MULTIPLY DEUTERATED SPECIES IN INTERSTELLAR AND PROTOSTELLAR ENVIRONMENTS.

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Observations of deuterated molecules have long been recognised as important tracers of the physical and chemical processes which are occurring in the Interstellar Medium (ISM). In the ISM, deuterium is mostly locked up in the form of HD, with an abundance relative to H_2 of only $\sim 10^{-5}$, but under certain conditions it can be preferentially brought out of this interstellar reservoir and into an active chemistry, resulting in greatly enhanced abundances of deuterium bearing molecules.

For a long time this fractionation process appeared to be well understood, and observations of deuterium-bearing molecules have been used to determine the chemical pathways by which molecules form in interstellar and protostellar regions. Recently, however, observations of multiply deuterated molecules, such as formaldehyde (D_2CO) and methanol (CH_2DOH/CHD_2OH), have found much larger relative abundances than we would have expected, and have cast doubt on our understanding of the deuteration processes in interstellar clouds.

In this talk I will present the most recent results from detailed chemical kinetic models of deuterium chemistry, focusing on theoretical predictions for multiply deuterated species. I will discuss the differences between pre-stellar and proto-stellar cores and the implications of current estimates of deuterium fractionation and suggest further observations which could help constrain the chemical processes occurring in these regions.