Searching for Methylamine in star-forming regions using ALMA archival data

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Methylamine (CH_3NH_2) is the simplest amine and thought to be a potential interstellar precursor of the amino acid glycine. It is confirmed by the experimental work that the reaction of methylamine with CO_2 in water ice yields glycine under UV irradiation [1]. In terms of exploration in the Solar system, this molecule has been detected in two comets. However, in molecular clouds, a robust detection of methylamine has been reported only for Sgr B2(N) [2] so far, while a variety of complex organic molecules have been detected by radio observations. To search for methylamine, we focused on the Orion Kleinmann–Low nebula (hereafter Orion KL) and IRAS 16293-2422 (IRAS 16293), which are known as examples of the most prolific sources of line emission of a variety of complex organic molecules.

We used the ALMA Cycle2 archival data toward Orion KL (#2013.1.00533.S) and Cycle1 archival data toward IRAS 16293 (#2012.1.00712.S) in Band 6. In Orion KL, we found several candidate features of methylamine lines in Hot Core (Figure 1; left panel). We evaluated its column density and rotational temperature to be $< 4.4\times10^{14}$ cm^{-2} and > 109 K, respectively, by preparing the rotation diagram (Figure 1; right panel). While in IRAS 16293, we cannot obtain a rotation diagram properly because of the line confusion.

We compare the results for several sources including the above two sources, considering their different chemical condition.

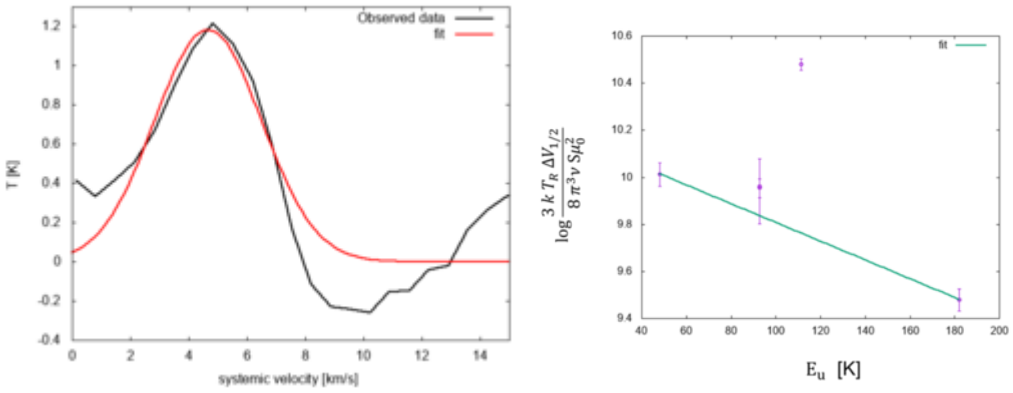

Figure 1: (*left panel*) Observed spectra of methylamine (black) and the result of the Gaussian fitting for it (red) in Orion KL (*right panel*) Rotation diagram of methylamine in Orion KL. The error bars represents ±3σ for each data.

References

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[2] D. T. Halfen, V. V. Ilyushin, & L. M. Ziurys, 2013, ApJ 767, 66.