THE ROTATIONAL SPECTRUM OF SINGLY AND DOUBLY ^{13}C-SUBSTITUTED DIMETHYLETHER

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Dimethylether (DME) is a nearly prolate asymmetric top with two internal rotors (methyl groups) which undergo periodic large amplitude motions and show a complicated torsional splitting of each rotational energy level. Due to its complex spectrum and its high abundance in hot cores such as Orion KL or Sagittarius B2 at temperatures exceeding 100 K, DME is very prominent in astronomical line surveys and contributes to spectral line confusion of such sources[a]. The interpretation of astronomical observations therefore depends on the knowledge of accurate rest frequencies and reliable intensities. Precise predictions for the ground state of DME's main isotopologue are now available up to 2.1 THz[b]. In contrast, very little is known about ^{13}C-substituted DME. Only a few data are available on singly ^{13}C-substituted DME[c], $^{12}CH_3O^{13}CH_3$. However, no data are available on doubly ^{13}C-substituted DME, $(^{13}CH_3)_2O$, yet. While in $(^{13}CH_3)_2O$ the two internal rotating methyl groups are equivalent and the splitting of rotational energy levels into four substates is comparable to the main isotopologue, singly ^{13}C-substituted DME has two non-equivalent internal rotors resulting in torsional splitting of rotational energy levels into five substates. The purpose of our new laboratory measurements is to extend the knowledge on the astrophysically relevant species $^{12}CH_3O^{13}CH_3$. To analyze the complicated spectrum resulting from a ^{13}C-enriched sample of DME, containing all different ^{13}C-substituted species as well as the main isotopologue, also precise data on doubly ^{13}C-substituted DME are inevitable. We performed measurements in the frequency region 35-120 GHz using an all solid state spectrometer. Rotational as well as torsional parameters have been obtained for $(^{13}CH_3)_2O$ as well as $^{12}CH_3O^{13}CH_3$ by fitting the assigned transitions to an effective rotational Hamiltonian introduced by Peter Groner[d].

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[d]P. Groner, *J. Chem. Phys.* **107**, 4483-4498 (1997)