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Nuclear Spin-Dependent Parity Violation in Diatomic Molecules
JEFFREY AMMON, SIDNEY CAHN, EMIL KIRILOV, DAVID DEMILLE, Yale University, MIKHAIL KOZLOV, Petersburg Nuclear Physics Institute, RICHARD PAOLINO, U.S. Coast Guard Academy — Nuclear spin-dependent parity violation (NSD-PV) effects arise from exchange of the Z^0 boson (parametrized by the electroweak coupling constants $C_{2P,N}$) between electrons and the nucleus, and from the interaction of electrons with the nuclear anapole moment, a parity-odd magnetic moment. The latter scales with the nucleon number A of the nucleus as $A^{3/2}$, while the Z^0 coupling is independent of A; the former will be the dominant source of NSD-PV in nuclei with A greater than 20. NSD-PV effects can be dramatically amplified in diatomic molecules by bringing two levels of opposite parity close to degeneracy in a strong magnetic field. This opens the prospect for measurements across a broad range of nuclei. As a precursor to the measurement of the nuclear anapole moment of ^{137}Ba, we have experimentally observed and characterized opposite-parity level crossings in ^{138}BaF. These are found to be in excellent agreement with parameter-free predictions and indicate that the sensitivity necessary for NSD-PV measurements should be within reach.

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