

## HK 28: Hadron Structure and Spectroscopy 6

Time: Tuesday 14:30–16:30

Location: T/SR25

**Group Report**

HK 28.1 Tue 14:30 T/SR25

**Analysis of  $\eta$ -Meson Decays from the WASA Campaign at COSY** — ●DANIEL LERSCH for the WASA-at-COSY-Collaboration — Forschungszentrum Jülich, Germany

A  $pp \rightarrow pp\eta$  data sample has been acquired with the WASA-at-COSY facility at Forschungszentrum Jülich. A proton beam is accelerated with 1.4 GeV kinetic energy within the COSY storage ring towards a liquid hydrogen pellet target producing  $\eta$ -mesons. The  $\eta$ -decay products as well as the forward-scattered projectiles are detected within the  $4\pi$  WASA-at-COSY detector. A first round of experiments was done with the  $pd \rightarrow {}^3\text{He}\eta$  reaction used for the study of the more abundant  $\eta$  decay channels and to set up the framework for a common analysis. In order to address also rare decays  $\sim 10^9$   $\eta$ -mesons have been collected in the  $pp \rightarrow pp\eta$  reaction.

The study of  $\eta$ -decays allows to probe symmetry-breaking phenomena (e.g.  $C$ - and  $CP$ -violation), to test theoretical calculations and to explore the anomalous sector of QCD. The current analysis of the  $pp \rightarrow pp\eta$  data set is related to the charged decay modes of the  $\eta$ -meson:  $\eta \rightarrow \pi^+\pi^-\pi^0$  allows to probe quark mass ratios,  $\eta \rightarrow e^+e^-\gamma$  and  $\eta \rightarrow e^+e^-e^+e^-$  serve to determine the electromagnetic transition form factor, the  $C$ -violating decay  $\eta \rightarrow \pi^0e^+e^-$ , or the radiative decay  $\eta \rightarrow \pi^+\pi^-\gamma$  which is (in the chiral limit) sensitive to the box anomaly.

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

HK 28.2 Tue 15:00 T/SR25

**Produktion neutraler Mesonen bei COMPASS** — ●TOBIAS WEISROCK — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

COMPASS untersucht die Reaktionen von 190 GeV/c Protonen mit einem Flüssigwasserstofftarget. Der Fokus liegt dabei auf der Produktion einzelner neutraler Mesonen, d.h.  $pp \rightarrow ppM^0$ , wobei sowohl pseudoskalare Mesonen ( $M^0 = \pi^0, \eta$ ) als auch Vektormesonen ( $M^0 = \omega, \phi$ ) untersucht werden. Das Verhältnis der Produktionsquerschnitte als Funktion der Feynmanvariable  $x_F$  und des Impulsübertrags  $t'$  ermöglicht eine Untersuchung der verschiedenen Reaktionsmechanismen. Dies ist ein erster Schritt zur Abtrennung des Untergrundes für eine Partialwellenanalyse.

HK 28.3 Tue 15:15 T/SR25

**Electromagnetic transition form factor of the  $\eta$  meson with WASA-at-COSY** — ●ANKITA GOSWAMI for the WASA-at-COSY-Collaboration — Indian Institute of Technology Indore, Indore, India

The aim of this work is to measure the transition form factor of the  $\eta$  meson. The transition form factor describes the internal structure of a particle. The precise determination of the transition form factor of the  $\eta$  meson is possible through the  $\eta \rightarrow \gamma e^+e^-$  Dalitz decay. When a particle is point-like then its decay rate can be calculated within QED. However, the complex structure of the particle modifies its decay rate. The transition form factor is determined by comparing the lepton-antilepton invariant mass distribution with QED.  $\eta$  mesons are produced using the reaction  $pp \rightarrow pp\eta$  at a beam kinetic energy of 1.4 MeV at the COSY accelerator of Forschungszentrum Jülich and decay particles of the  $\eta$  meson are detected with the WASA detector. In the higher invariant mass region recent theoretical calculations slightly deviate from the data. With the high statistics dataset we expect precise results in the higher invariant mass region. The status of the analysis will be reported.

\*Supported by the FFE program of Forschungszentrum Jülich.

HK 28.4 Tue 15:30 T/SR25

**Towards a new upper limit for the  $\eta$ -decay  $\eta \rightarrow \pi^0 + e^+ + e^-$  with WASA-at-COSY\*** — ●FLORIAN BERGMANN, KAY DEMMICH, NILS HÜSKEN, KARSTEN SITTERBERG, and ALFONS KHOUKAZ

for the WASA-at-COSY-Collaboration — Institut für Kernphysik, WestfälischeWilhelms-Universität Münster, Germany

A major part of the WASA-at-COSY experimental program is dedicated to investigations on symmetries and symmetry breaking to get a better understanding of the physics within the standard model. An elegant way to search for violation of conservation laws, which are directly connected to symmetry breaking effects, is the study of rare meson decays. Here the  $\eta$ -meson is of particular interest. High statistics of  $\eta$ -meson production are required to obtain new limits on the  $C$ ,  $P$  and  $T$  symmetry breaking or combinations thereof. The study of rare meson decays also allows to search for physics beyond the standard model like the dark photon.

In this contribution we will present and discuss investigations of the  $C$ -violating  $\eta$ -decay  $\eta \rightarrow \pi^0 + e^+ + e^-$  using the high statistics  $p + d \rightarrow {}^3\text{He} + \eta$  data obtained with WASA-at-COSY. The dominant  $C$ -conserving contribution to this decay via a  $\pi^0 + \gamma^* + \gamma^*$  intermediate state has an expected branching ratio of less than  $10^{-8}$  in the standard model. An observation of a significantly higher branching ratio would indicate the presence of a  $C$ -violating process.

\*Supported by FFE program of the Forschungszentrum Jülich.

HK 28.5 Tue 15:45 T/SR25

**Measurement of space-like  $\eta$  and  $\eta'$  transition form factors at BESIII** — ●MICHAEL DIEFENBACH, ACHIM DENIG, and CHRISTOPH REDMER — Institut für Kernphysik, Universität Mainz, Deutschland

Transition form factors of light pseudoscalar mesons are an important ingredient to the calculations of hadronic contributions to the anomalous magnetic moment of the muon. The BESIII experiment at the  $e^+e^-$  collider BEPCII in Beijing has collected 2.9 fb $^{-1}$  of data at the center of mass energy of 3.773 GeV. Based on these data two-photon collisions are studied using a single-tag technique. The analysis aims at the determination of the transition form factors of  $\eta$  and  $\eta'$  mesons in a region of momentum transfer below 3 GeV $^2$ . In this presentation we will give an overview of the current status of the analysis.

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HK 28.6 Tue 16:00 T/SR25

**Measurement of the hadronic cross section  $e^+e^-$  to  $\pi^+\pi^-\pi^0$  at BES-III** — ACHIM DENIG and ●MARTIN RIPKA — Kernphysik Uni Mainz

Experimental and theoretical values of the muon anomalous magnetic moment presently show a deviation of more than 3 standard deviations. While the electromagnetic and the weak contributions to its theoretical value are well under control, the QCD contributions have to be obtained from data. Experimental measurements of hadronic cross sections can indeed be used to determine the QCD loop contributions using the optical theorem. This talk is about the contribution of the  $2\pi^+\pi^0$  ISR channel using ISR data from the BESIII experiment in Beijing/China. Preliminary results of the simulated cross section will be shown.

HK 28.7 Tue 16:15 T/SR25

**Pseudoscalar transition form factors from rational approximants** — ●PABLO SANCHEZ-PUERTAS — Institut für Kernphysik , Johannes Gutenberg-Universität Mainz

Pseudoscalar Transition Form Factors are analyzed in the space-like region at the low- and intermediate- energy regions with rational approximants in a model-independent way. Low-energy parameters are, then, extracted from a fit to such data. The feasibility of the form factors to determine the  $\eta$  and  $\eta'$  mixing is analyzed as well as their implications into the light-by-light contribution to the anomalous magnetic moment and the pseudoscalar decays into a lepton pair.