Laser Induced Fluorescence Spectroscopy of Neutral and Ionized Polycyclic Aromatic Hydrocarbons in the Cosmic Simulation Chamber

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Polycyclic aromatic hydrocarbon (PAH) molecules are considered the best carriers to account for the ubiquitous infrared emission bands. PAHs have also been proposed as candidates to explain the diffuse interstellar bands (DIBs), a series of absorption features seen on the interstellar extinction curve and are plausible carriers for the extended red emission (ERE), a photoluminescent process associated with a wide variety of interstellar environments. Extensive efforts have been devoted over the past two decades to characterize the physical and chemical properties of PAH molecules and ions in space. Absorption spectra of PAH molecules and ions trapped in solid matrices have been compared to the DIBs [1, 2]. Absorption spectra of several cold, isolated gas-phase PAHs have also been measured under experimental conditions that mimic the interstellar conditions [see 3 for a review]. The purpose of this study is to provide a new dimension to the existing spectroscopic database of neutral and single ionized PAHs that is largely based on absorption spectra by adding emission spectroscopy data. The measurements are based on the laser induced fluorescence (LIF) technique [4] and are performed with the Pulsed Discharge Nozzle (PDN) of the COSmIC laboratory facility at NASA Ames laboratory. The PDN generates a plasma in a free supersonic jet expansion to simulate the physical and the chemical conditions in interstellar environments. We focus, here, on the fluorescence spectra of large neutral PAHs and their cations where there is a lack of fluorescence spectroscopy data. The astronomical implications of the data (e.g., ERE) are examined.

References

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