

The Nuclear Pear Factory: Searching for Time-Reversal Violation Using Pear-Shaped Nuclei in the FRIB Era

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Experimental tests of fundamental symmetries using nuclei and other particles subject to the strong nuclear force have led to the discovery of parity (P) violation and the discovery of charge-parity (CP) violation. It is believed that additional sources of CP-violation may be needed to explain the apparent scarcity of antimatter in the observable universe. A particularly sensitive and unambiguous signature of both time-reversal- (T) and CP-violation would be the existence of an electric dipole moment (EDM). The next generation of EDM searches in a variety of complimentary systems (neutrons, atoms, and molecules) will have unprecedented sensitivity to physics beyond the Standard Model. This talk will focus on current and planned experiments that use radioactive isotopes with pear-shaped nuclei. This uncommon nuclear structure significantly amplifies the observable effect of T, P, & CP-violation originating within the nuclear medium when compared to isotopes with relatively undeformed nuclei such as Mercury-199. Certain isotopes of Radium (Ra) and Protactinium (Pa) are both expected to have greatly enhanced sensitivity to symmetry violations and will be produced in abundance at the Facility for Rare Isotope Beams currently operating at Michigan State University. I will describe the current status of ongoing searches and the prospects for next generation searches for time-reversal violation possibly using radioactive molecules to further enhance the new physics sensitivity in the FRIB-era.

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