Modeling of spin-orbital dynamics in a storage ring

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**Abstract**. The idea of searching for the electric dipole moment of the proton by using a polarized beam in a frozen spin storage ring was originally proposed at Brookhaven National Laboratory (USA). Currently, the “Jülich Electric Dipole Moment Investigations” (JEDI) collaboration is developing the conceptual design of such a ring specifically for the search of the deuteron electric dipole moment. The present paper ...

1. The Frozen and Quasi-frozen Spin concepts

There exist two design approaches to the problem of measuring the deuteron Electric Dipole Moment (dEDM) inside a storage ring: the Frozen Spin (FS) lattice, and the Quasi-Frozen Spin (QFS) lattice.

In the FS ring design, the spin of a beam particle is aligned with its momentum at any point in time; this allows the maximization of the useful signal, but requires that the energy of the particle be its so-called “magical energy” – a condition that cannot be fulfilled exactly for an ensemble of particles. The QFS design does not require the continuous fulfillment of the Frozen Spin condition; the cost for this is a slight (on the order of percents) degradation of the EDM signal.

In order to decide which design solution is preferable for the attainment of the target accuracy (upped bound on the dEDM at 10-24 e·cm) one has to model the spin-orbital dynamics of the beam inside both lattices. The present work deals with some problems that are inherent in this enterprise.

1. Experiment systematics

The spin dynamics are determined by the Thomas-BMT equation:

In the above equation, the first two terms are caused by the

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References

1. Another reference
2. More references