

Accelerator physics challenges in Electric Dipole Moment measurements

M. Bai on behalf of JEDI collaboration *
Forschungszentrum GmbH, Juelich, 52428, Germany

Abstract

A convincing measurement of CP-violation that is significantly larger than Standard Model prediction will shine a strong light on the mystery of the asymmetry between matter and antimatter. Even though there have been breakthroughs of verifying CP-violation using accelerators, these measurements are still not at the level to explain the deficiency of anti-matter in our universe. Since the intrinsic electric dipole moment (EDM) requires simultaneous parity and time reversal violation, the search of the EDM of nucleon, atom and etc. provides another approach to probe CP-violation. Hence, such a precise direct measurement of charged particle's EDM has been encouraged as a strategic research field.

The quest to use storage rings to directly measure of EDM of charged particles with unprecedented precision pushes a number of current accelerator science and technologies beyond their state-of-the art to allow directly access to the EDM signal as well as keep all the systematics under full control. This includes a set of topics on the full understanding of various sources of systematics due the imperfection of the machine as well as intrinsic beam dynamics, development of high field electrostatic deflector as well as hybrid electric and magnetic bender, and precise control of beam properties, orbits and optics, as well as spin dynamics.

This presentation will report the status of current storage ring based EDM search R&D at Juelich as well as worldwide. It will also discuss a number of key technologies that need to be addressed for this challenging scientific adventure.

*Juelich Electric Dipole moment Investigation ”<http://collaborations.fz-juelich.de/ikp/jedi/about/introduction.shtml>”