

HK 37: Hadron Structure and Spectroscopy 7

Time: Tuesday 17:00–19:00

Location: T/SR19

Group Report

HK 37.1 Tue 17:00 T/SR19

New experimental results on the η' -nucleus optical potential*

— ●MARIANA NANOVA for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The η' -nucleus interaction has been studied in photo production of η' -mesons off C and Nb targets, using the CBELSA/TAPS detector system. 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 [1]. 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 C and Nb target have been analysed to determine the real part of the η' -nucleus optical potential. The results are compared to previous experimental results [2] and to model calculations assuming different scenarios for in-medium η' properties. The data of both measurements are consistent with a weakly attractive potential. The relatively small in-medium width of the η' meson encourages the search for η' bound states.

[1] M. Nanova et al., *Phys. Lett. B* **710** (2012) 600[2] M. Nanova et al., *Phys. Lett. B* **727** (2013) 417

*Funded by DFG(SFB/TR-16)

HK 37.2 Tue 17:30 T/SR19

Search for η' -nucleus bound states by missing mass spectroscopy*,**— ●STEFAN FRIEDRICH¹ and YOSHIKI TANAKA² for the EtaPrime-Collaboration — ¹II. Physikalisches Institut, Justus-Liebig-Universität Gießen — ²University of Tokyo

In a search for η' -nucleus bound states an inclusive measurement of the $^{12}\text{C}(p,d)$ reaction was performed using the fragment separator FRS at GSI as a spectrometer, as proposed in [1,2]. A proton beam of 2.5 GeV, delivered by SIS 18, was used to potentially populate η' -mesic states in ^{11}C . The missing mass of the reaction was measured by analyzing the momentum of the ejectile deuterons by particle tracking with two multi-wire drift chambers in the dispersive focal plane. An excitation energy range in ^{11}C of -100 MeV to +50 MeV near the η' production threshold was covered in several Bp settings of the FRS. Particle identification was achieved by time-of-flight measurements and Cherenkov detectors. Momentum calibration was provided by backward elastic scattering in the $\text{D}(p,d)p$ reaction. Background processes such as multi-pion production were studied in the $\text{D}(p,d)$ reaction. The current status of the data analysis will be presented.

[1] H. Nagahiro et al., *Phys. Rev. C* **87** (2013), 045201[2] K. Itahashi et al., *Prog. Theo. Phys.* **128** (2012), 601

*Funded by Grant-in-Aid for Young Scientists (A) (No. 25707018) from JSPS

**Experiment performed in the framework of the Super-FRS collaboration for FAIR

HK 37.3 Tue 17:45 T/SR19

Search for η' -mesic states at BGO-OD*

— ●ERIC GUTZ — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The study of the interaction between mesons and the nuclear medium is a very promising approach to understand strong QCD at a fundamental level. The determination of the real and imaginary part of the η' -nucleus potential [1,2] indicates attraction and a relatively narrow in-medium width of the η' meson, making it a suitable candidate for the observation of meson-nucleus bound states. It has been proposed [3] to search such states in the $^{12}\text{C}(\gamma,p)\eta'\otimes^{11}\text{B}$ reaction, using the BGO-OD setup at ELSA which combines a magnetic spectrometer at forward angles with photon detection over a large solid angle in the BGO ball. This setup allows a search for η' mesic states by missing mass spectrometry as well as by looking for decays from η' mesic states in coincidence with forward going protons. Simulations of the proposed reaction will be presented and the feasibility of the experiment will be discussed in view of a recent test experiment.

[1] M. Nanova et al., *Phys. Lett. B* **727** (2013), 417[2] M. Nanova et al., *Phys. Lett. B* **710** (2012), 600[3] V. Metag et al., *approved proposal ELSA/3-2012-BGO*

*Funded by DFG (SFB/TR16)

HK 37.4 Tue 18:00 T/SR19

Studies on $p + d \rightarrow d + \eta + p_{sp}$ at ANKE*

— ●DANIEL

SCHROEER, CHRISTOPHER FRITZSCH, DANIEL GUDERIAN, MALTE MIELKE, MICHAEL PAPENBROCK, and ALFONS KHOUKAZ — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

An unexpectedly strong interaction between η mesons and He nuclei has been observed which could lead to the formation of η -mesic nuclei. In order to further investigate the properties of this interaction for different nuclei a measurement on the reaction $p + d \rightarrow d + \eta + p_{sp}$ has been conducted at the ANKE spectrometer located at the COSY accelerator of the FZ Jülich. In this case the deuteron serves as an effective neutron target with the proton being a spectator particle. The combination of two different beam momenta of $p_1 = 2.09$ GeV/c and $p_2 = 2.25$ GeV/c and the Fermi motion inside the deuteron allows the extraction of total and differential cross sections in an excess energy range from 0 MeV up to 100 MeV. The behaviour of the total cross section near threshold will allow to calculate the scattering length $a_{d\eta}$ of an s-wave final state interaction ansatz while the differential cross sections enable to proof the validity of the s-wave assumption. These information will shed new light on the interaction between η mesons and nucleons. Additionally the data at higher excess energies will provide further information on the role of nucleonic resonances on the η meson production. Recent results will be presented and discussed.

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HK 37.5 Tue 18:15 T/SR19

Investigation of different normalization reactions for dp collisions at ANKE*

— ●CHRISTOPHER FRITZSCH, DANIEL GUDERIAN, MALTE MIELKE, MICHAEL PAPENBROCK, DANIEL SCHRÖER, and ALFONS KHOUKAZ — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

Studies on the total cross sections of the reaction $d + p \rightarrow {}^3\text{He} + \eta$ are of special interest since they differ strongly from a pure phase space behaviour near threshold. This behaviour could be an indication for the presence of a quasi bound state of the η - ${}^3\text{He}$ -system. New high precision data from the ANKE spectrometer at the accelerator ring COSY at the Forschungszentrum Jülich allow the extraction of precise total and differential cross section values for the η production up to an excess energy of $Q = 15$ MeV. Therefore, a careful luminosity determination was realized via dp -elastic scattering for 18 beam momenta in a range between 3120.17 MeV/c $\leq p_d \leq 3204.16$ MeV/c. Furthermore, to verify the results of the dp -elastic scattering an independent normalization channel $d + p \rightarrow d + \pi^0 + p_{spec}$ was used. The method and recent results for both channels will be presented and discussed.

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HK 37.6 Tue 18:30 T/SR19

Investigating the $pd \rightarrow {}^3\text{He}\eta$ production cross section between $Q \approx 13.6$ MeV and $Q \approx 80.9$ MeV with WASA-at-COSY*

— ●NILS HÜSKEN, FLORIAN BERGMANN, KAY DEMMICH, KARSTEN SITTERBERG, and ALFONS KHOUKAZ — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

In the near threshold region, the $pd \rightarrow {}^3\text{He}\eta$ reaction has been studied in great detail. At higher excess energies, however, the amount of available data is limited. While the data from the ANKE and WASA/PROMICE experiments expose a total cross section plateau, recent results from WASA-at-COSY suggest an unexpected narrow cross section variation at $Q = 48.8$ MeV. As the WASA-at-COSY experiment is perfectly suited to study the energy dependence of the total cross section, a beam time was realized in May 2014 in order to investigate the excess energy region of interest. The measurement covered 15 different beam momenta, resulting in a Q -value range between $Q \approx 13.6$ MeV and $Q \approx 80.9$ MeV. With the new data it will be possible to extract precise total and differential cross sections of the $pd \rightarrow {}^3\text{He}\eta$ reaction for all 15 excess energies.

First results on the $pd \rightarrow {}^3\text{He}\eta$ reaction will be presented as well as an outline for the future possibilities the new data presents.

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HK 37.7 Tue 18:45 T/SR19

Hard exclusive ω -meson production at the COMPASS experiment — •JOHANNES TER WOLBEEK, HORST FISCHER, MATTHIAS GORZELLIK, PHILIPP JÖRG, KAY KÖNIGSMANN, STEFFEN LANDGRAF, CHRISTOPHER REGALI, KATHARINA SCHMIDT, STEFAN SIRTTL, and TOBIAS SZAMEITAT — for the COMPASS collaboration, Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

In the theoretical framework of Generalized Parton Distributions (GPDs) the two-dimensional spatial information, given by form factors, and the longitudinal momentum information from the PDFs are

combined to a three-dimensional picture of the nucleon. According to Ji's sum rule, the GPDs H and E are directly connected to the total angular momenta of quarks and gluons. While H can be approached using electroproduction cross section, the exclusive production of ω -mesons off a transversely polarized target allows for access of GPD E . At the COMPASS experiment at CERN measurements were performed using a longitudinally polarized 160 GeV/c muon beam and a transversely polarized NH_3 target. This talk will introduce the data analysis of exclusive ω production and recent results will be presented and compared to theoretical predictions. Supported by BMBF, DFG and EU FP7 (Grant Agreement 283286).