Energy selective time of flight mass spectrometer to study low energy dissociation channels of PAHs

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Experimental Setup

- The experimental setup has an interaction chamber where absorption of photons by PAHs molecule occurs.
- Interaction chamber has four biased electrode plates that extract and accelerate fragments into drift tube.
- Ion beam pass through parallel plate energy analyzer for energy analysis of fragment ions.
- It also allows undeflected beam to pass through and get detected by an alternate position sensitive detector kept downstream.

Target molecules

Why Fluorene?
- Fluorene has several astrophysical interests as a test molecule.
- The dissociation barrier of H loss channel is calculated to be 2.62eV (low value). Therefore an efficient and fast dehydrogenation channel for fluorene cation is expected within the time window available to the spectrometer as a test case.

Comparison of experimental & simulated results

Experimental spectrum of experimental and simulated H loss peaks

Decay measurement as a function of photon energies

The dominant source of H loss was demonstrated to be 3-photon process. This lead to a variable internal energy to be left in the cation produced after photo excitation. As the photon energy was increased a constant shift of H loss yield was observed from slow to fast component.

Dehydrogenation series of fluorene cation

- Typical 2D plot measured for H loss series of fluorene parent ion for an excitation wavelength of 268nm.
- 3H loss is seen to be stronger than 2H loss.
- In contrast to H loss decay, multiple H emission rate is seen to be very sensitive to wavelength.
- Prompt vs delayed as well as sequential vs concerted decay channels can be observed effectively.

Refereces