HK 8: Fundamental Symmetries I

Time: Monday 16:30–17:45 Location: J-HS B

Group Report HK 8.1 Mon 16:30 J-HS B

Inputs to the Hadronic Contributions to $(g-2)_\mu$ from BESIII — •Christoph Florian Redmer and Achim Denig — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, 55128 Mainz, Germany

The Standard Model prediction of the anomalous magnetic moment of the muon $a_\mu = (g-2)_\mu/2$ is limited by its hadronic contributions, due to the non-perturbative nature of the strong interaction at the relevant energy scales. In order to establish the significance of the long standing discrepancy between the direct measurement and the prediction of currently three to four σ, both, experiment and theory, need to be improved. Recently developed data driven approaches allow to make use of related information obtained in precision measurements to reduce the uncertainties of the Standard Model prediction of a_μ.

The BESIII collaboration embarked on a dedicated experimental program of hadronic cross section and transition form factor measurements to provide inputs to the calculations. The large data samples acquired at center of mass energies at and above the $\psi(3770)$ peak allow to determine exclusive hadronic cross sections with high accuracy at energies below 2 GeV using the technique of initial state radiation. The single-tagged investigation of two-photon processes allows to measure transition form factors of light pseudoscalar mesons and meson systems in the range of momentum transfers, which is most relevant to the a_μ calculations.

In this presentation we discuss recent results, ongoing projects, and the prospects of the efforts at BESIII — Supported by DFG SFB1044.

HK 8.2 Mon 17:00 J-HS B

A new measurement of the electric dipole moment of the neutron — •Dieter Ries — Institut für Kernchemie, Johannes-Gutenberg-Universität, Mainz

A non-zero electric dipole moment of the neutron (nEDM) would violate CP symmetry, and thus would be an indication for a new source of CP violation, which might help to explain the matter to antimatter asymmetry in our universe.

The nEDM collaboration has taken data at the Paul Scherrer Institute in 2015 and 2016 in order to improve on the previous limit

$d_n < 3 \times 10^{-26} e \cdot cm$ at 90% C.L. [1].

In total more than 54000 individual measurement cycles were recorded using Ramsey's method of separated oscillating fields to measure the precession frequency of ultracold neutrons in electric and magnetic fields. The analysis of this dataset has been carried out in a blind fashion.

The collaboration has un-blinded their result at the end of November 2019.

The new result will be presented together with a detailed description of the experiment.

[1]: J.M. Pendlebury et al. PRD 92, 092003 (2015)

HK 8.3 Mon 17:15 J-HS B

Status of the neutron lifetime experiment τSPECT — •Kim Ulrike Ross[1], Peter Blümler[2], Martin Fertl[2], Werner Heil[2], Jan Kahlenberg[2], Simon Kaufmann[1], Dieter Ries[1], and Christian Schmidt[2] — [1]Institute of Nuclear Chemistry, Johannes Gutenberg University Mainz, Germany — [2]Institute of Physics, Johannes Gutenberg University Mainz, Germany

The τSPECT experiment aims to measure the neutron lifetime τ_n using a 3D magnetic storage technique. Due to the neutron's magnetic moment, very low-energetic neutrons (ultracold neutrons, UCN) with a maximum energy of ≈ 50 neV can be stored in the magnetic trap with a volume of $\approx$ 8 litres. τSPECT is designed to determine τ_n using two independent measurement methods. In phase I, surviving UCN in the storage volume after varying storage times are counted. Phase II involves the in-situ detection of decay protons. A proof-of-principle measurement using the magnetic field of the former aSPECT spectrometer (double hump structure) for longitudinal confinement and a fused silica tube for radial storage has been performed in July 2015. Since then, besides the successful upgrade of the UCN D source at the pulsed research reactor Mainz, the 3D magnetic trap using a magnetic octupole for the radial confinement has been installed and commissioned. Other relevant components are a movable neutron guide system with an adiabatic fast passage (AFP) spin flipper as well as a custom-designed UCN detector (boron-coated ZnS:Ag scintillator). We will present the current status of the experiment and the progress of the initial commissioning runs.

HK 8.4 Mon 17:30 J-HS B

Investigation of helicity correlated false asymmetries at the P2 experiment — Sebastian Baunack[1], Dominik Becker[1], Kathrin Imai[1], Rahima Krini[1], Frank Maas[1,2,3], David Rodriguez Pineiro[2], and •Malte Wilfert[1] for the P2-Collaboration — [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

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 a precision of 0.15% at a low four-momentum transfer of $Q^2 = 4.5 \cdot 10^{-3}$ GeV^2. This precision is comparable to existing measurements at the Z pole. The experiment will be built at the future MESA accelerator in Mainz.

The achievable precision in the measurement of the parity violating asymmetry depends not only on the statistical uncertainty, it also depends on various systematic effects. One of them are helicity correlated differences in beam parameters like energy, position and angle. The false asymmetry induced by such fluctuations is described in this talk.