Schiff Moments Of Xe Isotopes In The Nuclear Shell Model

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The electric dipole moment (EDM) is a physical observable which violates time reversal symmetry. Through the CPT theorem insisting that the simultaneous application of charge (C), parity (P), and time (T) reversal operators keeps the total symmetry of a system, violation of T reversal symmetry is equivalent to the violation of CP reversal symmetry. The Standard Model in particle physics violates CP invariance only through a single phase in the Kobayashi-Maskawa matrix that mixes quark flavors. The resulting T reversal violation is therefore expected to produce only tiny EDMs.

The EDM of a neutral diamagnetic atom arises from the Schiff moment of the nucleus. The nuclear Schiff moment originates mainly from the two-body nuclear interaction which violates P and T invariance. Theoretical calculations have been carried out for Hg, Rn, and Ra isotopes using mean field theories. However, until recently not so many nuclei have been investigated theoretically.

In this presentation the Schiff moments for the lowest $1/2^+$ states for ^{135}Xe, ^{133}Xe, ^{131}Xe, and ^{129}Xe nuclei are calculated assuming two-body interactions violating P and T invariance in terms of the nuclear shell model. Particularly effects of the particle-hole excitations from the core of the nucleus are considered, which was not considered in our previous study. Furthermore, contributions to the Schiff moment from one orbital to another are separately calculated and analyzed.