

Seminar

Institute for Plasma Research

- Title:** Fragmentation, multiple ionization and dehydrogenation of PAHs molecules by the impact of swift protons
- Speaker:** Dr. Shashank Singh
Panjab University, Chandigarh
- Date:** 25th October 2024 (Friday)
- Time:** 10:00 AM
- Venue:** Online (Link to join : <http://meet.google.com/aba-text-krx>)

Abstract

Polycyclic aromatic hydrocarbon (PAH) molecules are widely observed in diffuse interstellar bands (DIBs) via the absorption spectra in the optical region (0.4 and 1.3 μ m) [1- 3] and in aromatic infrared bands (AIBs) via the infrared emission spectra [1, 4]. In the interstellar medium, various forms of radiation, including photons, electrons and ions are prevalent. To understand how smaller molecules are produced through top-down fragmentation, it is crucial to study how large PAH molecules break apart when exposed to these different types of radiation.

Hydrogen is the most abundant atom in the interstellar medium. It is known that the abundance of H₂ in the cold interstellar medium cannot be explained by only considering the reactions in the gas phase [5]. It has been reported that the interaction of various ionizing radiation to PAHs can be one of the possible causes of the H₂ formation via the dehydrogenation process in the interstellar medium [6].

In present study, the coronene molecules have been bombarded by protons of energy by 100-300 keV. The time of flight mass spectrum has been recorded using a two-stage Wiley-McLaren type spectrometer. A large enhancement in the doubly and triply ionized recoil ion is observed compared to the singly ionized one. The single, double and triple ionization yields have also been calculated using the continuum distorted wave-eikonal initial state (CDW-EIS) theoretical model and are compared with the experimental results. Fragmentation products and dehydrogenation in intact cations are also observed. This study is important to understand the ionization, fragmentation and dehydrogenation mechanism of large PAHs by the energetic heavy ions.

References:

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 - [2] Herbig G H 1995 Annual Review of Astronomy and Astrophysics 33 19–73.
 - [3] Salama F, Bakes E, Allamandola L and Tielens A 1996 Astrophysical Journal v. 458, p. 621 458 621.
 - [4] Allamandola L, Tielens A and Barker J 1985 Astrophysical Journal, Part 2-Letters to the Editor (ISSN 0004-637X), vol. 290, March 1, 1985, p. L25-L28. 290 L25–L28.
 - [5] Vidali G, Jing D and He J 2013 Hydrogen and water in the interstellar medium AIP Conference Proceedings vol 1543 (American Institute of Physics) pp 31–47.
 - [6] Champeaux J P, Moretto-Capelle P, Cafarelli P, Deville C, Sence M and Casta R 2014 Monthly Notices of the Royal Astronomical Society 441 1479–1487
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