A MULTI-SPECTROSCOPIC APPROACH TO REVEAL THE ASTROCHEMISTRY OF POLYCYLIC AROMATIC HYDROCARBONS

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Polycyclic aromatic hydrocarbons (PAHs) are of great interest for its potential central role in astrochemistry. They are assumed to connect the chemistry between fullerenes and smaller carbon species, and it is assumed that they contain up to 20 % of the galactic carbon. To unravel the various aspects of their impact in astrochemistry, we perform a multi-spectroscopic approach covering large areas of the electromagnetic spectrum.

The structures and intermolecular interactions of PAH-water complexes are investigated using high-resolution chirped-pulse rotational spectroscopy in our lab and infrared spectroscopy using the Free-Electron Laser (FEL) FELIX in Nijmegen in the gas phase. With this work, we aim at understanding interactions between PAHs themselves and water. Another motivation is to learn how an ice layer begins to form on an extended carbon surface.

In another series of experiments, we perform plasma studies with PAHs and other astrochemically relevant molecules as precursors using an electric discharge. We observe a rich chemistry that we can then characterize spectroscopically using IR and rotational spectroscopy, which is highly complementary.

To study PAH photophysics, we use the Hamburg XUV to soft-X-ray Free-Electron Laser FLASH and perform ultra-fast XUV-UV/IR pump-probe experiments, with ionization and dissociation as competing pathways. We can extract life times of electronically excited neutral and cationic states and investigate characteristic fragmentation patterns depending on the nature of the PAH under investigation.

In my presentation, I will provide an overview of our research activities on PAHs and discuss some of the latest results.