Methanol is the simplest molecule with a three-fold internal rotation and the observation of its $\nu_8$ band served the primary catalyst for the development of internal rotation theory\(^{(a,b)}\). The 75 subsequent years of investigation into the $\nu_8$ band region have yielded a large number assignments, numerous high precision energy levels and a great deal of insight into the coupling of $\nu_t=3 & 4$ with $\nu_8$, $\nu_7$, $\nu_{11}$ and other nearby states\(^{(c)}\). In spite of this progress numerous assignment mysteries persist, the origin of almost half the far infrared laser lines remain unknown and all attempts to model the region quantum mechanically have had very limited success. The $C_3V$ internal rotation Hamiltonian has successfully modeled the $\nu_t=0,1 & 2$ states of methanol and other internal rotors\(^{(d)}\). However, successful modeling of the coupling between torsional bath states and excited small amplitude motion remains problematic and coupling of multiple interacting excited small amplitude vibrations featuring large amplitude motions remains almost completely unexplored. Before such modeling can be attempted, identifying the remaining low lying levels of $\nu_7$ and $\nu_{11}$ is necessary. We present an investigation into the microwave spectrum of $\nu_7$, $\nu_8$ and $\nu_{11}$ along with the underlying torsional bath states in $\nu_t=3$ and $\nu_t=4$.

\(^{(b)}\) J. S. Koehler and D. M. Dennison, Phys. Rev. 57, 1006 (1940).