THE $v_t = 1$ STATE OF METHANOL

JOHN C. PEARSON, CAROLYN BRAUER, BRIAN J. DROUIN and HERBERT PICKETT, *Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109*; JONATHAN FISHER, HONGYU SHI and LI-HONG XU, *Centre for Laser, Atomic and Molecular Sciences (CLAMS), Department of Physical Sciences, University of New Brunswick, Saint John, N.B., Canada E2L 4L5*.

Methanol is observed in a wide range of interstellar molecular clouds with the highest abundances in hot cores associated with star formation like where the $v_t = 1$ state was first observed over 30 years ago. Herschel, SOFIA and ALMA will require precise knowledge of methanol to much higher quantum numbers and frequencies than currently available. The rotational spectrum of methanol is characterized by an asymmetric top overall rotation coupled with an intermediate barrier three fold hindered rotation. The $v_t = 1$ state is at the top of the torsional barrier and has mixed character of rotation perturbed by internal rotation and free internal rotation perturbed by rotation. The spectrum features both the low K E-state level crossings found in the ground state, interacting A-state K levels and avoided crossings with other torsional states. Well over 2000 transitions have been assigned through $K = 14$ and $J = 47$. The emphasis of this work was to connect as many of the K levels as possible with microwave accuracy transitions and to extend the existing data set to higher J. We report b-type transitions connecting the A-state levels through $K = 13$ and E-state levels from $K = -12$ through $K = 12$. The detailed structure and pathologies in the spectrum will be discussed.