NARROW OPPOSITE-PARITY LEVEL CROSSINGS IN A DIATOMIC RADICAL

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We have measured and characterized narrow opposite-parity level crossings of the BaF radical in a molecular beam by Zeeman tuning molecular rovibrational levels to these crossings and effecting the transfer with a static electric field pulse. Because of the exquisite homogeneity of the magnetic field (0.1 ppm) during the application of the electric field, the crossings were as narrow as the inverse fly-through time of the radicals through this electric field pulse. The energies, electric dipole moments, and electric polarizabilities of the crossings confirm the predictions of molecular calculations and establish this technique as viable for the proposed measurement of the nuclear anapole moment of the ^{137}Ba nucleus in the continuing experiment, and also as a testbed for the study of two-level quantum systems.