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Search of electric dipole moment using storage ring

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The Standard Model (SM) of Particle Physics fails to explain the reason for our very existence since it is not capable to account for the apparent matter-antimatter asymmetry of our Universe. Permanent EDMs of particles violate both time reversal and parity invariance, therefore via CPT theorem CP is violated. Finding an EDM value larger than predicted by SM would be a strong indication for physics beyond the SM. The JEDI collaboration attempts to measure EDM for proton and deuteron using storage ring. Final precision of 10-29 e·cm is expected with the dedicated storage ring.

The assumed precision level is very high so it is necessary to pay attention to some standard effects which could mimic the investigated EDM. Up to now only the magnetic dipole moment (MDM) and EDM interaction with electromagnetic fields were considered when calculating spin evolution in the storage ring. However, the elements of the storage ring have complicated field distributions, hence the fields gradients are also present. Therefore, the MDM and electric quadrupole moment (EQM) interaction with fields gradients must be considered. This usually neglected effects could mimic EDM signal at the goal precision. The analytical calculations for EQM-gradients interaction [1] confirm the importance of taking into account effects from field gradients in the planned EDM measurements.

The simulations of these effects have to be performed prior to deciding about the design and construction of the final storage ring. Such calculations could be performed with properly modified BMAD software, equipped with realistic fields for all elements. BMAD software was modified implementing particles tracking in custom defined elements and extending T-BMT equation with MDM and EQM interaction with fields derivatives. Presently the custom elements fields are defined with analytical formula taken from Ref. [2]. This allows easy definition of fields gradients and direct control of fields parameters. Preliminary calculations of spin precession with fields gradients effect included will be presented for the quasi-frozen spin method of EDM measurement described in Ref. [3].

References:

1. A. Magiera, Phys. Rev. Accel. Beams 20, 094001 (2017)
2. B.D. Muratori et al., Phys. Rev. Accel. Beams 18, 064001 (2015)
3. Y. Senichev et al., in Proc. 6th Int. Particle Accelerator Conf. (IPAC'15), Richmond, VA, USA, May 2015, p. 213

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