Measuring the Electric Dipole Moment of the Electron in a Two-energy Spin-Transparent Storage Ring

R. Suleiman1, V. S. Morozov2, Ya. S. Derbenev1

1Thomas Jefferson National Accelerator Facility, Newport News, Virginia 23606, USA

2Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA

We will present a new design of a two-energy storage ring for low energy (0.2-2 MeV) polarized electron bunches\*. The new design is based on the transparent spin methodology that cancels the spin precession due to the magnetic dipole moment at any energy while allowing for spin precession induced by the fundamental physics of interest to accumulate. Counter-rotating electron beams of multiple bunches, with different polarizations (longitudinal and radial) and with both positive and negative helicities, provide adequate control of systematic effects. The buildup of the vertical component of beam polarization can be measured using standard Mott polarimetry that is optimal at low electron energy. These rings can be used to measure the permanent electric dipole moment of the electron, relevant to CP violation and matter-antimatter asymmetry in the universe, and to search for dark energy and ultra-light dark matter.

\* R. Suleiman, V. S. Morozov, and Y. S. Derbenev, On possibilities of high precision experiments in fundamental physics in storage rings of low energy polarized electron beams, arXiv:2105.11575 [physics.acc-ph] (2021). <https://doi.org/10.48550/arXiv.2105.11575>

This work is supported by the U.S. Department of Energy, Office of Science, Office of Nuclear Physics under contract DE-AC05-06OR23177 and by UT-Battelle, LLC, under contract DE-AC05-00OR22725.