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Probing the Dissociation of Interstellar Polyaromatics Using Synchrotron and FEL Radiation

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The presence of interstellar polycyclic aromatic hydrocarbons (PAHs) is inferred from the widespread mid-infrared (IR) emission bands that are observed at 3.3, 6.2, 7.7, 8.6 and 11.2 μm. [1] This IR radiation is emitted as the PAHs cascade down to the ground state after they have been excited by interstellar (vacuum) ultraviolet radiation. [2] PAHs have been observed towards a large number of galactic and extragalactic sources and it has been derived that they constitute up to 15% of the total cosmic carbon budget.

Energetic processing of interstellar polyaromatics may result in ionization and/or dissociation. It has been hypothesized that this chemical evolution is reflected in subtle changes in the interstellar mid-IR emission bands. Observational and laboratory data suggest that dissociation of large interstellar polyaromatics eventually leads to fullerene formation. [3,4] The underlying chemical mechanisms involved in the dissociation of aromatics are not yet understood.

Our group characterizes the dissociation of polyaromatics by means of vacuum ultraviolet synchrotron radiation and mid-infrared free electron laser radiation. By combining these techniques with quantum chemical computations we obtain insight into the isomerization and dissociation at a molecular level of detail. [5-7] I will review our most recent results and will emphasize their importance in light of astronomical observations.

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Summary

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