Observations of deuterium-bearing molecules in star-forming regions

B. Parise [1]

[1]*Max-Planck-Institut für Radioastronomie, Bonn, Germany*

Despite the low deuterium abundance in the Universe (D/H ~ 1.5 x 10^{-5}), high abundances of deuterated molecules are detected in star-forming regions, with the abundance ratio of the deuterated over the main isotopologues being higher than the cosmic abundance of deuterium by several orders of magnitude. Particularly, the warm dense gas in hot cores around low-mass protostars is enriched in deuterated species, with even high observed abundances of triply-deuterated species such as CD_3OH ([1], see Figure 1). These deuterated molecules provide valuable tools to probe the physical conditions occurring during star formation, as well as the formation mechanisms of molecules. Deuteration is thought to be driven by the small energy differences between a deuterated species and the normal isotope. Because the temperatures indicated by the fractionation are much lower than the present gas temperatures in hot cores, the observed deuterations are thought to reflect a previous cold phase. Likely these molecules formed during the preceding prestellar core phase -- either in the gas phase or on the grain surface -- and were stored in an ice mantle which evaporated once the YSO heated its environment above the ice sublimation temperature.

In this talk, I will present observations of deuterium-bearing molecules in star forming regions, and illustrate which constraints they bring to the understanding of the formation processes of molecules. I will also underline the interaction with studies performed in the laboratory.

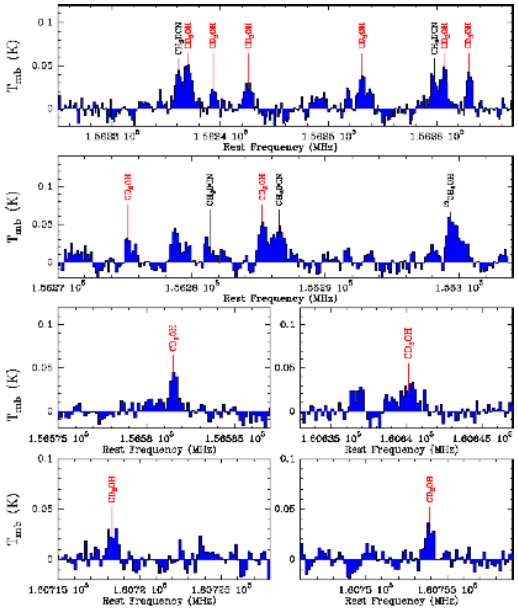

Figure 1: Detection of CD_3OH towards the low-mass protostar IRAS16293-2422. The abundance ratio CD_3OH/CH_3OH is 13 orders of magnitude higher than the cosmic D/H ratio.

References

[1] B. Parise, A. Castets, E. Herbst et al., 2004, A&A 416, 159.