HK 41: Fundamental Symmetries II

Zeit: Mittwoch 16:30–17:45 Raum: HZO 100

Gruppenbericht HK 41.1 Mi 16:30 HZO 100

Recent Progress of the Storage Ring EDM Search with the JEDI Collaboration — •Maria Zurek for the JEDI-Collaboration — Forschungszentrum Jülich, Institut für Kernphysik, Jülich, Germany

Understanding the origin of the matter-antimatter imbalance in the universe is one of the grand challenges of modern physics. One of the necessary conditions to explain it is the violation of CP symmetry. Predictions given by the Standard Model are orders of magnitude too small to explain the observed preponderance of matter. Therefore, new sources of CP violation, coming from outside the realm of the Standard Model, are needed. They can manifest in Electric Dipole Moments (EDM) of elementary particles.

The efforts of the Jülich Electric Dipole Moment Investigations (JEDI) Collaboration concentrate on a direct measurement of the EDM of charged hadrons (protons and deuterons). The goal of the project is to develop the required technologies for a dedicated storage-ring experiment, and to perform a first precursor measurement at the Cooler Synchrotron (COSY) using an RF Wien Filter to demonstrate the feasibility of such a study.

In my talk, I will present the status of the project with emphasis on recent achievements of the collaboration. I will discuss the first results from the commissioning of the RF Wien Filter, as well as for the polarimetry database experiment on deuteron-carbon scattering.

Gruppenbericht HK 41.2 Mi 17:00 HZO 100

Search for a Permanent Electric Dipole Moment of the ^{129}Xe Atom — •Fabian Allmendinger[1], Olivier Grasdijk[3], Werner Heil[2], Klaus Jungmann[3], Hans-Joachim Krause[4], Ulrich Schmidt[1], Lorenz Willmann[3], and Stefan Zimmer[2] — [1]Physikalisches Institut, Universität Heidelberg — [2]Institut für Physik, Universität Mainz — [3]University of Groningen — [4]Peter Grünberg Institut, Forschungszentrum Jülich

A permanent electric dipole moment (EDM) of the ^{129}Xe atom would imply a breakdown of both parity P and time-reversal symmetry T and, through the CPT theorem, a breakdown of CP, the combined symmetries of charge conjugation and parity. Our goal is to improve the present experimental limit ($d_{\mathrm{Xe}} < 3 \cdot 10^{-27}$ ecm). To get more stringent limits, we perform a ^{3}He/^{129}Xe clock comparison experiment with the detection of free spin precession of gaseous, nuclear polarized ^{3}He and ^{129}Xe samples with SQUIDs as magnetic flux detectors. The precession of co-located ^{3}He/^{129}Xe nuclear spins are used as an ultrasensitive probe for non-magnetic spin interactions like the coupling of the EDM to an electric field. With our experimental setup at the research center Jülich we are able to observe spin coherence times T_2^* of several hours for both species. We report on technical improvements with first experimental results showing a factor of 10 higher EDM sensitivity achieved within the MIXed-collaboration.

HK 41.3 Mi 17:30 HZO 100

Development of compact, highly sensitive beam position monitors for storage rings — •Falasatine Abusaif for the JEDI-Collaboration — Forchungszentrum Jülich, IKP-2, Germany — RWTH Aachen University, Physics Institute B, Germany

The Jülich Electric Dipole Moment (JEDI) Collaboration is presently preparing for a first direct measurement of the deuteron Electric Dipole Moment (EDM) in a storage ring using a recently developed novel waveguide RF Wien filter. A non-vanishing EDM signal would provide a new source for CP violation which could explain one of the biggest mysteries in contemporary cosmology; namely the matter over antimatter asymmetry of the Universe. Spin rotations due to an EDM are many orders of magnitude smaller than rotations due to magnetic dipole moment, and in order to suppress systematic effects, the beam position in the RF Wien filter has to be determined with high precision. To this end, a new type of Beam Position Monitor (BPM) was developed which is based on a Rogowski pickup coil.

In this talk, the development of a laboratory test station for the Rogowski coil BPMs, the calibration measurements, and the beam determination of the geometrical center of the pickup coil using a laser tracker system are introduced. The calibrated coils will be installed at the entrance and exit of the RF-Wien filter in the COSY accelerator in January 2018.