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Hyperfine structure of the hydroxyl free radical (OH) in electric and magnetic fields[1] KENJI MAEDA, Department of Physics, Colorado School of Mines, MICHAEL L. WALL, JILA, NIST and Department of Physics, University of Colorado, Boulder, LINCOLN D. CARR, Department of Physics, Colorado School of Mines — We investigate single-particle energy spectra of the hydroxyl free radical (OH) in the lowest electronic and rovibrational level under combined static electric and magnetic fields, as an example of heteronuclear polar diatomic molecules. In addition to the fine-structure interactions, the hyperfine interactions and centrifugal distortion effects are taken into account to yield the zero-field spectrum of the lowest $^2\Pi_{3/2}$ manifold to an accuracy of less than 2kHz. We also examine level crossings and repulsions in the hyperfine structure induced by applied electric and magnetic fields. Compared to previous work, we found more than 10 percent reduction of the magnetic fields at level repulsions in the Zeeman spectrum subjected to a perpendicular electric field. In addition, we find new level repulsions, which we call Stark-induced hyperfine level repulsions, that require both an electric field and hyperfine structure. It is important to take into account hyperfine structure when we investigate physics of OH molecules at micro-Kelvin temperatures and below.

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