The chemical nature of Orion protostars: Are ORANGES different from PEACHES?

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The protostellar stage is known to be chemically rich and diverse. Indeed, molecules that were trapped onto the ice mantles of grains during the prestellar core phase are released into the gas phase, resulting in the chemical enrichment and diversity of the protostar environment [1][2]. Key pieces of evidence of this chemical diversity are hot corinos and Warm Carbon Chain Chemistry (WCCC) objects, two chemically distinct types of solar-mass protostars. On the one hand, hot corinos are compact (<100 au), dense ($n>10^7$ cm^{-3}) and hot (T>100K) regions [3], enriched in interstellar Complex Organic Molecules (iCOMs; e.g. CH_3OH, CH_3OCH_3) [4][5]. On the other hand, WCCC protostars have an inner region deficient in iCOMs but a larger zone (~1000-2000 au) enriched in hydrocarbons (e.g. CCH, c-C_3H_2)[6]. This protostellar chemical diversity could reflect a difference in the chemical composition of the grain ice mantle set during the pre-stellar core phase. Whether the environment affects this diversity and how, is still an open question.

In order to understand what causes the chemical diversity of solar-type protostars, we need to perform systematic studies of the chemical composition of solar-mass protostars at small scales located in different environments. In this context, two recent studies were performed. The first one is the PErseus ALMA CHEmistry Survey (PEACHES)[7], which targeted a relatively close protocluster containing only low-mass objects. The second one is the ORion ALMA New GEneration Survey (ORANGES)[8][9], which targeted the Orion Molecular Cloud 2/3 filament, the nearest low- to high- mass star-forming region, highly UV-illuminated by nearby HII regions. While PEACHES showed that hot corinos were likely dominant in Perseus, I will present the new results obtained from ORANGES, and answer the question of whether ORANGES are different from PEACHES.

Références

[1] Cazaux et al., ApJ, 593, 51 (2003)

[2] Jørgensen et al., A&A, 595, 117 (2005)

[3] Ceccarelli et al. PP V, 47 (2007)
[4] Herbst & van Dishoeck, ARA&A, 47, 427 (2013)
[5] Ceccarelli et al., ApJ, 850, 176 (2017)
[6] Sakai et al., ApJ, 672, 371 (2008)
[7] Yang et al., ApJ, 910, 20 (2020)
[8] Bouvier et al., A&A, 653, A117 (2021)
[9] Bouvier et al., ApJ, 929, 10 (2022)