

# Gas-phase Interstellar Ion-Molecule Reactivity Driven by VUV Synchrotron Light

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## ABSTRACT

The polycyclic aromatic hydrocarbons (PAHs) are universally acknowledged as key molecular species in space, potentially accounting for up to 25% of the carbon budget in the interstellar medium (ISM).<sup>1</sup> They are also thought to be responsible for the aromatic infrared bands. However, their formation pathways under interstellar conditions remain poorly understood.

In the bottom-up formation scenario, i.e. building up large molecular species from small hydrocarbons, ion–molecule reactions are of central importance, as they are typically exothermic and barrierless. However, astrochemical models crucially lack laboratory reactivity data such as reaction rates and product formation branching ratios to understand and accurately modelled the complex chemical network of the ISM.

The work that will be presented investigates hydrocarbon ion-molecule chemical growth routes. Using the CERISES instrument on the DESIRS beamline, we measured absolute reaction cross section (RCS) for reaction between a cation generated by vacuum-ultraviolet (VUV) photoionization and a neutral partner. RCS are recorded as a function of the photon energy used to ionize the precursor, providing insights on the isomeric nature of the reactant as more energy is deposited in the system above their appearance energy.<sup>2</sup> These measurements can be converted into reaction rate coefficients, thereby supplying essential input parameters for astrochemical models.

## REFERENCES

1. A. G. Tielens. *Annu. Rev. Astron. Astrophys.*, 2008, 46, 289
2. C. Rossi et al. *J. Phys. Org. Chem.*, 2023, 36, e4489.