

# 30 Years of Photodissociation Regions:

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## Observational evidence of the evaporation of aromatic / aliphatic very small grains in the NGC 7023 PDR

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Carbon is an important building block of both interstellar gas and dust in Photo-Dissociation Regions (PDRs). A significant fraction of this element (up to 20%) is tied up in the carriers of the Aromatic Infrared Bands (AIBs), which consist in Polycyclic Aromatic Hydrocarbons (PAHs) and evaporating very small grains (eVSGs, Rapacioli et al., A&A 429, 2005; Pilleri et al., A&A, 542, 2012). The nature of PAHs and eVSGs and their link with smaller hydrocarbons are still under debate, in particular the aliphatic/aromatic composition of PAHs (Joblin et al., ApJ 458, 1996) and whether the photo-destruction of PAHs can inject fresh hydrocarbons into the gas phase, which could explain why the abundances of small hydrocarbons (e.g., CCH and c-C<sub>3</sub>H<sub>2</sub>, C<sub>4</sub>H) in cool PDRs are one or two order of magnitudes higher than those predicted by current gas-phase chemical models (Pety et al., A&A 435, 2005, Guzman et al., ApJL 800, 2015).

In this contribution, we will present our recent results on the aromatic-aliphatic nature of PAHs/eVSGs and their link with gas phase chemistry in the prototypical PDR NGC 7023. We obtained spatially resolved spectro-imagery observations in the near-IR using the AKARI space telescope to study the spatial variation of the 3.3 and 3.4 $\mu$ m emission features, that are associated with aromatic and aliphatic C–H bonds in PAHs, respectively. The comparison with mid-IR Spitzer observations shows that PAHs containing aliphatic side-groups are released from the photo-evaporation of eVSGs, which strongly suggests that eVSGs have mixed aromatic/aliphatic composition (Pilleri et al., A&A in press). We performed a spectral survey in the 3, 2 and 1mm range using the IRAM-30m telescope to determine the hydrocarbons census in this PDR. This survey was completed with high resolution maps of key hydrocarbon species (CCH and c-C<sub>3</sub>H<sub>2</sub>) obtained with the Plateau de Bure Interferometer to investigate the chemical link between PAHs/eVSGs and gas-phase hydrocarbons. Our results show that the photo-evaporation of eVSGs not only releases PAHs but also small hydrocarbons in the gas-phase.