Complex Organics in the Horsehead Photo-Dissociation Region

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Résumé

The Horsehead nebula is a prototypical photodissociation region. Its closeness (_˜400 pc) and favorable almost edge-on geometry make it an excellent source to serve as a template to chemical models. Due to the low-UV flux (G0 _˜ 100) and high density (nH _˜ 10ˆ5 cmˆ-3), dust grains close to the cloud edge are expected to be covered by ice mantles, which can be photodesorbed into the gas, producing a peculiar chemistry and molecular content. I will summarize our results from the Horsehead WHISPER unbiased spectral line survey at 3, 2 and 1mm with the IRAM-30m telescope towards the warm PDR and its associated cold dense core (PI: J.Pety). We detected a new species in the ISM, the hydrocarbon C3H+, which confirm the top-down scenario in the formation of small carbon chains, like C2H and C3H2, in the presence of FUV radiation (Pety et al. 2012; Guzman et al. 2015). We also detect

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the complex organic molecules H2CO, CH3OH, HCOOH, CH2CO, CH3CHO and CH3CCH, with similar abundances in the PDR and dense core, and show the importance of the interplay between the solid and gas phase chemistry in the formation of (complex) organic species, and confirm that photo-desorption by far UV photons is an efficient mechanism to release frozen species in the gas phase (Guzman et al. 2011, Guzman et al. 2013, Guzman et al. 2014). Finally, we detect CH3CN and its isomer CH3NC in the PDR (Gratier et al. 2013). Surprisingly, and 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: photo-desorption, top-down chemitry, or other.

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