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Andrea Maggio - Free jet millimeter wave torsion-rotation spectrum of a silicon containing molecule: dimethylsilane

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In the interstellar and circumstellar medium, Silicon can be found in form of silicates in the core of dust grains surrounding carbon stars; when the grains are destroyed it quickly reacts to form SiO and SiS. As today, among the 260 and more molecular species found in the interstellar medium, less than fifteen are silicon-based, so the research of molecules containing Silicon is crucial to build better theoretical models about formation and reaction pathways. The research and identification of molecular species in the interstellar medium relies heavily on spectroscopic techniques, such as microwave spectroscopy, due to the fact that the rotational spectrum of a molecule can be regarded as its fingerprint and allows a straightforward and unambiguous determination. For this reason, laboratory work is essential to outline a reliable predictive model useful to analyze cosmological surveys. Being methylsilane among the silicon-based molecules already discovered, we decided to characterize by means of rotational spectroscopy its superior homologue, dimethylsilane, in the hope that it could be found in environments resembling those where most of the silicon-containing species have been found. (cit) In our laboratory we measured the spectra of dimethylsilane and its isotopologues in the frequency interval 60 to 78 GHz with the supersonic expansion technique, assigning the transitions belonging to four isotopologues of dimethylsilane: those containing the isotopes ^{28}Si , ^{29}Si , ^{30}Si and ^{13}C . Dimethylsilane exhibits internal rotation of the two methyl groups around their own axes. This has the effect of splitting every rotational transition into four components with different intensity, labelled AA, EE, EA and AE according to the symmetry of the torsional wavefunctions. At the conclusion of the experiment, we successfully characterized the spectra of the four species in exam, obtaining their spectroscopical parameters, conducted a geometry analysis and built a predictive model, comprehensive of the internal rotation splitting, useful for the research of these molecules in the interstellar medium in different conditions. Discovery of methyl silane and confirmation of silyl cyanide in IRC +10216 J.

Session Classification: Posters: 1-minute talks