low energy nucleons due to rescattering. At neutrino energies above 1 GeV, we also obtain that the contribution to nucleon knockout from Delta excitation is comparable to that from quasielastic scattering.

Supported by DFG.

HK 29.8 Mi 16:00 A

Überraschungen in der Proton-Neutron Wechselwirkung — •Hartmut Machner für die GEM-Kollaboration — Institut für Kernphysik, FZ Jülich, 52425 Jülich

Die Kenntnis der Nukleon-Nukleon Wechselwirkung ist zentral für für das Verständnis von Kernen. Sie wird einerseits in Streuexperimenten, andererseits in der Endzustandswechselwirkung untersucht. Von besonderem Interesse ist die $p-n$-Wechselwirkung, da nur sie einen gebundenen Zustand hat. Für das $p-n$-Kontinuum gibt es zwei Möglichkeiten der Antisymmetrischen Wellenfunktion: antisymmetrische Ortsfunktion und symmetrische Spinwellenfunktion (Spin-Triplett) oder umgekehrt (Spin-Singulett).

Wir haben die $p-n$-Wechselwirkung im Endzustand der Reaktion $p+p\to \{p+n\}+\piˆ-$ über die Δ-Resonanz hin untersucht. Pionen wurden unter 0 Grad mit dem Magnetspektrographen Big Karl spektroskopiert. Dabei wurde eine Auflösung der missing mass von 10$ˆ{-5}$ erreicht. Die Spektren sind praktisch frei von Untergrund. Wesentlich war ein Protonenstrahl Von COSY, der beim Einschuss in COSY mit Elektronen gekühlt und stochastisch extrahiert wurde.

Durch die hohe Auflösung konnten frühere Messungen widerlegt werden. Ein Spin-Singulett Zustand wird mit $10ˆ{-6}$ nicht beobachtet! Die Endzustandswechselwirkung ergibt für den Spin-Triplett Zustand ein Theorem, das die Stärke des gebundenen Zustandes zu der des ungebundenen Zustandes angibt. Dieses Theorem ist offensichtlich verletzt! Die möglichen Erklärungen für diese Überraschungen werden diskutiert.

HK 29.9 Mi 16:15 A

Proton-Antiproton-Studien mit dem ROC Modell — •Ralf Kliemt[1], Heinz Müller[2], K-T. Brinkmann[1] und René Jäkel[1] — [1]TU-Dresden — [2]FZ-Rossendorf

Das Rossendorf Collision Modell (ROC) ist ein empirisches Modell zur Beschreibung hadronischer Wechselwirkungen und zur Berechnung von Reaktionswirkungsquerschnitten. Hierbei wird der Phasenraum der auslaufenden Teilchen durch die Bildung von Feuerbällen modelliert. Das Modell wurde um die Beschreibung der Annihilation erweitert, um Proton-Antiproton-Reaktionen bei Energien unter 100GeV zu berechnen. Die Qualität der Beschreibung soll anhand von Vergleichen experimenteller Daten mit Vorhersagen des Modells und durch den Vergleich zu anderen Modellen gezeigt werden.
(Unterstützt durch das BMBF)