Contribution submission to the conference Karlsruhe 2024

The Search for Electric Dipole Moments of Charged Particles in Storage Rings — •Achim Andres — IKP, Jülich, Germany

The matter-antimatter asymmetry in the universe, unexplained by the Standard Model of elementary particle physics, requires CP-violating phenomena, as proposed by A. Sakharov. Subatomic elementary particles with Permanent Electric Dipole Moments (EDMs) violate time reversal and parity asymmetries, implicating CP violation if the CPT theorem holds. In addition, the axion or axion like particles (ALPs), initially proposed to explain CP violation in quantum chromodynamics and potentially constituting dark matter, induce an oscillating Electric Dipole Moment (EDM) along the spin direction when coupled with gluons.

The Cooler Synchrotron COSY at Forschungszentrum Jülich provides polarized and unpolarized protons and deuterons up to a momentum of 3.7 GeV/c and serves as an ideal platform for the JEDI - Collaboration (Jülich Electric Dipole moment Investigations) to conduct the first direct measurement of the permanent deuteron EDM by observing its influence on spin motion. In addition to this measurement of the static EDM, upper limits of the oscillating deuteron EDM due to Axions or ALPs have been measured. Both effects result in a build-up of a vertical polarization component which can be measured with a polarimeter. This presentation will describe both the permanent EDM and the oscillating axion-induced EDM experiments.

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