THE GROUND STATE ROTATIONAL SPECTRUM OF METHANOL

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Internal rotation plays a very important role in the rotational spectrum of methanol. The overall rotation of the molecule couples very strongly to the rotation of the methyl top, which results in a significant K-dependant contribution to the energy levels. The light nearly prolate nature of methanol results in the most intense Q and R-branches being in the THz region of the spectrum. It also results in the $K > 8$ P-branch transitions being at high J in the millimeter and microwave regions of the spectrum. In addition, methanol is one of the most abundant molecules in star-forming regions in the molecular interstellar medium and is therefore of great interest to astronomy as it will have a significant presence in almost any far-infrared astronomical spectrum.

The ground state spectrum of methanol has been studied in unprecedented detail, with over 1 THz of frequency measured spectra with sufficient sensitivity to detect weak high J transitions. Previous studies of the ground state avoided a number of pathologies in the spectrum such as K crossings in the E-states and level crossings between the ground state and the excited torsional state. A number of these strongly interacting energy levels have been identified and should facilitate precise determination of the off-diagonal torsion rotation interaction parameters. The v_t=0 state data has been compiled together with previous data into an extensive line list of over 3800 transitions, including new assignments up to J=46 and K=18. This data set will allow for fitting of some of the higher order effects in the rotational Hamiltonian of this state as well as potentially illuminating a number of quantum mechanical details in the C_{3V} internal rotation problem. Lastly it will provide a very complete database for observable transitions in interstellar spectra. The results of our analysis will be discussed here.