COMPREHENSIVE SUBMILLIMETER WAVE STUDIES OF THE ISOTOPIC SPECIES OF A MAJOR WEED: METHYL FORMATE

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Complex organic molecules are relatively heavy, their maximum absorption is in the millimetric domain at about 300 GHz. But the most abondant, like methyl formate, could be detected in the ISM up to 900 GHz.[a] We will present here the last results obtained about the two ^{18}O and the doubly-deuterated species of methyl formate. This concludes the systematic investigation up to 660 GHzfor the mono-substituted isotopic species with either ^{13}C, ^{18}O, or D, which began in 2006.

The lines from these isotopic species will certainly be present in the spectra which will be recorded in the next years with the very sensitive telescope ALMA, HERSHEL and SOFIA. The detection of isotopic species is very important for the astrophysical community to improve the interstellar chemical modeling and to understand the formation mechanism of these complex organic molecules.

Our interest was also on the theoretical aspects. Like other complex organic molecules, methyl formate displays a large amplitude motion. Here it is the rotation of the methyl group with respect to the rest of the molecule. Theoretical models were developed to reproduce accurately the observed frequencies for large quantum numbers values as J-values as high as 70 could be reached. Similarly the investigation of the doubly-deuterated $HCOOCHD_2$ was undertaken to test the model developed for mono-deuterated $HCOOCH_2D$.[b]

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[a] C. Comito, P. Schilke, T. G. Phillips, et al., *Astrophys. J. Supp.* **156** (2005) 127.

[b] L. Margulès, L. H. Coudert, H. Møllendal, et al., *J. Mol. Spec.* **254** (2009) 55.