HK 48: Hadron Structure and Spectroscopy V

Time: Wednesday 17:30–19:00 Location: SCH/A316

HK 48.1 Wed 17:30 SCH/A316

Status report of the PANDA FAIR Phase-0 detector development and installation at MAMI — Nicolo Baldicchi[1], Luigi Capozza[1], Samet Katilmis[1], Dong Liu[1], Frank Maas[1,2,3], Julian Moik[1], Oliver Noll[1,2], David Rodriguez Piñeiro[1], •Christoph Rosner[1], Paul Schöner[1], and Sarah Wolf[1] — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA+ Cluster of Excellence, Mainz, Germany

The PANDA experiment will be one of the main pillars of the future FAIR facility in Darmstadt. In the scope of the PANDA FAIR Phase-0 project, the backward electromagnetic calorimeter (EMC) of Panda will be used at the Mainz Microtron (MAMI) accelerator to determine the neutral pion transition form factor, which is a crucial ingredient to reduce the uncertainty of the theoretical calculation of the muon anomalous magnetic moment. Together with an improved experimental uncertainty, this will allow to shed light on the muon g-2 puzzle.

In this contribution, the current status of the detector assembly for the PANDA Fair Phase-0 version of the backward EMC will be summarised. In addition, the first efforts to install the experiment at MAMI will be discussed.

HK 48.2 Wed 17:45 SCH/A316

Search for $J/\psi \to p\bar{p}e^+e^-$ decays at the BESIII experiment — •Saskia Plura, Achim Denig, and Christoph Florian Redmer for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

In 2016, the ATOMKI collaboration proposed the existence of a new neutral boson with a mass of 17 MeV to explain their observation of a significant enhancement in the angular correlations of e^+e^- pairs in nuclear transitions of ^{8}Be and ^{4}He. This new particle, referred to as the X17 boson, sparked interest in the particle physics community.

As the X17 should couple to nucleons, the decay $J/\psi \to p\bar{p}e^+e^-$ has been selected as a potential channel for X17 searches, where the (anti-)proton radiates off an X17, which subsequently decays to an e^+e^- pair. The concurrent QED process offers the possibility to measure the timelike proton form factor in the unphysical region. However, the decay has not yet been measured. The BESIII experiment, located at the BEPCII collider in Beijing, China, has collected a data sample of 10^{10} J/ψ events.

In this talk, the current status of the search for the decay of $J/\psi \to p\bar{p}e^+e^-$ at the BESIII experiment is presented.

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HK 48.3 Wed 18:00 SCH/A316

Luminosity Determination for the FAIR Phase-0 Beamtime to Study Hyperon Production with HADES — •Gabriela Perez Andrade[1,2], James Ritman[1,2], and Peter Wintz[2] for the HADES-Collaboration — [1]GSI, Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt, Germany — [2]Wilhelm-Johnen-Straße, 52428 Jülich

New data on hyperon production have been measured with the upgraded HADES Spectrometer, including the new Forward Detector components (FD). These measurements used a proton beam of 4.5 GeV kinetic energy impinging onto a fixed liquid hydrogen target. Proton-proton elastic scattering with one proton going in the FD ($3^\circ < \theta_{FD} < 6^\circ$) and the other proton in the main HADES acceptance ($70^\circ < \theta_H < 79^\circ$) has a high differential cross-section. This reaction is used to calibrate the FD and determine the integrated luminosity. Event selection is based on the kinematic observables, and the integrated luminosity is calculated considering the elastics yield, the elastic scattering cross-section interpolated from measurements in other experiments, and a correction factor that accounts for the reconstruction efficiency in the FD. Preliminary results of the integrated luminosity for the beamtime will be presented in this talk.

HK 48.4 Wed 18:15 SCH/A316

Study of Elastic Muon-Electron Scattering as Energy Calibration Process for the Proton Radius Measurement at AMBER* — Christian Dreisbach, Karl Eichhorn, Jan Friedrich, •Simon Helbing, Igor Konorov, Martin Losekamm, Stephan Paul, and Thomas Pöschl — Technische Universität München, Physik-Department E18, Garching, Germany

The proton radius can be determined by measuring the slope of the electric form factor G_E at small squared four-momentum transfer Q^2. Numerous elastic scattering and laser spectroscopy measurements of the proton radius have been performed with contradicting results – the so-called proton radius puzzle. We propose to measure the proton radius in high-energy elastic muon-proton scattering at the M2 beam line of CERN's Super Proton Synchrotron in the year 2023. A high-precision measurement at low Q^2 implemented using a high-pressure hydrogen TPC can contribute to a solution of the puzzle, especially in view of the systematics of this approach compared to electron scattering. The kinematic relation in elastic muon-electron scattering is foreseen as calibration process for the momentum of the incoming muon. Data collected in a pilot run in 2021 is used to study the resolutions and methods under comparable conditions to the proposed setup. We present results of the ongoing analysis and developments towards a possible application in the final setup.

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HK 48.5 Wed 18:30 SCH/A316

Study of η and η' Production in Double-Tagged Two-Photon Scattering — •Maurice Anderson, Achim Denig, Christoph Florian Redmer, and Max Lellmann for the BESIII-Collaboration — JGU Mainz

The g-2 puzzle describes a 4.2 σ discrepancy between the experimental measurements of the muon's magnetic moment and the Standard Model prediction. In order to determine whether this observed deviation is a significant discovery of possible Beyond the Standard Model physics, the measurement uncertainty must be reduced. The primary source of systematic error stems from the hadronic quantum fluctuations affecting the muon, specifically the hadronic vacuum polarization (HVP) and the hadronic light-by-light (HLbL) scattering contributions. The HLbL term is dominated by the exchange of pseudoscalar mesons.

In this talk, the production of η and η' mesons via two virtual spacelike photons will be studied. Double-tagged measurements are conducted at the BESIII experiment in Beijing, China, in which both virtual photons possess nonzero momentum transfers (Q^2). The transition form factor needed for the calculation of the HLbL contribution is determined in dependence of both Q^2-values.

HK 48.6 Wed 18:45 SCH/A316

Study of neutral-pion pair production in two-photon scattering at BESIII — •Max Lellmann, Achim Denig, and Christoph Florian Redmer — Johannes Gutenberg-Universität Mainz

The anomalous magnetic moment of the muon, a_μ, is one of the most precisely measured observables of the Standard Model, yet it shows a discrepancy of about 4.2σ between Standard Model prediction and measurement. It is still under discussion whether this discrepancy is a hint for New Physics or a proof for the poor understanding of strong interaction at low energies. To get a better understanding of this discrepancy, one needs to reduce the uncertainty of both, the Standard Model prediction and the direct measurement. Since the uncertainty of the Standard model prediction is dominated by hadronic contributions, it is crucial to gather more information about the contributing hadronic processes.

Information on the production of pion pairs in two-photon fusion processes plays an important role in the calculation of the hadronic light-by-light scattering contribution to a_μ. The BESIII experiment, located at the institute of high energy physics in Beijing/China, offers a perfect testbed for the investigation of two-photon processes at small momentum transfers. The process $e^+e^- \to e^+e^-\pi^0\pi^0$ is measured at the BESIII experiment at centre-of-mass energies between 3.77 and 4.6 GeV with a total integrated luminosity of more than 10 fb^{-1}. This presentation will discuss the current status of the analysis.