# MICROWAVE AND MMWAVE STUDY OF $CH_3SiH_3$ INCLUDING THE PERTURBATION-ALLOWED TORSION-VIBRATION DIFFERENCE BAND $(v_{12} = 0, v_6 = 3) \leftrightarrow (v_{12} = 1, v_6 = 0)$

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The vibration-torsion-rotation Hamiltonian in $CH_3SiH_3$ has been investigated using Fourier transform microwave methods and tunable sideband far-infrared spectroscopy. Four different studies have been carried out. First, the $Q$-branch of the torsion-vibration difference band $(v_{12} = 0, v_6 = 3) \leftrightarrow (v_{12} = 1, v_6 = 0)$ has been measured between $17.8$ and $26.6$ GHz. When three quanta of the torsional mode $\nu_6$ are excited in the ground vibrational state (gs) for $(\sigma = -1)$ torsional sublevels with $K = 6$, these transitions become allowed through resonant Coriolis-like coupling to the lowest lying degenerate mode $\nu_{12}$ with no quanta of $\nu_6$ excited. Second, direct $l$-doubling transitions in the state $(v_{12} = 1, v_6 = 0)$ have been observed between $8.3$ and $17.5$ GHz for both $\sigma = 0$ and $\sigma = \pm 1$. In the limit that the intervibrational interactions vanish, the $\sigma$-splitting between lines of the same $J$ would be difficult to resolve, but frequency differences of more than 1 GHz due to these interactions have been determined. Third, the $(J = 1 \leftarrow 0)$ spectrum just below 22 GHz has been re-measured with higher resolution for $0 \leq v_6 \leq 4$ in the gs and for $(v_6 = 0)$ in $\nu_{12}$. Finally, the $(J = 45 \leftarrow 44)$ spectrum near 1 THz has been obtained for $0 \leq v_6 \leq 2$ in the gs. A global data set of $3423$ frequencies has been formed by merging the present $123$ measurements with the data set used recently in the simultaneous analysis of the $\nu_{12}$ and $\nu_5$ bands. By refining the $(\text{gs}/\nu_{12}/\nu_5)$ Hamiltonian developed in this earlier work, a good fit to within experimental error has been obtained by varying $45$ parameters. The grouping of the torsional motion with rotational rather than vibrational degrees of freedom will be discussed.