

Beam and Spin Dynamics for Charged Particle EDM Searches in Storage Rings

Andreas Lehrach on behalf of the JEDI collaboration

Institut für Kernphysik, Forschungszentrum Jülich, Germany

III. Physikalisches Institut B, RWTH Aachen University, Germany

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Permanent EDMs (electric dipole moment) of fundamental particles violate both time invariance \mathcal{T} and parity \mathcal{P} . Assuming the CPT theorem this implies CP violation. The Standard Model predicts non-vanishing EDMs, their magnitudes, however, are expected to be unobservably small with current techniques. Hence, the discovery of a non-zero EDM would be a signal for "new physics".

As a first step towards EDM searches of charged particles in storage rings, R&D work at the Cooler Synchrotron COSY is pursued. Subsequently, a first direct EDM measurement of a charged particle will be performed at COSY, and, on a longer time scale, the design and construction of a dedicated storage ring will be carried out.

Full spin-tracking simulations of the entire experiment are absolutely crucial to explore the feasibility of the planned storage ring EDM experiments and to investigate systematic limitations. Existing spin tracking programs like COSY Infinity have to be extended to properly simulate spin motion in presence of an EDM. In addition, benchmarking experiments are performed at the Cooler Synchrotron COSY to check and to further improve the simulation tools.