

## HK 54: Hadronenstruktur und -spektroskopie

Zeit: Freitag 11:00–13:00

Raum: RW 1

**Gruppenbericht**

HK 54.1 Fr 11:00 RW 1

**Hadron physics with WASA-at-COSY** — ●PATRICK WURM for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, Germany

The Wide Angle Shower Apparatus (WASA) is a close to  $4\pi$  detector which is used to study the hadronic production and the decays of light mesons. Extended beam times at high luminosities enable to measure rare meson decays, which are used to scrutinize symmetries and symmetry breaking mechanisms in hadronic systems and to test Chiral Perturbation Theory, for example with  $\eta \rightarrow \pi^+\pi^-\pi^0$  and  $\eta \rightarrow \pi^+\pi^-\gamma$ . The electron and pion decay plane of the decay  $\eta \rightarrow \pi^+\pi^-e^+e^-$  is sensitive to a possible flavor conserving CP violation. A better understanding of the hadron structure can be achieved by a precise determination of transition form factors, which can be measured in the decays  $\eta \rightarrow e^+e^-\gamma$ ,  $\eta \rightarrow e^+e^-e^+e^-$  or  $\omega \rightarrow \pi^0e^+e^-$ . Additionally, the branching ratio of  $\eta \rightarrow e^+e^-e^+e^-$  is measured, since there exists currently only one experimental value. Signs for new physics beyond the Standard Model is searched for in  $\pi^0$  and  $\eta$  decays into a single lepton pair. The talk will give an overview of these WASA-at-COSY activities and also about other topics like the ABC effect.

HK 54.2 Fr 11:30 RW 1

**Meson Transition Form Factors at BABAR** — ●KONRAD GRIESSINGER for the BABAR-Collaboration — Institut für Kernphysik, Universität Mainz, Deutschland

At electron-positron colliders like the PEP-II rings at SLAC (Stanford), meson transition form factors can be accessed through  $\gamma^{(*)}\gamma^{(*)}$ -processes. We present recent BABAR results for the cross sections of the  $\gamma\gamma^*$ -fusion reaction resulting in either  $\pi^0$ ,  $\eta$  or  $\eta'$ , where one of the photons is quasi-real ( $Q^2 \approx 0$ ). The  $\gamma\gamma^*$  production cross section in such a single-tag measurement is proportional to the transition form factor  $F(Q^2)$ . After extracting  $F(Q^2)$ , models to compute the contribution of the hadronic light-by-light scattering process to the standard model prediction of the muon anomaly ( $a_\mu - 2$ ) can be tested via the transition form factor's  $Q^2$  dependence.

HK 54.3 Fr 11:45 RW 1

**Analyse des Zerfallskanals  $\psi(2S) \rightarrow \gamma(\pi^+\pi^-\eta)$  bei BES-III** — ●MICHAEL LEYHE für die BES III-Kollaboration — Lehrstuhl für Experimentalphysik I, Ruhr-Universität Bochum

Das BES-III Experiment, welches am Beijing-Elektron-Positron-Speicherring BEPCII aufgebaut ist, konnte bisher unter anderem einen Datensatz von mehr als 100 Millionen  $\psi(2S)$ -Zerfällen aufzeichnen. Mit diesem weltgrößten Datensatz ist es möglich, auch Reaktionskanäle mit geringen Wirkungsquerschnitten zu untersuchen.

In diesem Vortrag wird die Analyse des radiativen Zerfallskanals  $\psi(2S) \rightarrow \gamma(\pi^+\pi^-\eta)$  vorgestellt. Es werden die beobachteten, in  $\pi^+\pi^-\eta$  zerfallenden Resonanzen diskutiert, und hierbei insbesondere der Fokus auf den Glueball-Kandidaten  $\eta(1405)$  gelegt.

HK 54.4 Fr 12:00 RW 1

**Central and spin-spin heavy-quark potentials from QCD** — ●ALEXANDER LASCHKA, NORBERT KAISER, and WOLFRAM WEISE — Physik Department, Technische Universität München, D-85747 Garching, Germany

Potential models with several free parameters have been used in the past to reproduce the experimentally observed charmonium and bottomonium spectra. Nowadays heavy-quark potentials can be derived in QCD from first principles. The spin-dependent heavy-quark potential, necessary to describe the hyperfine splittings, has been studied recently in a new lattice QCD approach. We show that the spin-spin potential, as well as the central potential, can be extended to short distances by

matching the lattice results to the corresponding potentials derived in perturbative QCD. These matched potentials have only a single free parameter, an overall additive constant, and can be used to calculate quarkonium spectra. We find that the empirical hyperfine splittings in the ground states of charmonium and bottomonium can be accurately reproduced. Furthermore, we extract values for the charm and bottom quark masses and compare to other mass schemes.

Work supported in part by BMBF, GSI and by the DFG Excellence Cluster "Origin and Structure of the Universe".

HK 54.5 Fr 12:15 RW 1

**Dynamical light vector mesons in low-energy scattering of Goldstone bosons.** — ●IGOR DANILKIN, LAURA GIL, and MATTHIAS LUTZ — GSI, Planck Str. 1, 64291 Darmstadt, Germany

We present a study of Goldstone boson scattering based on the flavor SU(3) chiral Lagrangian formulated with vector mesons in the tensor field representation [1]. A coupled-channel channel computation is confronted with the empirical s- and p-wave phase shifts, where good agreement with the data set is obtained up to about 1.2 GeV. There are two relevant free parameters only, the chiral limit value of the pion decay constant and the coupling constant characterizing the decay of the rho meson into a pair of pions. We apply a recently suggested approach that implements constraints from micro-causality and coupled-channel unitarity. Generalized potentials are obtained from the chiral Lagrangian and are expanded in terms of suitably constructed conformal variables. The partial-wave scattering amplitudes are defined as solutions of non-linear integral equations that are solved by means of an ND ansatz.

[1] I.V. Danilkin, L.I.R. Gil, M.F.M. Lutz, Phys.Lett. B703 (2011) 504-509

HK 54.6 Fr 12:30 RW 1

**GPDs measurement using DVCS process at ENC/FAIR** — ●DONGHEE KANG — Institut für Kernphysik, Universität Mainz, Germany

Generalized Parton Distributions (GPDs) describe simultaneously distributions for the transverse position and longitudinal momentum of partons inside the nucleon. The Deeply Virtual Compton Scattering (DVCS) process on the proton,  $ep \rightarrow e'p'\gamma$ , is the simplest and promising reaction channel to access GPDs. An Electron Nucleon Collider (ENC) using the High Energy Storage Ring (HESR)/FAIR and utilizing the high resolution PANDA spectrometer is proposed to investigate the DVCS process. We demonstrate this specific advantage from the collider kinematic. In a feasibility study, we have estimated the acceptance and resolution for the DVCS process assuming 15 GeV proton beam and 3 GeV electron beam in collision.

HK 54.7 Fr 12:45 RW 1

**Monte Carlo event generators for Panda** — ●MANUEL ZAMBRANA — Institut fuer Kernphysik, Mainz University and Helmholtz Institut Mainz, Mainz, Germany

Lepton production in proton-antiproton annihilation is one of the main channels to access the proton form factors in the timelike region. The development of Monte Carlo event generators for  $\bar{p}p \rightarrow e^+e^-$  is described. The used cross section results from a leading order calculation, the so called one-photon exchanged approximation. In addition, a Monte Carlo event generator for the main background channel, i.e.  $\bar{p}p \rightarrow \pi^+\pi^-$  is also described. In this case, the parametrisation of the cross section comes from a polynomial fit and from a Regge description in the low and high energy regime, respectively. Preliminary results on the channel  $\bar{p}p \rightarrow e^+e^-\pi^0$ , which opens the possibility of accessing the unphysical region  $q^2 < 4M^2$ , are discussed.