

Photolysis-induced scrambling processes in Polycyclic Aromatic Hydrocarbon Isotopologues – A pathway to D enrichment

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The evolution of large organic molecules in the interstellar medium is greatly governed by photochemistry. In our laboratories, we study the spectroscopic signatures and the photolysis of large organics and investigate the underlying molecular physics such as for Polycyclic Aromatic Hydrocarbons. We present mass spectrometry and spectroscopic results of PAH isotopologues measured at the FELIX Laboratory revealing a scrambling mechanism to be present that provides a pathway for D enrichment in PAHs induced by photolysis [1]. We also observe the scrambling contribution to differ between isomers, ranging from dominant to full scrambling. We propose that the rate of scrambling process depends on the structure of the PAH with species containing solo hydrogen atoms to feature less scrambling. Moreover, the scrambling mechanism seems not only to be limited to these PAH isotopologues as it has also been reported to play a role in the photoinduced PAH dehydrogenation [2]. This scrambling mechanism for hydrogen and deuterium atoms on PAH molecules can lead to a novel approach in the calculations concerning the D/H ratio in the ISM and thereby to new estimations on the contribution of PAHs as sink to account for the missing deuterium in our Universe. The scrambling also indicates a re-interpretation of the aliphatic and aromatic CH/CD vibrations bands observed in space, especially for the CD stretches in the 4-5 μm region, might be in order.

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References

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