Abstract Submitted
for the DNP20 Meeting of
The American Physical Society

A survey of quadrupole deformation in nuclei in order to estimate the enhancement of nuclear MQM and its contribution to atomic EDM[1]

PRAJWAL MOHANMURTHY, University of Chicago, JEFF WINGER, Mississippi State University, UMESH SILWAL, University of Wyoming — New sources of CP violation, beyond the known sources in the standard model (SM), are required to explain the baryon asymmetry of the universe. Measurement of a non-zero permanent electric dipole moment (EDM) of fundamental particles, such as in an electron or a neutron, or in nuclei or atoms, can help us gain a handle on the sources of CP violation, both in SM and beyond. Nuclear magnetic quadrupole moment (MQM), the central topic of this work, is CP, P, and T violating. Nucleons and nuclei have a non-zero MQM from sources within the SM. But the nuclear MQM is dramatically enhanced if the nuclei are structurally quadrupole deformed. Multiple sources contribute to an atomic EDM, viz. nuclear EDM, CP violating interactions between the electrons and the nuclei, and finally the nuclear MQM also contributes to the atomic EDM. Unlike nuclear EDM which are shielded by the Schiff effect, nuclear MQMs are not shielded, making the search for them an attractive avenue to probe CP violation. The goal of this work is two fold: (i) to survey the nuclide chart to estimate the enhancement of nuclear MQM in highly quadrupole deformed nuclei, and (ii) to study the relative contribution of these enhanced nuclear MQMs to atomic EDM.

[1]Supported by DOE grant DE-SC0014448

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Date submitted: 15 Jun 2020 Electronic form version 1.4