NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF RUBIDIUM BY MOLECULAR BEAM SPECTROSCOPY OF RbF AND RbCl

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We have used a molecular beam spectrometer to study the hyperfine spectra of RbF and RbCl to test for the consistency of molecular parameters between the two molecules and their different isotopomers. By applying sufficient DC and RF electric fields to resolve the Stark components we can fit and correct for the Stark shifts to achieve a precision of better than one hertz in unshifted frequencies that range up to 23 MHz. By looking at pure hyperfine transitions in a wide range of vibrational and rotational states we can correct for zero-point vibration and centrifugal stretching effects to get equilibrium values for the hyperfine interactions, including the nuclear electric quadrupole interactions, the spin-rotation interactions, and the tensor and scalar spin-spin interactions. The high precision of the measurements means that the ratio of the effective nuclear electric quadrupole moments of the two Rb isotopes can be determined to about 8 significant figures. This ratio is nearly the same in RbCl as it is in RbF, though there may be a small difference that would be evidence for a pseudoquadrupole interaction. The other interactions are fully consistent between the different isotopomers.