STEPS TOWARD EXPERIMENTAL DETECTION OF MOLECULAR PARITY VIOLATION: ROVIBRATIONAL ANALYSIS OF THE CF-STRETCHING MODE AND FIRST OVERTONE OF CHFBrI

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The experimental detection of molecular parity violation[a] $\Delta_{PV}E$ is of great interest because of its importance in the understanding of fundamental aspects of molecular dynamics and symmetries. One possible method for this is measuring the rovibrational or rotational frequency shifts in the infrared or microwave spectra of enantiomers[b]. A value of 50 mHz is predicted for vibrational frequency shifts in CHFBrI[c], which is almost within the range of current infrared[d] and submm wave spectroscopic resolution. We report here IR-spectroscopic results and a first high resolution analysis of the infrared spectrum of CHFBrI. The FTIR spectrum of CHFBrI was recorded at 190 K and 295 K in the regions 600–1300 cm^{-1} and 1800–2350 cm^{-1}[e]. We were able to analyse the rovibrational spectra of $CHF^{79}BrI$ (ν_0 = 1060.81569 cm^{-1}) and $CHF^{81}BrI$ (ν_0 = 1060.77864 cm^{-1}) in the CF-stretching (ν_6) and its overtone regions with band centers ν_0 = 2103.75730 cm^{-1} for $CHF^{79}BrI$ and ν_0 = 2103.65974 cm^{-1} for $CHF^{81}BrI$. We will discuss a possible application of CO_2 laser quasi-resonant two photon transitions in the overtone region of CHFBrI. Finally, we will show submm spectra of CHFBrI recorded with the Zürich-FASSST spectrometer and discuss how submm wave spectroscopy based on FASSST[f] and phase-locked backward wave oscillators[g] can be used to determine line shifts on the order of mHz.

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