TORSION-ROTATIONAL TERAHERTZ SPECTROSCOPY ON DIMETHYL ETHER

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Dimethyl ether (DME) was first detected in the interstellar medium more than 30 years (1974) ago towards Orion[a]. It is highly abundant in hot cores such as Orion or Sagittarius B2 at temperatures exceeding 100 K. A large amount of ground state transitions up to 900 GHz have been detected in several line surveys[b]. Due to high excitation temperatures in hot cores, rotational levels of torsional excited states are expected to be sufficiently populated to show transitions in these surveys. New telescopes, such as the Herschel Space Observatory will grant observations with greatly improved sensitivity at even higher frequencies reaching far into the THz regime. This will drastically increase the request of accurately known rest frequencies for the interpretation of astronomical observations.
Since precise predictions for the ground state of DME are available only up to 600 GHz[c], and the datasets for the excited torsional states are very limited, we decided to record spectra into the THz region by using frequency multiplier techniques. Weaker transitions have been additionally obtained with highly sensitive spectrometers using phase-locked backward wave oscillators. The greatly extended ground state dataset currently includes transitions up to 1.2 THz and transitions accessing J and K rotational quantum numbers up to $J = 69$ and $K = 18$. An increased number of P-branch transitions improves the quality of the predictions for line frequencies. Equally, the very limited datasets for the first two excited torsional states of DME have been greatly enlarged and analyzed to allow predictions for the mm- and submm-range.

[a] L. E. Snyder *et al. Astrophys. J.*, **191**, L79−L82 (1974)
[b] C. Comito, P. Schilke, T.G. Philips, D.C. Lis, F. Motte, and D. Mehringer. *Astrophys. J. Suppl. Ser.*, **156**, (2005) 127−167
[c] P. Groner, S. Albert, E. Herbst, and F.C. De Lucia. *Astrophys. J.*, **500**, 1059−1063 (1998)