HK 18: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 14:00–15:30 Raum: HZ 3

Gruppenbericht HK 18.1 Di 14:00 HZ 3

Experimental determination of the meson-nucleus potential* — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The investigation of in-medium properties of mesons is motivated by expectations to find evidence for partial restoration of chiral symmetry. In order to study the meson-nucleus interaction and the in-medium properties of mesons it is important to find experimental approaches to determine the meson-nucleus optical potential. Transparency ratio measurements provide information on the inelastic cross section and in-medium width of mesons and thereby on the imaginary part of the meson-nucleus potential. The real part of the optical potential can be deduced from measurements of the excitation function and momentum distribution which are sensitive to the sign and depth of the potential. Data taken on a carbon target at CB/TAPS@ELSA in 2009 have been analysed to determine the real part of the η'- and ω-nucleus optical potential. The results are compared to model calculations assuming different scenarios for in-medium η' and ω mass shifts. The data for both mesons are consistent with a weakly attractive potential. The formation and population of ω-nucleus and η'-nucleus bound states will be discussed. In case of the ω meson the in-medium width is larger than the potential depth which hampers a successful identification of ω-mesic states. The relatively small in-medium width of the η' meson encourages the search for η' bound states.

*Funded by DFG(SFB/TR-16)

HK 18.2 Di 14:30 HZ 3

Testing for spin dependence in the final state interaction of the reaction $\vec{\mathbf{d}}\mathbf{p} \to {}^3\mathbf{He}\,\eta$ — •Michael Papenbrock[1], Alfons Khoukaz[1], Christopher Fritzsch[1], Paul Goslawski[1], Malte Mielke[1], Daniel Schröer[1], Alexander Täschner[1], and Colin Wilkin[2] for the ANKE-Collaboration — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität, 48149 Münster, Germany — [2]Physics and Astronomy Department, UCL, London WC1E 6BT, UK

The $dp \to {}^3\mathrm{He}\,\eta$ reaction is known for the unexpected energy dependence of its total cross section, which rises rapidly to its plateau value within the first 1 MeV of excess energy Q. This behaviour has been ascribed to a strong final state interaction and may indicate a quasi-bound $\eta\,{}^3\mathrm{He}$ state. In order to investigate the possibility of spin-dependent contributions to the total cross section, the deuteron tensor analysing power t_{20} has been measured in an excess energy range from $Q = 0\,\mathrm{MeV}$ up to above $Q = 10\,\mathrm{MeV}$ at the COSY-ANKE spectrometer. This allows one to compare the magnitudes of the contributions from the two spin configurations in the entrance channel with the strong variation seen in the average production amplitude. Furthermore, a weak angular dependence of t_{20} was also extracted and this provides insight into the structure of the production amplitude close to threshold.

Final results will be presented and discussed.

Supported by the COSY FFE programme.

HK 18.3 Di 14:45 HZ 3

Initial Research of np Scattering with Polarized Deuterium Target at ANKE/COSY — •Boxing Gou for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — Institute of Modern Physics, Chinese Academy of Sciences, 73000 Lanzhou, China

With the goal of understanding the nuclear forces, the ANKE collaboration has been working on a systematic NN spin program for many years. Due to the lack of free neutron sources experimental data of np scattering are very rare, especially at higher energies. It has been shown that using phase shift analysis (PSA) it is possible to reconstruct np scattering amplitudes from the spin observables of $pd \to \{pp\}_{{}^1S_0} n$ charge-exchange reaction. So far experiments were conducted using polarized deuteron beams and hydrogen target, which led to valuable results. To extend the research up to the highest nucleon energy available at COSY (2.8 GeV), proton beam and polarized deuterium target will be used. This talk will present the results of the commissioning experiment of a deuterium target at ANKE with emphasis on the initial research of charge-exchange reaction.

Supported by CSC program.

HK 18.4 Di 15:00 HZ 3

Investigation of the $\mathbf{p + d \to {}^3He} + \eta'$ reaction at WASA-at-COSY* — •Nils Hüsken, Florian Bergmann, Kay Demmich, Patrice Hüsemann, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

The $\eta'(958)$ meson is of special interest, because its higher mass compared to other pseudoscalar mesons is directly related to the $U_A(1)$ problem of QCD. Recent theoretical works discuss studies on the formation of $\eta'(958)$-mesic nuclei as a possibility to investigate an in-medium modification of the η' mass. Such a modification could shed light on the mechanism responsible for the generation of the η' mass. With the WASA-at-COSY setup two test beam times on proton-deuteron collisions were carried out at proton kinetic energies of $T_p = 1800\,\mathrm{MeV}$ and $T_p = 1850\,\mathrm{MeV}$ respectively to investigate the possibility to perform studies on the η' production in the proton-deuteron fusion at this installation. First results of the analysis of both beamtimes will be presented, focusing on the production of both the $\omega(782)$ meson, used for normalization purposes, and the $\eta'(958)$ meson.

*Supported by COSY-FFE grants

HK 18.5 Di 15:15 HZ 3

Meson Masses are Integer Multiples of 70 MeV / c2** — •Karl Otto Greulich — Fritz Lipmann Institut, Jena, Germany

A contribution to the Mainz Conference presents the alpha / beta rule for exact calculation of masses of fundamental particles. Thereby alpha is the fine structure constant, beta is the proton / electron mass ratio. These masses are: m(particle) = a**-n * ß**m * Q * 27,2 eV/c**2. For n = 3, m = 0 and Q = 1, a mass of 70, 01 MeV / c**2 is predicted, for which no particle exists. In the present contribution it is shown, that this mass is the bases for calculation of meson masses, in the most cases with an accuracy in the 1 % range or better. The meson masses are m(meson) = N * 70,01 MeV/c**2, where N = 2**k + 3**l, with k = 1,2,3 and l = 0 or 1. For k=1, l=0 the pion mass results as 140,02 MeV/c**2 (experimental value 139,57), for k=2, l=1 the kaon mass results as 490,07 (experimental 493,68)MeV/c**2. The eta meson follows from k,l = 3,0. The rho and omega from k,l = 3,1.

Reference: KO. Greulich, What are Particles? A lesson from the photon. 2013 proceedings of SPIE 8832-43 (for download see http://www.fli-leibniz.de/kog, then click "here" and subsequently click "Physics")