Complex molecules in PDRs and protoplanetary disks

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Abstract

Complex molecules are commonly detected in high- and low-mass star forming regions. In the past years, however, complex species have been detected in unexpected environments like photo-dominated regions (PDRs). The great sensitivity and resolution power of ALMA has also allowed us to start detecting and resolving complex species in protopanetary disks. I will first show results from the WHISPER line survey in the famous Horsehead nebula. We detect the complex organic molecules H2CO, CH3OH, HCOOH, CH2CO, CH3CHO and CH3CCH, with similar abundances in the UV-exposed PDR and the UV-shielded dense core. This shows the importance of the interplay between the solid and gas phase chemistry in the formation of (complex) organic species, and confirm that ice photo-processing is an efficient mechanism to release frozen species in the gas phase. We also detect CH3CN and its isomer CH3NC in the PDR. In contrast to the other complex molecules, CH3CN is 30 times more abundant in the PDR than in the core, suggesting a specific formation mechanism.

In the second part, I will show recent observations of complex organic molecules in protoplanetary disks. CH3CN and HC3N have been detected in at least two disks, MWC 480 and V4046 Sgr, and CH3OH been detected towards the TW Hya disk. I will also discuss observations of H2CO, a key intermediate in the formation of more complex species in ices. Contrary to CH3OH, H2CO is readily observable in disks and could thus be used to trace the cold organic reservoir in disks.

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