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Solid state-based searches for violation of parity and time-reversal symmetries

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We are conducting two novel searches for parity and time reversal invariance-violating permanent electric dipole moments (EDMs), using ferroelectric solids. We have identified, synthesized, and characterized $Eu_{1-x}Ba_xTiO_3$ ceramics to be used for the electron EDM search. The search for the Schiff moment of ^{207}Pb nucleus is conducted using $PbTiO_3$ ceramics, in which we have demonstrated decoupling of the nuclear spins from the lattice. The sensitivity gains in these materials originate from large densities $n \approx 10^{22}$ cm^{-3}, and from large effective electric fields $E^* \approx 10$ MV/cm due to the ferroelectric displacement of the ions in the crystal lattice field. These experiments aim to achieve factor of 100 improvements to the current limits on the electron EDM and the nuclear Schiff moment.