Molecular reactions of PAH fragments in astronomical environments irradiated by soft X-rays

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Introduction

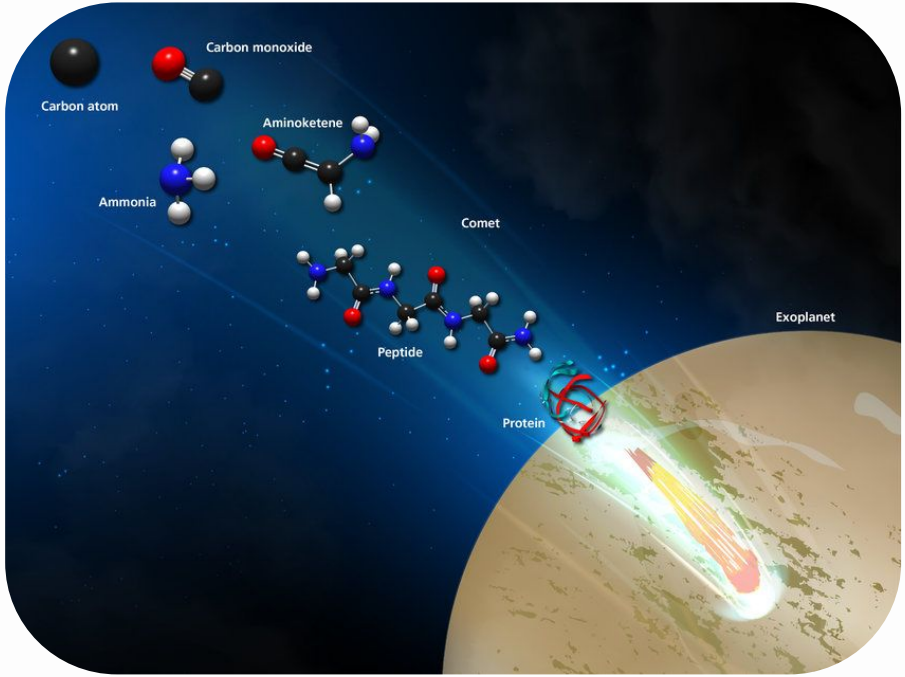
PAHs and prebiotic molecules in space

Introduction

Prebiotic molecules, predominantly organic, are considered pivotal in the origin of life on Earth and potentially in other planetary environments.

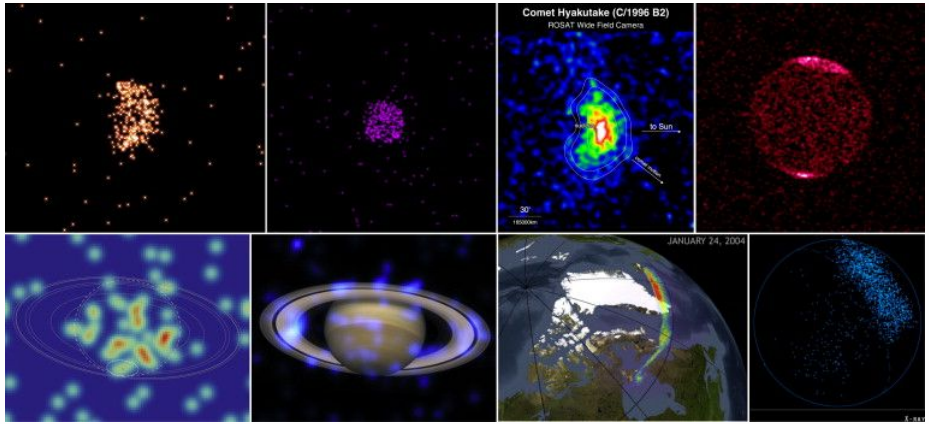
Relevant molecules:

- Aromatic hydrocarbons
- Ammonia derivatives
- Carbon compounds



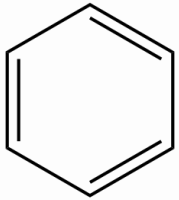
Introduction

In circumstellar regions, benzenoid molecules undergo significant modifications under the influence of ultraviolet (UV) photons and X-rays. Processes such as ionization, dissociation, and photo-fragmentation result in the formation of its ionic species and free radicals, potentially leading to the creation of new organic molecules and giving valuable insights into mechanisms.

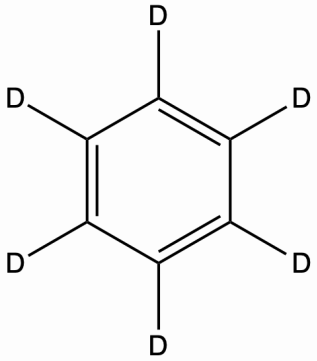


Objective

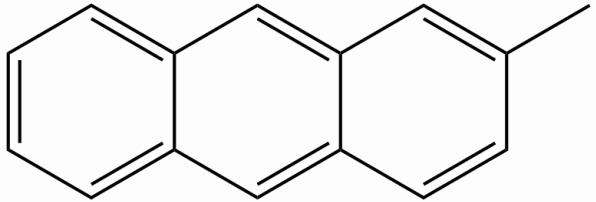
Investigate the impact of soft X-rays on the physicochemical properties of aromatic hydrocarbons, their potential involvement in the genesis of prebiotic molecules, and their potentially interesting applications in storage devices.



benzene



benzene-d_6



2-methylanthracene

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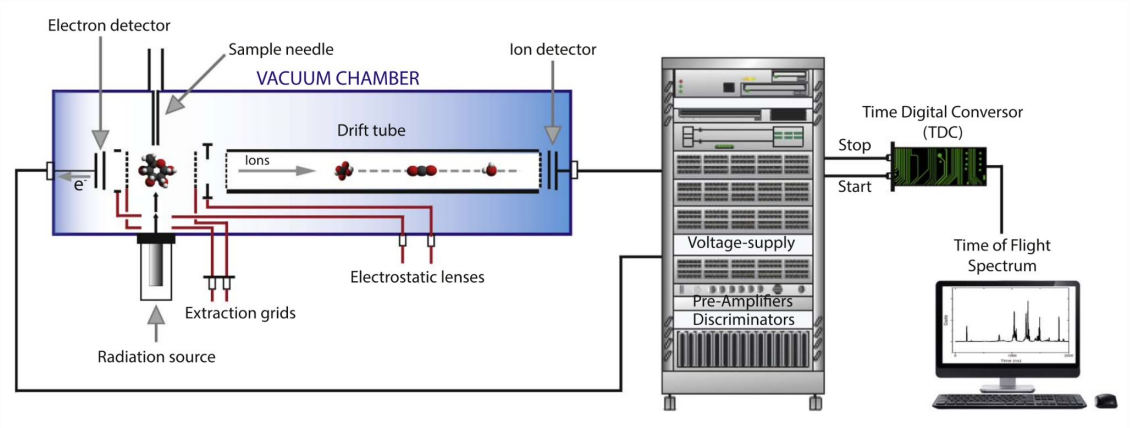
Data acquisition

MS-TOF

Sigma-Aldrich reagents



- Samples were purchased from Sigma-Aldrich
- Radiation source: Spherical Grating Monochromator (SGM)
- Ultrahigh vacuum chamber: $\lesssim 10^{-18}$ mbar
- Drift tube: 297 mm

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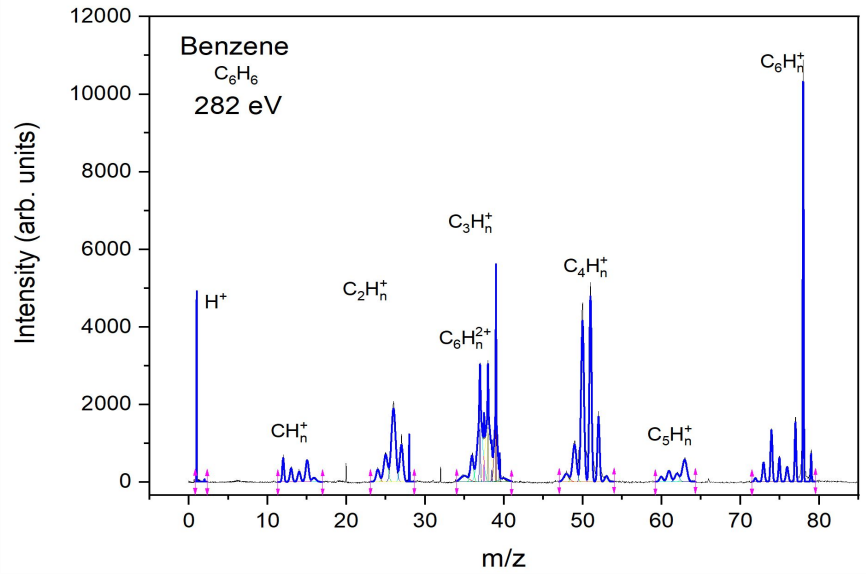
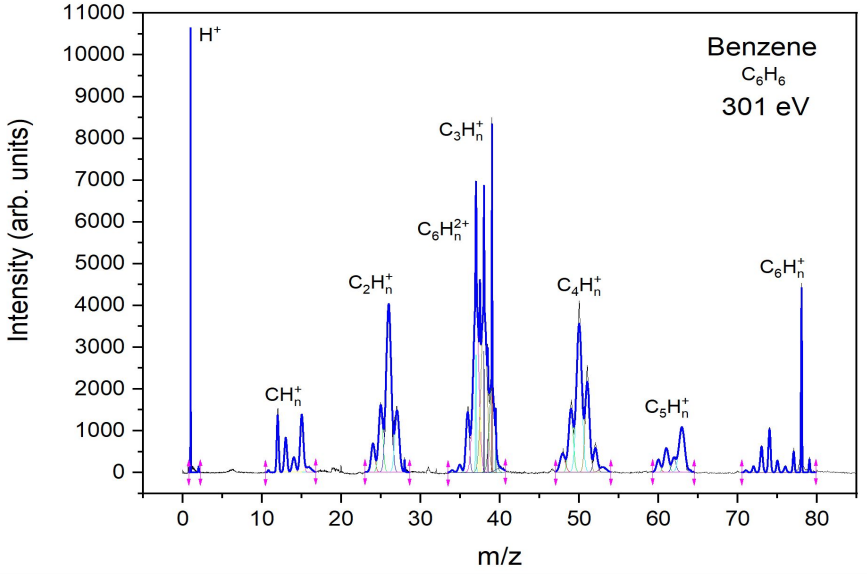
Results

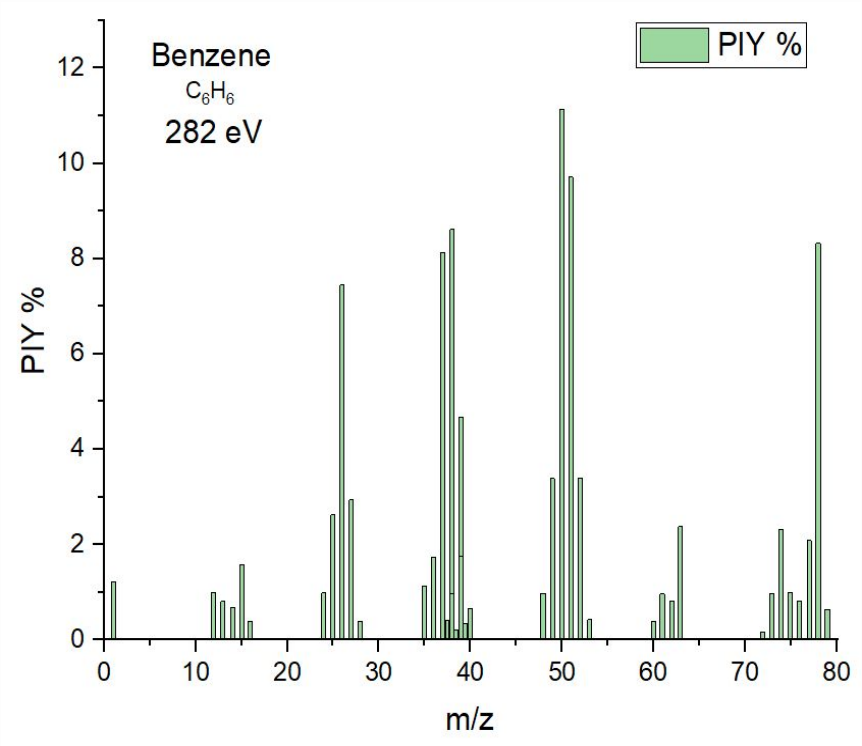
What has been achieved?

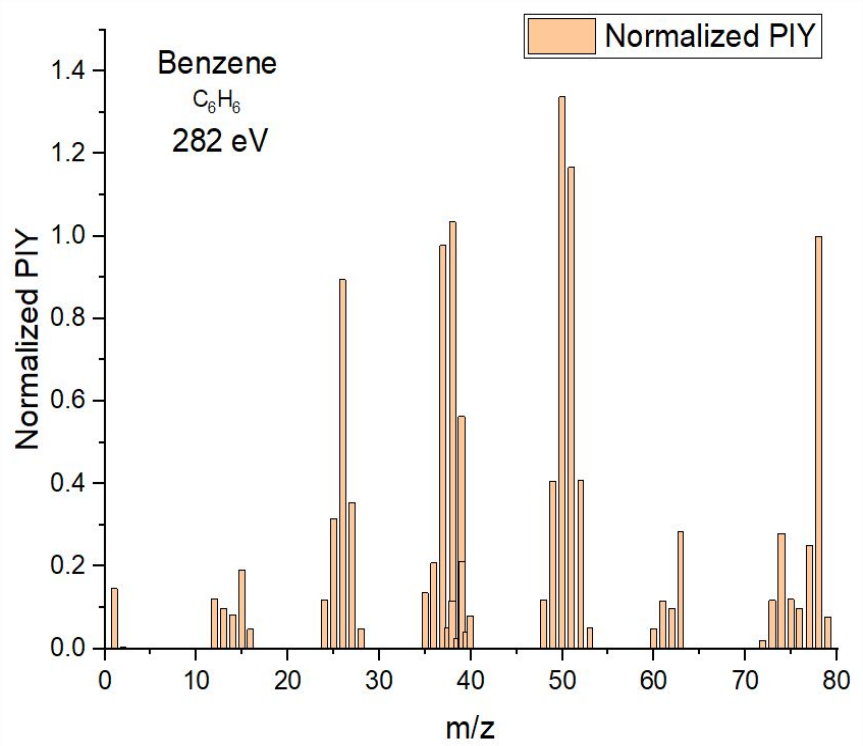
Results for benzene



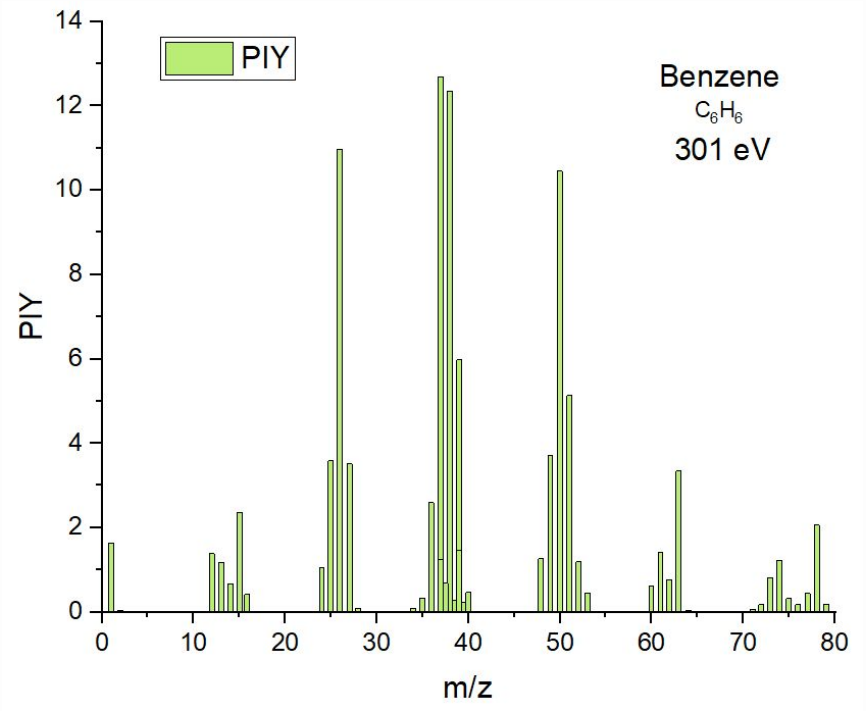


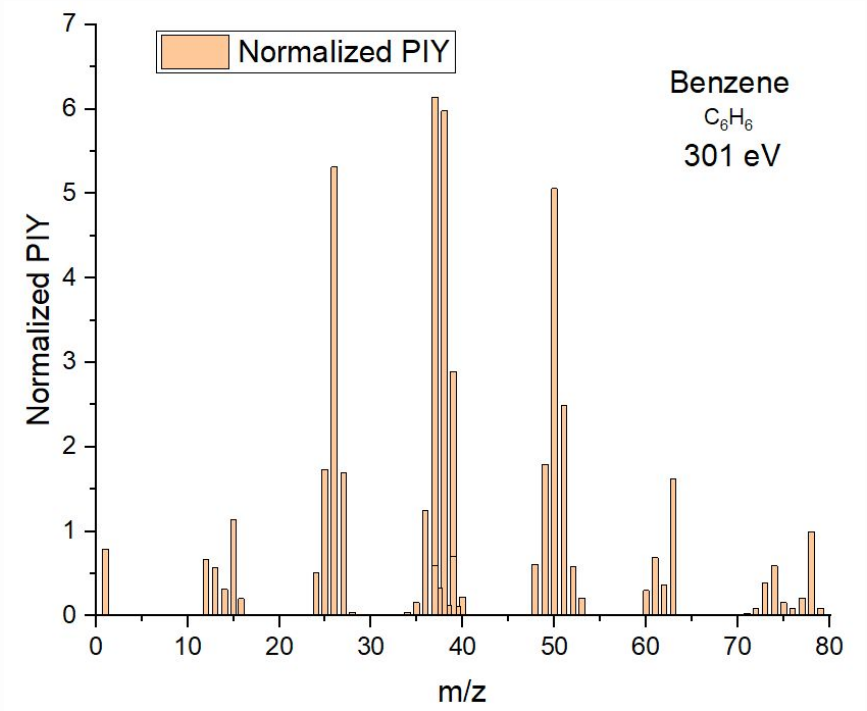
Results for benzene



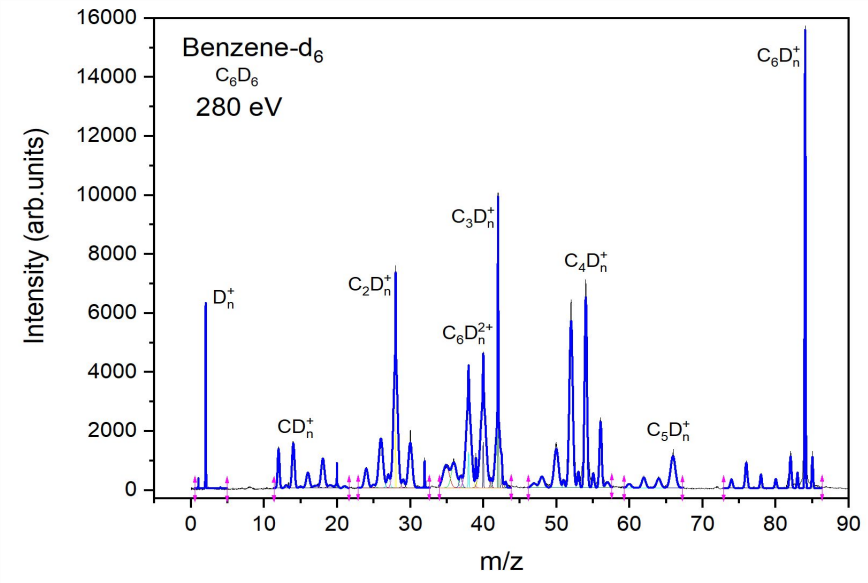


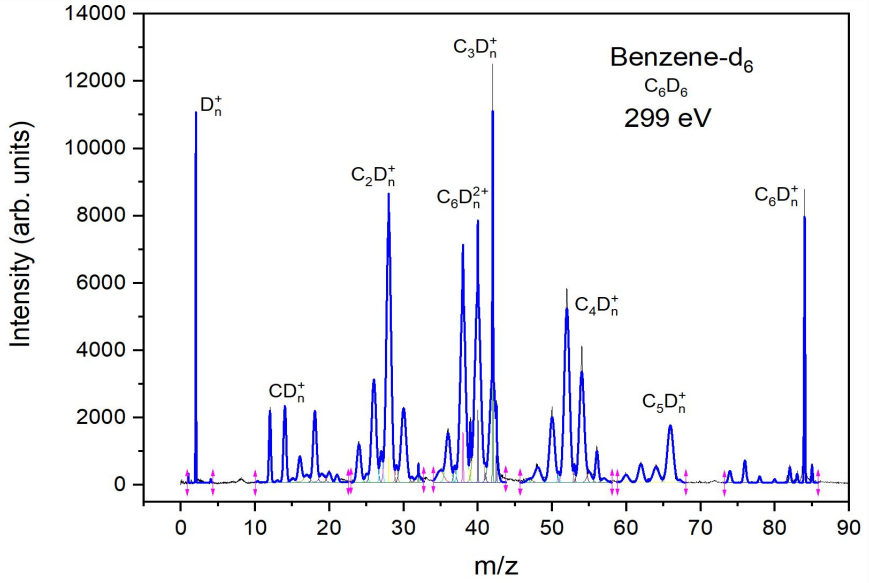
Results for benzene





Results for benzene-d 6





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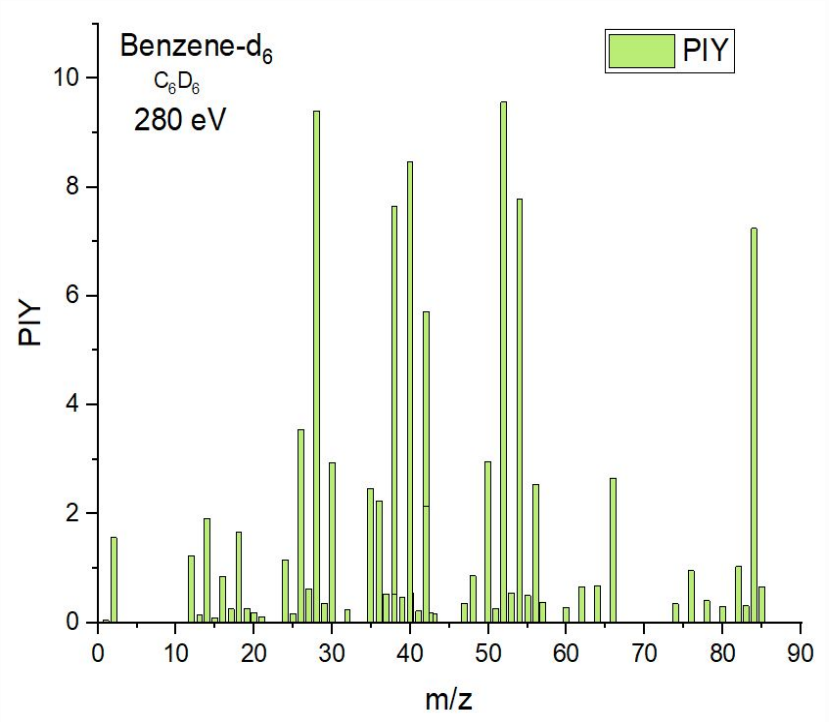
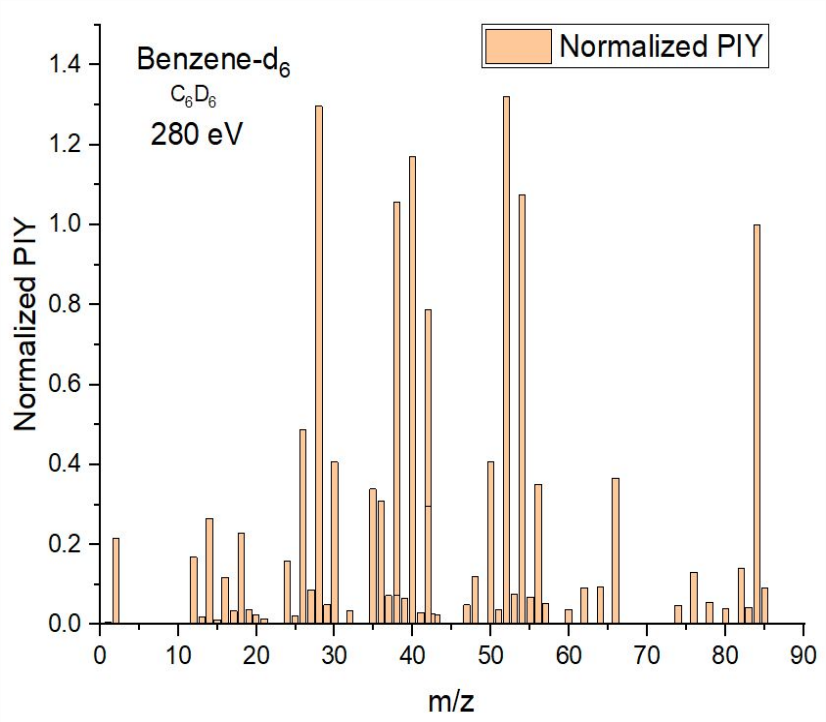
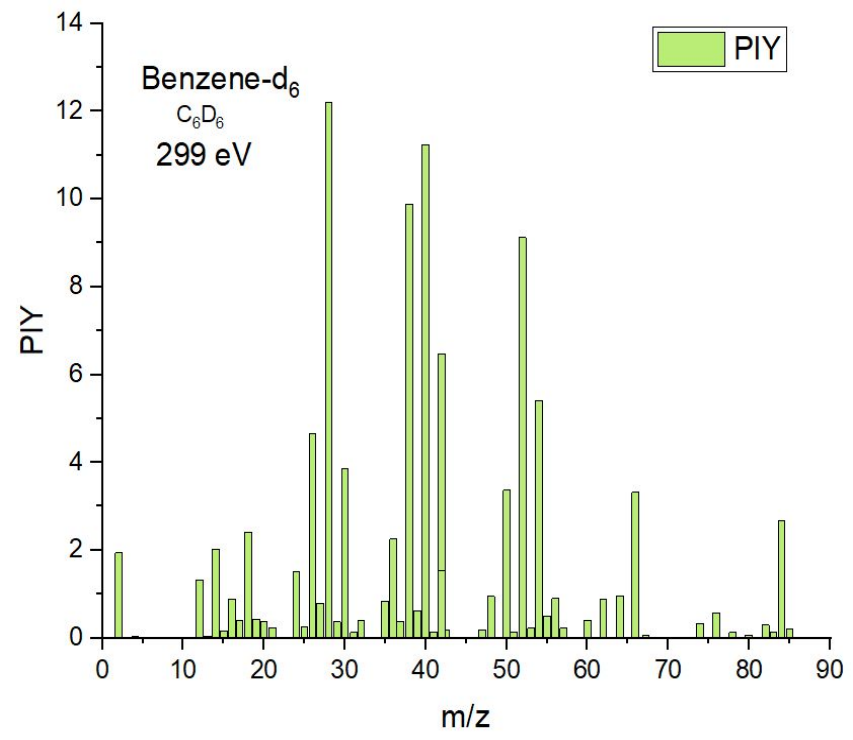
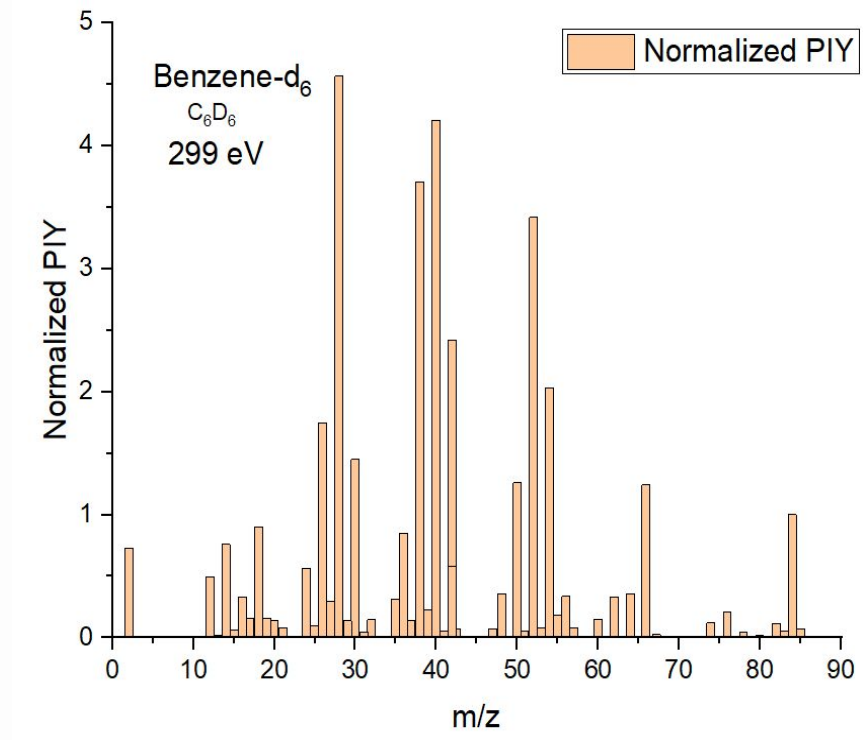


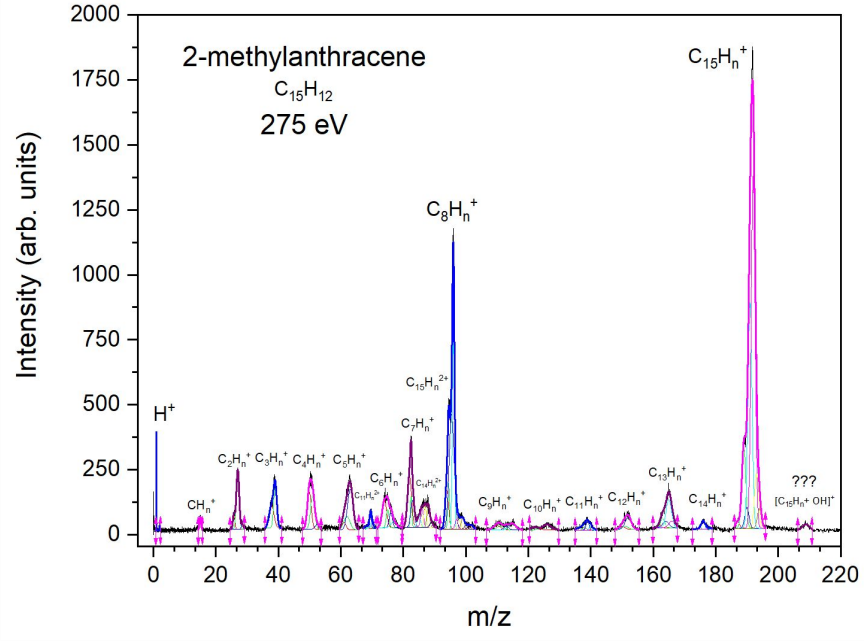


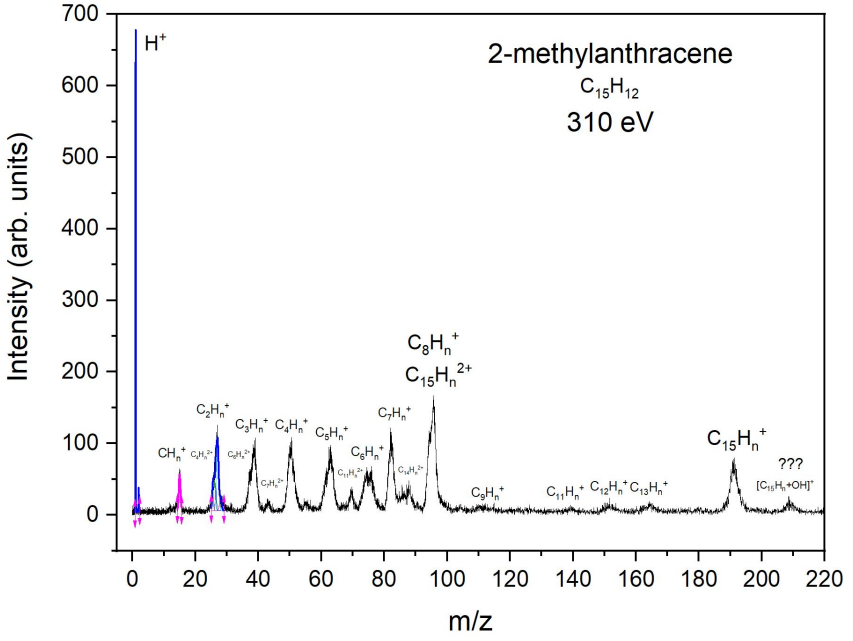
Results for benzene-d 6





Preliminary results for 2-methylanthracene





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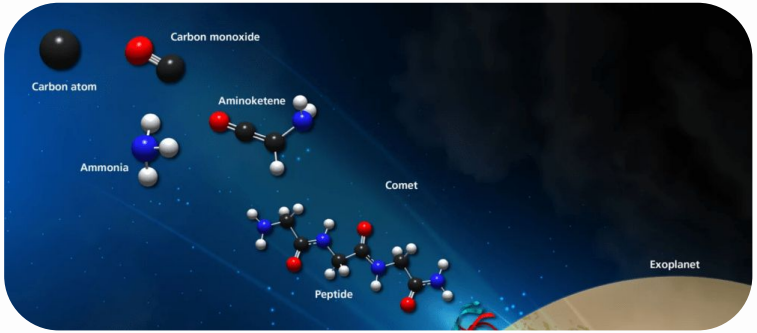
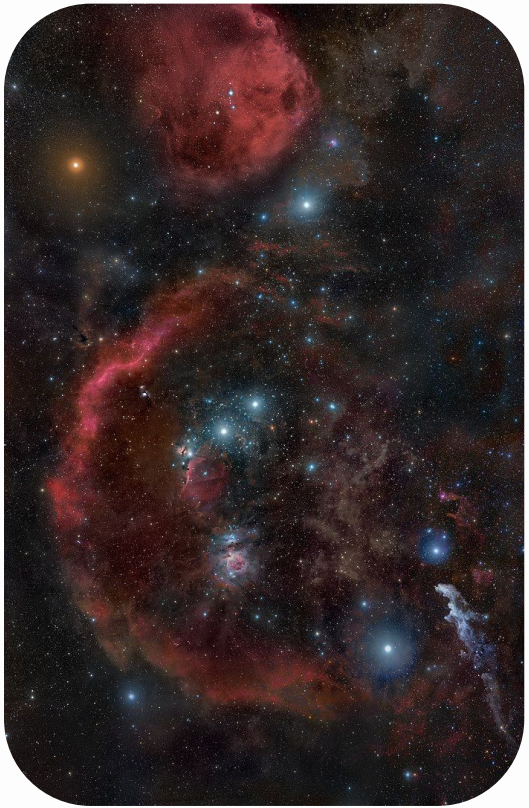
Future perspectives

What is yet to come?

Future perspectives

The resulting PAH fragments product of the soft X-ray fragmentation and photo-dissociation may interfere in the formation of diverse COMs. They may also give valuable insights about the genesis of prebiotic molecules as well as other applications relevant to modern investigations about new materials or new appliances subjected to harsh and hostile conditions such as astronomical environments.





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Acknowledgments

Acknowledgements

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