

PRELIMINARY WORK TO ALMA: SUBMILLIMETER WAVE SPECTROSCOPY OF ^{18}O AND D SPECIES OF METHYL FORMATE^a

L. MARGULÈS, R. MOTIYENKO, T. R. HUET, *Laboratoire PhLAM, CNRS UMR 8523, Université de Lille 1, 59655 Villeneuve d'Ascq Cedex, France.*; H. MØLLENDAL, *Centre for Theoretical and Computational Chemistry (CTCC), University of Oslo, P. O. Box 1033, Blindern, NO-0315 Oslo, Norway*; J.-C. GUILLEMIN, *Sciences Chimiques de Rennes-Ecole Nationale Supérieure de Chimie de Rennes-CNRS, 35700 Rennes, France*; K. DEMYK, *Centre d'Etude Spatiale des Rayonnements, Université de Toulouse 3, 31028 Toulouse cedex 4, France*; M. CARVAJAL, *Departamento de Física Aplicada, Universidad de Huelva, Spain*; I. KLEINER, and L. H. COUDERT, *LISA, CNRS UMR 7583, Université Paris 12, 94010 Créteil Cedex France.*

New radiotelescopes, working in the submillimeter range, will be operating in the next few years: ALMA, Herschel, and SOFIA. A large amount of laboratory work is required in order to account for the increased resolution and accuracy needed to analyze the numerous data which will be obtained with these new instruments. There is a strong interest of the astrophysical community in isotopic species for two main reasons: (i) Their detection provides us with key information about interstellar chemical modeling, especially for complex organic molecules, like methyl formate, as their formation mechanisms is not well understood yet. (ii) They are responsible for a large fraction of U-lines and their assignments are necessary to allow the detection of new species.

In this context we continue a systematic study of the isotopic species of methyl formate (HCOOCH_3) initiated with $\text{H}^{13}\text{COOCH}_3$.^b Our next investigation of $\text{HCOO}^{13}\text{CH}_3$ allowed us the detection of 500 lines in Orion.^c The treatment of the data concerning methyl formate is not obvious due to the internal rotation of the methyl group. This treatment is different in case of a symmetric (CH_3) or an asymmetric (CHD_2) rotor part. We will report here on recent results obtained for DCOOCH_3 , HCOOCHD_2 , $\text{HC}^{18}\text{OOCH}_3$, and $\text{HCO}^{18}\text{OCH}_3$.

^aThis work is supported by ANR-08-BLAN-0054 and ANR-08-BLAN-0225

^bWillaert, Møllendal, Alekseev, *et al. J. Mol. Struct.* **795** (2006) 4

^cCarvajal, Margules, Tercero, *et al. Astron. Astrophys.* (2009) in press