HK 67: Fundamental Symmetries I

Time: Thursday 15:45–17:15 Location: HBR 19: C 103

Group Report HK 67.1 Thu 15:45 HBR 19: C 103

Improved measurement of the anomalous magnetic moment of the muon with 200ppb precision — •René Reimann, Mohammad Ubaidullah Hassan Qureshi, and Martin Fertl for the Muon g–2-Collaboration — Institute of Physics and Cluster of Excellence PRISMA+, Johannes Gutenberg University Mainz, 55099 Mainz, Germany

The magnetic moment anomaly of the muon, that relates the cyclotron and spin precession frequency, provides one of the most stringent tests of the Standard Model of Particle Physics since it is measured and theoretically predicted to very high precision. In August 2023, the Fermilab Muon g-2 experiment reported its result from measurement campaigns 2 and 3 with an increased precision of now 200 ppb, which is both due to increased statistics and reduced systematics. This milestone puts the Muon g-2 experiment well on its way towards its design precision of 140 ppb with final statistics. In this talk we review the key improvements that lead to the reduction of uncertainty on Muon g-2 by a factor of about two and put the measurement in the context of the current theoretical understanding.

Group Report HK 67.2 Thu 16:15 HBR 19: C 103

Status report on the P2 experiment — Sebastian Baunack[1], Maarten Boonekamp[4], Boris Gläser[1], Rahima Krini[1], Frank Maas[1,2,3], Moran Neher[1], Tobias Rimke[1], David Rodriguez Pineiro[2], and •Malte Wilfert[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz, Johannes Gutenberg-Universität Mainz — [3]PRISMA+ Cluster of Excellence, Johannes Gutenberg-Universität Mainz — [4]IRFU, CEA, Université Paris-Saclay, Gif-sur-Yvette, France

The weak mixing angle $\sin^2\theta_W$ can be measured in parity violating elastic electron-proton scattering. The aim of the P2 experiment is a very precise measurement of the weak mixing angle with an accuracy of 0.15% at a low four-momentum transfer of $Q^2 = 4.5 \cdot 10^{-3}\,\mathrm{GeV}^2$. In combination with existing measurements at the Z pole with comparable accuracy, this comprises a test of the standard model with a sensitivity towards new physics up to a mass scale of 50 TeV. The experiment is being set up at the MESA accelerator in Mainz. In this talk, the motivation and challenges for this measurement will be discussed together with the current status of the construction of the P2 experiment.

HK 67.3 Thu 16:45 HBR 19: C 103

Search for Charged Lepton Flavor Violation with the Mu2e experiment at Fermilab — •Anna Ferrari, Stefan E. Müller, Oliver Knodel, and Reuven Rachamin — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

The Mu2e experiment, which is currently under construction at the Fermi National Accelerator Laboratory (USA), will search for the charged-lepton flavor violating neutrino-less conversion of negative muons into electrons in the field of an aluminum nucleus. A conversion signal would require physics beyond the Standard Model, and the aim of Mu2e is to reach a single-event sensitivity four order of magnitude better than previous experiments. This can be achieved by a rigorous control of all backgrounds that could mimic the monoenergetic conversion electrons, together with an accurate normalization of the signal events.

At the ELBE facility of the Helmholtz-Zentrum Dresden-Rossendorf the pulsed Bremsstrahlung photon beam played a key role to study the performance of the detector system that will monitor the rate of the stopped muons in the aluminum target. In addition, ELBE photon and neutron secondary beams allowed radiation hardness studies of the electronic components that will equip the Mu2e electromagnetic calorimeter.

The design and current status of the Mu2e experiment will be presented, together with a summary of the ELBE results.

HK 67.4 Thu 17:00 HBR 19: C 103

Towards axion searches with polarized hadron beams and targets at the GSI/FAIR storage rings — •Daoning Gu for the JEDI-Collaboration — Institut für Kernphysik, FZ Jülich, Germany — III. Physikalisches Institut B, RWTH Aachen University, Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Polarized hadron beams can be used to explore interactions that are not observable with unpolarized beams. In particular, polarized beams are more advantageous for testing symmetry violations. They also offer the opportunity to search for new physics beyond the Standard Model (SM).

Axions are leading particle candidates for dark matter. They were originally introduced to solve the strong CP problem and have also appeared in various extensions to the SM. The axion/axion-like-particle (ALP) field has an effect on the spin motion of the particles in storage rings, which leads to an oscillating electric dipole moment (oEDM).

In this talk, results obtained at the Cooler Synchrotron COSY and possible future experiments that can be performed with existing accelerators at GSI/FAIR in Darmstadt with polarized hadron beams and targets will be discussed. The working principle of axion searches in storage rings will be explained and the preliminary results of simulations will be shown.