

HK 38: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 16:30–19:00

Raum: RW 1

Gruppenbericht

HK 38.1 Do 16:30 RW 1

Threshold photoproduction of η and η' mesons off light nuclei - search for mesic nuclei — •IRAKLI KESHELASHVILI for the A2-Collaboration — University of Basel

The interaction of mesons with nuclei is a major source for our understanding of the strong interaction. In the case of short lived neutral mesons the only access is indirect, making use of final-state interaction. The mesons are produced with some initial reaction in the nucleus and then there interaction with the same nucleus is studied. It much discussed whether it is possible to form, via the strong interaction, quasi-bound states of mesons and nuclei, which would be the ideal tool for such studies. In particular, the case of η and η' mesons is of large interest and controversially discussed in the literature. Experimentally, signatures for such states have been sought in the threshold behavior of meson production reactions, using different probes. We will present new results from the Crystal Ball/TAPS experiment at the Mainz MAMI accelerator for coherent photoproduction of η mesons from ^3He and ^7Li nuclei showing strong threshold enhancement in particular for the ^3He case and discuss their relevance for the formation of an η -mesic state. Furthermore a first attempt has been made to measure the threshold behavior of the photoproduction of η' mesons from the deuteron and ^3He . Preliminary results will be discussed.

Gruppenbericht

HK 38.2 Do 17:00 RW 1

Production of η mesons and pion pairs in dp scattering at COSY-ANKE — •MICHAEL PAPENBROCK, PAUL GOSLAWSKI, ALFONS KHOUKAZ, MALTE MIELKE, DANIEL SCHRÖER, and ALEXANDER TÄSCHNER for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

Detailed measurements on the reaction $dp \rightarrow ^3\text{He}\eta$ with unpolarized particles have been performed at the COSY-ANKE spectrometer. The rapid rise of the total cross section within the first 0.5 MeV above threshold implies a very strong final state interaction and might indicate the presence of a quasi-bound η -mesic state close to threshold. To further investigate this issue, measurements with a polarized deuteron beam have been performed in order to determine tensor analyzing powers in the near-threshold region. Furthermore, the reaction $dp \rightarrow ^3\text{He}\eta$ has been used to perform a high precision measurement on the η meson mass by a model independent method based on pure kinematics.

Parallel to measurement on the η meson, data on the production of charged pion pairs have been taken. In the studied energy region, the reaction $dp \rightarrow ^3\text{He}\pi^+\pi^-$ allows for further investigation on the ABC effect, a phenomenon which enhances the two pion invariant mass distribution at low values.

Recent results on these topics will be presented and discussed.

Supported by the COSY-FFE program.

HK 38.3 Do 17:30 RW 1

ω Photoproduction off Protons and Neutrons with CBELSA-TAPS* — •FRIDA DIETZ for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

ω photoproduction off LH_2 and LD_2 targets has been studied with the tagged photon beam of the ELSA accelerator in Bonn. The combined setup of the Crystal Barrel and TAPS detecting systems, which formed a 4π electromagnetic calorimeter, was used for detecting the ω meson via the $\omega \rightarrow \pi^0 \gamma$ decay mode. The aim of this study is to determine the ω photoproduction cross section on the neutron, which has not been measured so far but is an important prerequisite for studying the in-medium properties of the ω meson. The quasi-free production channels of the ω off the proton and neutron were studied with both exclusive and inclusive analyses. Preliminary results on both the total and differential cross sections will be presented.

* supported by the DFG (SFB/TR-16)

HK 38.4 Do 17:45 RW 1

In-Medium Properties of the η' Meson* — •MARIANA NANOVA for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Universität Giessen, Heinrich-Buff-Ring 16, 35392 Giessen

The attenuation of η' -meson in cold nuclear matter has been studied in photonuclear reactions off LH_2 , LD_2 , ^{12}C , ^{40}Ca , ^{93}Nb and ^{208}Pb nuclei. The experiment was performed at the ELSA accelerator in Bonn

with the combined setup of the Crystal Barrel and TAPS detectors. The inelastic η'/N cross section and the in-medium width are deduced and compared to theoretical predictions. Effects of photon shadowing and secondary production processes are discussed. Momentum distributions of η' -mesons are compared for the different targets. The feasibility of planned experiments searching for η' -mesic states is analyzed. *Funded by DFG(SFB/TR-16)

HK 38.5 Do 18:00 RW 1

Medium modifications of mesons with charm — •THOMAS HILGER¹, BURKHARD KÄMPFER¹, SERGEY DORKIN², LEONID KAPTARI², and STEFAN LEUPOLD³ — ¹Helmholtz-Zentrum Dresden-Rossendorf, PF 510119, 01314 Dresden — ²Joint Institute for Nuclear Research Joliot-Curie 6 141980, Dubna Moscow Region, Russia — ³Univ. of Uppsala Box 256 S-75121 Uppsala, Sweden

The in-medium behavior of pseudo-scalar and vector mesons is investigated with QCD sum rules. The rho meson is considered within a scenario where the chirally odd condensates are zero. The interplay of mass shift and broadening of the spectral function is highlighted and compared to NA60 data. We apply finite density QCD sum rules to mesons consisting of a heavy and a light quark (D, Ds and B) and investigate their sensitivity to the chiral condensate and consider the splitting of particle and antiparticle spectral functions with increasing density of the ambient nuclear matter [1]. In order to gain a more direct dependence on the chiral condensate and other potential order parameters of chiral symmetry we present a series of Weinberg-Shuryak type sum rules for heavy-light systems at finite densities [2].

[1] T. Hilger, R. Thomas, B. Kämpfer, Phys.Rev. C79 (2009) 025202.

[2] T. Hilger, B. Kämpfer, S. Leupold, Phys.Rev. C84 (2011) 045202.

HK 38.6 Do 18:15 RW 1

In search of the box anomaly by studying $\eta \rightarrow \pi^+\pi^-\gamma$ — •DANIEL LERSCH¹ and FRANK GOLDENBAUM^{1,2} — ¹Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich — ²Bergische Universität Wuppertal FB C

The decay channel $\eta \rightarrow \pi^+\pi^-\gamma$ provides the opportunity to study QCD anomalies at the chiral limit. The decay width and the shape of the E_γ -distribution of this channel are sensitive to the box anomaly term which is part of the Wess-Zumino-Witten (WZW) Lagrangian. However, the theoretically predicted decay width and E_γ -distribution do not agree with the experimental results, if final state interactions are not included by unitarized extensions of the WZW-Lagrangian. The experimental observables for testing these extensions are (i) the branching (done by CLEO and KLOE) or (ii) the distribution of the single photon energy.

Recently, the reaction $pd \rightarrow ^3\text{He}[\eta \rightarrow \pi^+\pi^-\gamma]$ has been measured with WASA-at-COSY.

The aim of this work is to measure the branching ratio and the single photon energy distribution in one experiment using the reaction: $pp \rightarrow pp[\eta \rightarrow \pi^+\pi^-\gamma]$, using the data acquired during spring 2010.

As a first step in the recent analysis the channel $\eta \rightarrow \pi^+\pi^-\pi^0$ has been investigated, because it is important for determining the relative branching ratio $\frac{\Gamma(\eta \rightarrow \pi^+\pi^-\gamma)}{\Gamma(\eta \rightarrow \pi^+\pi^-\pi^0)}$ and also because it contributes to the background of the decay $\eta \rightarrow \pi^+\pi^-\gamma$.

First results will show how the channel of interest is extracted from data and how the remaining background is determined.

HK 38.7 Do 18:30 RW 1

Measurement of the Rare Decay $\eta \rightarrow \pi^+\pi^-e^+e^-$ with WASA-at-COSY — •DANIEL CODERRE^{1,2} and JAMES RITMAN^{1,2} for the WASA-at-COSY-Collaboration — ¹Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich — ²Institut für Experimentalphysik I, Ruhr-Universität-Bochum

One focus of the WASA-at-COSY physics program is the testing of fundamental symmetries by measuring decays of light mesons. The decay $\eta \rightarrow \pi^+\pi^-e^+e^-$ has been measured with two main goals. First, to use a high-statistics sample of events to determine the branching ratio and second, to probe possible violation of CP-symmetry. It has been suggested that interference terms involving the CP-violating E1 transition could contribute to the decay rate. This would induce an asymmetry in the angle between the electron and π decay planes that could be an observable for CP-violation outside of the standard model.

The theoretical upper limit for this asymmetry is 1%.

At WASA η mesons are produced in the $pd \rightarrow {}^3\text{He}\eta$ and $pp \rightarrow pp\eta$ reactions. Preliminary results for the branching ratio and the CP-violating asymmetry term have been obtained from the proton-deuteron data, which features relatively low backgrounds but limited rates of η production. In the proton-proton data, which features significantly higher rates of η production but also higher backgrounds, the signal decay has been identified with improved statistics and extraction of the physics observables is in progress. This presentation will describe the analysis process with a focus on current and future results.

HK 38.8 Do 18:45 RW 1

Analysis of the ω and $\phi \rightarrow 3\pi$ Dalitz plot — •FRANZ NIECKNIG, SEBASTIAN P. SCHNEIDER, and BASTIAN KUBIS — Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Nussallee 14-16, D-53115 Bonn

The theoretical description of vector meson interactions in hadron physics remains a challenge. With the ongoing experimental interest in $\omega \rightarrow 3\pi$ and $\phi \rightarrow 3\pi$ decays the need for equally precise theoretical predictions remains. The prevailing treatments all lack a thorough inclusion of final state interactions.

In this talk we will introduce a dispersive approach to these decays and study how crossed-channel rescattering effects shape the Dalitz plot.