

HK 47: Hadron Structure and Spectroscopy VIII

Zeit: Donnerstag 14:00–16:00

Raum: S1/01 A5

Gruppenbericht HK 47.1 Do 14:00 S1/01 A5
Study of η -Meson Decays with the WASA-at-COSY experiment — •DANIEL LERSCH for the WASA-at-COSY-Collaboration — Forschungszentrum Juelich, Germany

The study of η -decays allows to probe symmetry-breaking phenomena (e.g. C- and CP-violation), to measure the electromagnetic transition form factor and to explore the anomalous sector of QCD.

In order to perform those studies two data samples have been acquired with the WASA-at-COSY facility at Forschungszentrum Jülich. A proton beam, provided by COSY, is impinged upon a liquid deuterium / hydrogen pellet target producing η -mesons via: $pd \rightarrow {}^3\text{He}\eta$ / $pp \rightarrow pp\eta$. The η -decay products as well as the forward-scattered projectiles are detected within the 4π WASA-at-COSY detector.

A first iteration of measurements was done using the $pd \rightarrow {}^3\text{He}\eta$ reaction for the study of the more abundant η decay channels (such as $\eta \rightarrow \pi^+\pi^-\pi^0$) and to set up the framework for a common analysis. In order to address the rare η -decays (e.g. $\eta \rightarrow \pi^+\pi^-e^+e^-$) a high-statistics data set has been collected using the reaction $pp \rightarrow pp\eta$.

The current analysis of the $pp \rightarrow pp\eta$ data set is dedicated to the isospin violating decay $\eta \rightarrow \pi^+\pi^-\pi^0$; The determination of the electromagnetic transition form factor via the decays $\eta \rightarrow e^+e^-\gamma$ and $\eta \rightarrow e^+e^-e^+e^-$; Testing C- and CP-violation by investigating $\eta \rightarrow \pi^0e^+e^-$ and $\eta \rightarrow \pi^+\pi^-e^+e^-$; Exploring the box anomaly via the radiative decay $\eta \rightarrow \pi^+\pi^-\gamma$.

This talk will give an overview about the status of the analyses.

HK 47.2 Do 14:30 S1/01 A5

Study of excited η mesons at CLAS. — •CATHRINA SOWA — Institut für Experimentalphysik I, Ruhr Universität Bochum

The analysis presented in this talk focuses on the reaction $\gamma p \rightarrow p\pi^+\pi^-\eta$ to investigate excitations of η mesons. The CLAS experiment at CEBAF at Jefferson Laboratory investigates photoproduction on the proton with high intensities. The observed η' as well as the $\eta(1295)$ and $\eta(1405)$ decay preferably to $\pi^+\pi^-\eta$.

Based on SU(3) symmetry for the light mesons a singlet as well as an octet is formed. Each contains one isoscalar state which mix to the lightest pseudoscalar mesons η and η' . Thus two first radial excitations are expected, but three states were found: $\eta(1295)$, $\eta(1405)$ and $\eta(1475)$. The $\eta(1405)$ is debated to be a gluonic bound state because it has been observed in gluon rich production mechanisms only. In this scenario the $\eta(1405)$ should have a low production cross section in $\gamma\gamma$ fusion or photoproduction.

We report on preliminary results for $\eta', f_1(1285)/\eta(1295)$ and $\eta(1405)$ production cross sections in $\gamma p \rightarrow p\pi^+\pi^-\eta$.

HK 47.3 Do 14:45 S1/01 A5

Measuring the branching fraction of $\omega \rightarrow \eta\gamma$ with the Crystal Ball Experiment at MAMI — •OLIVER STEFFEN and WOLFGANG GRADL for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

The Crystal Ball Collaboration uses energy tagged bremsstrahlung photons produced from the MAMI electron beam to study photo-induced reactions on nucleons and nuclei. The Crystal Ball/TAPS 4π calorimeter setup is optimized for the detection of neutral final states. Charged particles are identified and measured by the inner detector system.

A large data set of photoproduced η' and ω mesons has been obtained during recent data taking periods with the End Point Tagger ($E_\gamma = 1.4$ to 1.6 GeV) and the liquid hydrogen target.

With this dataset we want to measure the branching fraction of the $\omega \rightarrow \eta\gamma$ decay. This is useful for understanding the pseudo vector-gamma interaction within effective field theories. In this talk we will give an overview of the ongoing analysis. This work is supported by DFG under contract SFB1044.

HK 47.4 Do 15:00 S1/01 A5

Measurement of the relative branching fraction of $\eta' \rightarrow \pi^0\pi^0\pi^0$ — •MARTIN WOLFES und WOLFGANG GRADL für die A2-Kollaboration — Institut für Kernphysik Universität Mainz, Mainz, Rheinland-Pfalz

The A2 Collaboration uses an electron beam provided by the MAMI accelerator in Mainz to produce an energy tagged photon beam. Photon induced reactions are studied with the Crystal Ball/TAPS 4π

calorimeter, which is optimized for neutral final states. Identification of charged particles is accomplished by an inner detector system.

In the course of the year 2014 this experimental setup was used to gather a large data-sample of photo-produced η' and ω mesons off a hydrogen nuclei. This dataset is used to determine various branching fractions.

In this talk the ongoing work on the analysis of the isospin-violating decay of η' to three neutral pions is presented. We will also present an add-on for the PLUTO event generator, which produces a cocktail of photo-production data for a given energy distribution.

HK 47.5 Do 15:15 S1/01 A5

XYZ rates with $\bar{\text{P}}\text{ANDA}$ at FAIR — •ELISABETTA PRENCIPE¹ and JENS SOEREN LANGE² for the PANDA-Collaboration — ¹Forschungszentrum Jülich IKP1, Jülich (DE) — ²Justus-Liebig-Universität Giessen, Giessen (DE)

Narrow states have been recently observed, which do not fit into the predictions of static quark anti-quark potential, and thus they are often regarded as exotic states. The $\bar{\text{P}}\text{ANDA}$ experiment at FAIR aims, among other topics of interest, to investigate XYZ states in the charmonium mass region in antiproton-proton collisions, with a very high rate ($\leq 10^7$ interactions per second), leading to a copious and statistically significant production of these states with up to 10^4 per day, already on the first day of data taking with an average luminosity of $L=10^{31}$ cm⁻²s⁻¹. We present results from a complete MC simulation, and estimates on cross sections of the X(3872), the Y(4260) and the charged Z(3900). In particular new, yet unobserved states will be explained, for which the production in e^+e^- collisions, radiative decays or B meson decays is forbidden, e.g. by parity conservation, and production in $p\bar{p}$ collisions represents a unique possibility.

HK 47.6 Do 15:30 S1/01 A5

simulations of the measurement of the form factor for the D_s semileptonic decay with the PANDA detector — •LU CAO¹, TOBIAS STOCKMANN¹, and JAMES RITMAN^{1,2} for the PANDA-Collaboration — ¹Forschungszentrum Jülich GmbH — ²Ruhr-Universität Bochum

The PANDA experiment will study a wide range of physics topics with beams of antiprotons incident on fixed protons or complex nuclei targets. One of the interesting issues is the D_s semileptonic decay, which is governed by both the weak and strong forces. Here the strong interaction effects can be parameterized by the transition form factor. Techniques such as lattice QCD offer increasingly precise calculations, but as the uncertainties shrink, experimental validation of the results becomes increasingly important. The achievable performance of the full PANDA detector for these types of reactions has not yet been studied in detail; however, this is expected to work very well based upon the design performance and experience with similar detector systems.

We evaluate the performance in the measurement of the semileptonic decay form factor of $D_s^+ \rightarrow \nu_e e^+$. With different beam momenta, the Monte Carlo studies have been performed to obtain the achievable reconstruction efficiency using a complete simulation model of the detector and analysis tools. In the reconstruction procedure, we focus on developing the software and evaluating the expected precision. This talk summarizes the simulation status of the D_s decay chain. With theoretical predictions of the cross section, we obtain a preliminary estimate of the expected count rate for the future data taking.

HK 47.7 Do 15:45 S1/01 A5

Momentum dependence of the imaginary part of the ω - and η' -nucleus optical potential* — •STEFAN FRIEDRICH and MARIANA NANOVA for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The attenuation of ω - and η' -mesons in cold nuclear matter has been studied in photonuclear reactions on ¹²C and ⁹³Nb for photon energies of 1.2-2.9 GeV, using the tagged photon beam at the ELSA accelerator. ω - and η' -mesons have been identified via the $\omega \rightarrow \pi^0\gamma$ and $\eta' \rightarrow \pi^0\pi^0\eta$ decays, respectively, registered with the CBELSA/TAPS detector system. The momentum dependence of the transparency ratio has been determined for both mesons. Results on the in-medium width of the ω - and η' -meson and the corresponding meson-nucleon inelastic cross sections will be compared to previous experimental data [1,2]

and recent theoretical predictions [3,4,5]. The energy dependence of the imaginary part of the ω - and η' -nucleus optical potential has been extracted. The higher statistics and finer binning of the present data allow an extrapolation to the production threshold. Corresponding values for the imaginary part of the optical potential will be discussed in view of recent determinations of the ω and η' scattering lengths [6,7].

*Funded by DFG (SFB/TR16)

[1] M. Kotulla et al., *PRL* **100**, 192302 (2008). [2] M. Nanova et al., *PLB* **710**, 600 (2012). [3] D. Cabrera and R. Rapp, *PLB* **729**, 67 (2014). [4] A. Ramos et al., *EPJA* **49**, 148 (2013). [5] E. Oset and A. Ramos, *PLB* **704**, 334 (2012). [6] I. Strakovsky et al., *PRC* **91**, 045207 (2015). [7] E. Czerwinski et al., *PRL* **113**, 062004 (2014).