HK 64: Hadron Structure and Spectroscopy XI

Zeit: Freitag 14:00–16:00 Raum: S1/01 A5

Gruppenbericht HK 64.1 Fr 14:00 S1/01 A5

Status of $d^*(2380)$ and Search for an Isospin $I = 3$ Dibaryon Resonance*. — •Heinz Clement[1], Mikhail Bashkanov[2], and Tatiana Skorodko[1] for the WASA-at-COSY-Collaboration — [1]Physikalisches Institut der Universität Tübingen — [2]School of Physics and Astronomy, University of Edinburgh, UK

For the meanwhile established dibaryon resonance $d^*(2380)$ with $I(J^P) = 0(3^+)$ all decay branchings into NN and $NN\pi\pi$ channels have been determined. A principially possible, though unlikely decay into the isoscalar $NN\pi$ channel is under investigation – see separate contribution. The total decay width as well as the extracted branching ratios bear important information about the internal structure of the dibaryon. They agree with a subthreshold $\Delta\Delta$ system as asymtotic two-hadron configuration in the intermediate state and discriminate against other recently discussed decay scenarios like, *e.g.* via the $N\Delta$ threshold state $D_{12}(2144)$.

The experimental results are compared with various theoretical calculations in the framework of Faddeev or quark model treatments. The possible role of hidden color is discussed.

Many of these theoretical studies predict also another, truly exotic state with mirrored quantum numbers $I(J^P) = 3(0^+)$, *i.e.* decoupled from the NN system and consisting of just six up-quarks in its $I_z = +3$ state. Such a state may be searched for in four-pion production. The status of this search by use of WASA data on the $pp \to pp\pi^+\pi^+\pi^-\pi^-$ reaction will be reported.

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HK 64.2 Fr 14:30 S1/01 A5

Isoscalar Single Pion Production in the Energy Region of Roper and $d^*(2380)$ Resonances*. — •Tatiana Skorodko[1], Mikhail Bashkanov[2], and Heinz Clement[1] for the WASA-at-COSY-Collaboration — [1]Physikalisches Institut, Uni Tübingen — [2]School of Physics and Astronomy, University of Edinburgh, UK

The single pion production in NN collisions may be decomposed into its isoscalar and isovector parts, which give important information about the pion production mechanism – in particular on the role of isoscalar and isovector resonance excitations in the course of the reaction process.

Whereas the isovector pion production being sensitive to baryonic Δ excitations is reasonably well known from threshold up to several GeV, the isoscalar pion production has been determined experimentally only for beam energies below 1 GeV. The reason is that the isoscalar strength needs pn collisons for its experimental extraction.

In order to obtain information about the isoscalar strength above 1 GeV WASA data for the reactions $pp \to pp\pi^0$ and $pn \to pp\pi^-$ at $T_p = 1.2$ GeV are being analyzed. Since these reactions have been taken in the quasifree mode by use of a deuterium target, the beam energy region of 1.0 - 1.3 GeV is covered, which is just the region of the Roper $N(1440)$ baryon resonance and of the $d^*(2380)$ dibaryon resonance. We observe a pronounced signal from the Roper resonance, in particular in the $pp\pi^-$ channel. A possible, though unlikely contribution from $d^*(2380)$ is being searched for.

*supported by DFG (CL 214/3-1) and STFC (ST/L00478X/1)

HK 64.3 Fr 14:45 S1/01 A5

Search for η'-nucleus bound states by missing mass spectroscopy*,** — •Stefan Friedrich[1] and Yoshiki Tanaka[2] for the EtaPrime-Collaboration — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen — [2]University of Tokyo

In a search for η'-mesic states in ^{11}C the ^{12}C(p,d) reaction has been studied at a proton beam energy of 2.5 GeV, using the fragment separator FRS at GSI in spectrometer mode, as proposed in [1,2]. Applying several $B\rho$ settings of the FRS, the missing-mass spectrum was measured by analyzing the momentum of the ejectile deuterons through particle tracking with two multi-wire drift chambers in the dispersive focal plane, covering an excitation energy range in ^{11}C of -90 MeV to +30 MeV with respect to the η' production threshold. Particle identification was achieved by momentum and time-of-flight measurements. Backward elastic scattering in the D$(p,d)p$ reaction was used for momentum calibration. Background processes such as multi-pion production were studied in the D$(p,d)X$ reaction. The current status of the data analysis will be discussed. Upper limits for the population cross section of $\eta' \otimes ^{11}$C states will be presented and compared to theoretical predictions [1,2].

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

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

HK 64.4 Fr 15:00 S1/01 A5

Determination of the real part of the η'-Nb optical potential — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The excitation function and momentum distribution of η' mesons have been measured in photo production off ^{93}Nb in the energy range of 1.2-2.9 GeV. The experiment has been performed with the combined Crystal Barrel and MiniTAPS detector system, using tagged photon beams from the ELSA electron accelerator. Information on the sign and magnitude of the real part of the η'-Nb potential has been extracted from a comparison of the data with model calculations. An attractive potential of -$(38 \pm 9(stat) \pm 12(syst))$ MeV depth at normal nuclear matter density is deduced within model uncertainties. This value is consistent with the potential depth of -$(37 \pm 10(stat) \pm 10(syst))$ MeV obtained in an earlier measurement for a light nucleus (carbon) [1].

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

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HK 64.5 Fr 15:15 S1/01 A5

Measurement of the absolute differential cross section of proton-proton elastic scattering at small angles, using ANKE-COSY facility — •Zara Bagdasarian — Forschungszentrum Juelich

The most accepted approach to describe nucleon-nucleon (NN) interaction is the partial wave analysis (PWA). The goal of many experiments held at COSY-Jülich has been to provide PWA with valuable precision measurements at different energies aiming to cover the full angular range. This contribution reports on the differential cross section for proton-proton elastic scattering that has been measured at a beam energy of 1.0 GeV and in 200 MeV steps from 1.6 to 2.8 GeV at centre-of-mass angles between about 10 and 30 degrees.

The ANKE collaboration and the COSY machine crew have jointly developed a very accurate method for determining the absolute luminosity in an experiment at an internal target position. The technique relies on measuring the energy losses due to the electromagnetic interactions of the beam as it passes repeatedly through the thin target and measuring the shift of the revolution frequency by studying the Schottky spectrum. This powerful technique allows one to measure the absolute differential cross section for elastic pp scattering with the accuracy of typically 3%.

After extrapolating the differential cross sections to the forward direction, the results are broadly compatible with the predictions of forward dispersion relations. Finally, it is shown that the data have a significant impact on the partial wave analysis.

HK 64.6 Fr 15:30 S1/01 A5

Studies on the η meson production channel $d + p \to {}^3\mathrm{He} + \eta$ — •Christopher Fritzsch, Alfons Khoukaz, Marcel Rump, and Daniel Schröer for the ANKE-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

Investigations on the total and differential cross sections of the reaction $d + p \to {}^3\mathrm{He} + \eta$ are of special interest since they differ strongly from a pure phase space behavior near threshold. Furthermore, analysis of the asymmetry factor α of the differential cross sections show a distinct effect of s- and p-wave interference with the η momentum, which can be explained by a rapid variation of the relative phase. These effects are an indication for an unexpected strong final state interaction (FSI) between η mesons and ^{3}He nuclei which could lead to a quasi bound state of the ^{3}Heη-system. Current investigations on high precision data at the internal fixed target experiment ANKE of the storage ring COSY, located at the Forschungszentrum Jülich in Germany, enable the extraction of additional total and differential cross sections for

the η production up to an excess energy of $Q = 15\,\mathrm{MeV}$ with significantly improved accuracy, which will allow to study the behavior of the asymmetry factor α with high resolution. Recent results will be presented and discussed.

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HK 64.7 Fr 15:45 S1/01 A5

The quasi-free reaction p+d → d+η+p_{sp} at ANKE* — •Daniel Schröer, Christopher Fritzsch, Alfons Khoukaz, and Marcel Rump for the ANKE-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität, 48149 Münster, Germany

The interaction between η mesons and hadrons is an intensively investigated topic. Due to its stength it might lead to the formation of η-mesic nuclei. In order to study the characteristics of this interaction a measurement of the reaction $p + d \rightarrow d + \eta + p_{sp}$ has been performed at the ANKE spectrometer at the COSY accelerator of the Forschungszentrum Jülich. In this context the deuteron serves as an effective neuteron target whereas the proton is treated as a spectator particle. The two different beam momenta ($p_1 = 2.09$ GeV/c and $p_2 = 2.25$ GeV/c) in combination with the Fermi motion inside the target deuteron grant access to the determination of total and differential cross sections in an excess energy range from threshold up to Q = 90 MeV. While the course of the total cross section, especially near threshold, will allow to compute the scattering length $a_{d\eta}$ of an s-wave final state interaction ansatz, the differential cross sections permit to verify the legitimacy of the s-wave assumption. Furthermore the data taken at higher excess energies enable to examine the role of nucleonic resonances in the production process of η mesons. Recent results will be presented and discussed.

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