

Destruction of PAHs by X-Rays in circumnuclear regions of AGNs

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Synopsis This work shows the experimental results of the photodissociation and photoionization of small PAH molecules, analysed in the context of circumnuclear environments of AGNs.

Emission bands associated with Polycyclic Aromatic Hydrocarbon (PAH) molecules are observed in the direction of some classes of Active Galactic Nuclei (AGNs), like Seyfert 2, LINERs and obscured quasars - e.g. [1, 2, 3]. The molecular stability in these environments suggest the presence of very dense gas ($\sim 10^{23-24} \text{ cm}^{-2}$) to shield the cloud of PAHs against X-ray radiation [5, 4, 3]. We examined the x-ray photochemistry of simple PAHs —naphthalene (C_{10}H_8), anthracene ($\text{C}_{14}\text{H}_{10}$), methyl-anthracene ($\text{C}_{15}\text{H}_{12}$) and pyrene ($\text{C}_{16}\text{H}_{10}$)—, in order to apply the findings at the AGN scenario. The measurements were performed at the Brazilian Synchrotron Light Source Laboratory (LNLS) using soft X-rays photons selected from the Spherical Grating Mono-chromator (SGM) and the Soft X-ray Spectrometry (SXS) at energies around 280-320 eV and 1900-2500 eV, respectively. It was used an oven to sublime the samples. The gas is injected into a high vacuum chamber, through a needle, where it interacts with the X-ray photons perpendicularly. A time-of-flight mass-spectrometer was used to produce Photo-Electro Photo-Ion Coincidence (PEPICO) spectra. The absolute single and double photoionization and photodissociation cross sections were determined for each molecule at each energy. Their ionization and destruction induced by X-rays were examined in the conditions of the circumnuclear region of NGC 1808, a Seyfert 2 galaxy, where PAH emission was detected at 26 pc from the central object [3]. It was verified the higher pho-

tostability of PAHs without functional groups attached. At higher photon energies, the results suggest a higher production yield of double charged PAHs in comparison with the single charged ones (e.g., $2 \times$ higher for double ionized naphthalene at 2500 eV). The production of double charged molecules increase with the size of the molecules. We also discuss a minimum formation rate of PAH to balance the photodestruction rate and maintain a minimum density for their detection (e.g. $4.0 \times 10^{-7} M_{\odot} \text{ year}^{-1}$ for a column density N_H of 10^{23} cm^{-2} at 26 pc).

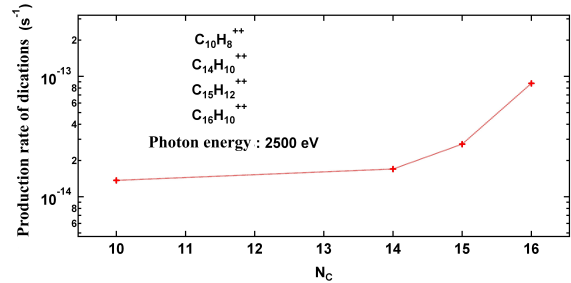


Figure 1. Production rate of dications as function of the number of carbons in the molecule.

References

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