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Complex organics in the Horsehead PDR

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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 ($G_0 \sim 100$) and high density ($n_H \sim 10^5$ cm^{-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 an unbiased spectral line survey at 3, 2 and 1mm with the IRAM-30m telescope towards the warm PDR and its associated cold dense core (WHISPER; PI: J. Pety). We detected a new species in the ISM, the hydrocarbon C_3H^+, which confirm the top-down scenario in the formation of small carbon chains, like C_2H and C_3H_2, in the prescence of FUV radiation (Pety et al. 2012; Guzmán et al. 2015). We also detect the complex organic molecules H_2CO, CH_3OH, HCOOH, CH_2CO, CH_3CHO and CH_3CCH, 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 FUV photons is an efficient mechanism to release frozen species in the gas phase (Guzmán et al. 2011, Guzmán et al. 2013, Guzmán et al. 2014). Finally, we detect CH_3CN and its isomer CH_3NC in the PDR (Gratier et al. 2013). Surprisingly, and in contrast to the other complex molecules, CH_3CN is 30 times more abundant in the PDR than in the core, suggesting a specific formation mechanism.

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