ROTATIONAL SPECTRUM AND INTERSTELLAR DETECTION OF THE FIRST TORSIONALLY EXCITED STATE OF METHYLAMINE

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Methylamine (CH_3NH_2) was first detected in the interstellar medium (ISM) toward Sgr B2 almost 50 years ago by observation of its v_t = 0 rotational transitions[a]. Methylamine exhibits two large amplitude motions, methyl torsion and amine wagging, that complicate the spectral analysis especially in excited vibration states. This work aims to study experimentally and theoretically the terahertz rotational spectrum of methylamine to provide a reliable basis for the ISM detection of rotational transitions in v_t = 1 state. The terahertz spectrum of methylamine was measured from 150 to 1520 GHz with the Lille fast scan spectrometer. Using a new "hybrid" Hamiltonian model, we were able to fit accurately the rotational spectrum of the v_t= 1 state of methylamine including the analysis of the nuclear quadrupole hyperfine structure. The results of this spectroscopic analysis allowed us to search for rotational transitions of methylamine in its first torsionally excited state toward the high-mass star forming region Sgr B2(N) that was the target of the imaging spectral line survey ReMoCA performed with the Atacama Large Millimeter/submillimeter Array (ALMA). We report the first interstellar detection of methylamine in its v_t = 1 state on the basis of this interferometric data set.

[a]Kaifu, et al. 1974, ApJ, 191, L135; Fourikis et al. 1974, ApJ, 191, L139