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Title

Microwave spectroscopy of methanol between 2.48 and 2.77 THz

Source

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Abstract

Methanol is the prototypical intermediate $C(3V)$ barrier to the internal rotation molecule. It is also one of the primary sources of line confusion in the interstellar medium where it is observed in a variety of regions with temperatures approaching room temperature in the more extreme cases. Recently, a fairly comprehensive rotational study of methanol was performed that analyzed the available data to $J = 30$ in the first three torsional states with a rho axis method (RAM) Hamiltonian. The availability of a new frequency source covering 2.48 to 2.77 THz offered a unique opportunity to rigorously test the ability of the RAM Hamiltonian model in extrapolation in both J and K quantum numbers and an opportunity to confirm a number of newly assigned methanol levels. It also facilitated a unique opportunity for a direct comparison of results obtained with a frequency multiplier, Fourier transform infrared, laser sideband, tunable far infrared, and quantum cascade lasers at terahertz frequencies. The spectrum of methanol is presented and assigned for the 2.48-2.77 THz band. Lines in the first four torsional states are identified and compared to predictions of the RAM model for the first three torsional states and available energy levels for the $\nu(t) = 3$ state. A number of previously unidentified subbands are assigned for the first time, providing some unique insight into the difficulties of extrapolating with a rho axis $C(3V)$ internal rotation Hamiltonian. (C) 2011 Optical Society of America