HK 10: Hadron Structure and Spectroscopy II

Time: Tuesday 14:00–16:00 Location: H3

Group Report HK 10.1 Tue 14:00 H3

Experimental Inputs to the Hadronic Light-by-Light Contributions to $(g-2)_\mu$ from BESIII — •Max Lellmann, Achim Denig, and Christoph Florian Redmer — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

The long-standing discrepancy between Standard Model prediction and direct measurement of the muon anomalous magnetic moment $a_\mu = (g-2)_\mu/2$ has recently been confirmed by a new measurement by the Muon-g-2-collaboration at Fermilab. In order to establish the significance of the discrepancy between the prediction and direct measurement of currently 4.2σ, both, experiment and theory, need to be improved.

The Standard Model prediction of a_μ is limited by its hadronic contributions, due to the non-perturbative nature of the strong interaction at the relevant energy scales. A large contribution to the uncertainty of the Standard Model calculation stems from the hadronic light-by-light scattering contribution. Its accuracy depends heavily on the knowledge of transition form factors of light pseudoscalar mesons and the production of meson systems from two-photon collisions.

The BESIII experiment, a τ-charm-factory located at the Institute of High Energy Physics in Beijing, China, offers a perfect test bed for the investigation of two-photon processes in the momentum transfer range, which is most relevant to the a_μ calculations. In this presentation we discuss recent results, ongoing projects, and future prospects of the measurements of transition form factors at BESIII.

Group Report HK 10.2 Tue 14:30 H3

Experimental Inputs to the Hadronic Vacuum Polarization Contribution to the Anomalous Magnetic Moment of the Muon at the BESIII Experiment — •Riccardo Aliberti — JGU Mainz

The recent result from the Muon $g-2$ Experiment has confirmed the tension between the Standard Model (SM) prediction of the anomalous magnetic moment of the muon (a_μ) and the experimental measurement at a 4.2 σ level. To understand the origin of this discrepancy further improvements of experiment and theory are necessary.
The uncertainty on the SM prediction is dominated by hadronic contributions and particularly by the Hadronic Vacuum Polarization (HVP) component, which is evaluated with a dispersive formalism from the measurement of hadron production cross sections in electron-positron annihilations. Therefore, improvements in the cross section measurements directly reflect in a reduction of the uncertainty on the HVP contribution to a_μ
The BESIII Experiment, located at the BEPCII collider in Beijing, has collected the world largest dataset of e^+e^--annihilations in the τ-charm energy region. In this talk, the current status and perspective for the measurement of hadron production cross sections, entering the evaluation of the HVP contribution to a_μ, at BESIII are reviewed. The author of this talk is supported by DFG.

HK 10.3 Tue 15:00 H3

Small Angle ISR Analysis of the Pion Form Factor with BESIII — •Yasemin Schelhaas and Achim Denig for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

The anomalous magnetic moment of the muon $a_\mu = (g_\mu - 2)/2$ is one of the most precisely measured variables in modern physics. However, there is a discrepancy of 4.2 standard deviations between the Standard Model (SM) prediction and the experimental average of the latest direct measurements, known as the Muon $(g-2)$-puzzle. The main uncertainty of the SM prediction arises from hadronic contributions and can be improved systematically using experimental measurements of hadronic cross sections at e^+e^- colliders. One of the most important processes is $e^+e^- \to \pi^+\pi^-$. Using a data set of $3.1\,\mathrm{fb}^{-1}$ at a center of mass energy of $4.18\,\mathrm{GeV}$, the $\pi^+\pi^-$ cross section is measured at the BESIII experiment located at the BEPCII collider in Beijing, exploiting Initial State Radiation (ISR) at small angles. The analysis aims to determine the pion form factor at masses above $0.8\,\mathrm{GeV}$, which is also interesting for hadron spectroscopy. In this presentation an overview of the current status of the analysis is given.

Supported by DFG.

HK 10.4 Tue 15:15 H3

Feasibility Studies of Axial Meson Production in Two-Photon Fusion Processes at BESIII — •Nick Effenberger, Christoph Redmer, and Achim Denig for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz, Deutschland

The Standard Model prediction of the muon's anomalous magnetic moment, a_μ, is completely limited in precision by the knowledge of the hadronic contributions. Data driven approaches have been developed to improve the calculations. Recent estimates demonstrate the importance of axial mesons with masses larger than 1 GeV for the hadronic Light-by-Light scattering contribution to a_μ.

The BESIII experiment, located at the BEPCII collider in Beijing, China, has collected data with center-of-mass energies residing in the τ-charm region. These can be used to study the production of axial mesons in two-photon fusion processes with quasi-real or virtual photons. In this presentation, we discuss the prospects of studying axial mesons decaying into the four pion final state containing charged pions only.

HK 10.5 Tue 15:30 H3

Measurement of proton–deuteron correlations in pp collisions at $\sqrt{s} = 13\,\mathrm{TeV}$ — •Michael Jung[1] and Bhawani Singh[2] for the ALICE-Collaboration — [1]Goehte-Universität Frankfurt — [2]Technische Universität München

The first measurement of p–d two-particle correlations in high-multiplicity pp collisions at $\sqrt{s} = 13\,\mathrm{TeV}$ will be presented. The studies of source sizes in these collision systems by the ALICE Collaboration enabled the possibility to study final-state interactions using two-particle momentum correlations. The measured correlation functions as well as comparisons with theoretical predictions using the Lednický-Lyuboshits model will be presented. The theoretical correlations include two interaction models using only the Coulomb force as well as both Coulomb and strong interaction. For the later the measured scattering lengths of proton–deuteron pairs from scattering experiments were taken. However both predictions cannot reproduce the measured correlation function. This deviation might give a hint for a different production mechanism of deuterons such as a late formation of these light nuclei in high-energy pp collisions. Finally we present briefly the status of an analysis of Λ–d correlations.

HK 10.6 Tue 15:45 H3

Investigation of the p–ϕ and p–D interaction in pp collisions at $\sqrt{s}$ = 13 TeV with ALICE — •Emma Chizzali for the ALICE-Collaboration — TUM, Munich, Germany

The strong hadron-hadron interaction can be investigated with high precision using two-particle momentum correlations, as demonstrated by recent ALICE studies performed in pp collisions. This also includes hyperons (Y), for which the existing experimental uncertainties related to their two- and three-body interaction with nucleons (N) prohibits theoretical calculations to obtain firm conclusions on the nuclear equation of state (EoS). This has a direct consequence on the modeling and composition of neutron stars. In this context, the strong Y–Y interaction can be mediated by the ϕ meson within certain effective meson exchange models. This requires experimental input related to the N–ϕ and Y–ϕ systems. Additionally, understanding the N–ϕ interaction provides valuable input to interpret the signs of partial restoration of chiral symmetry in the nuclear medium. The latter can further be studied by means of the interaction between open charm hadrons and nucleons. An experimentally accessible system is the p–D, which has the benefit of also providing information regarding the nature of the newly observed heavy quarkonium-like states and charm pentaquarks. In this talk, the first direct experimental investigation, using correlation techniques, of the p–ϕ and p–D systems will be presented. This has been achieved by the ALICE collaboration, using data from high-multiplicity pp collisions at $\sqrt{s}$ = 13 TeV. These results are capable of providing new constraints to existing theoretical models.