

From Interstellar Ices to Polycyclic Aromatic Hydrocarbons

A symposium to honor Lou Allamandola's Contributions to the Molecular Universe

Annapolis, MD, USA - September 13th to September 17th, 2015

VUV Photoabsorption Spectroscopy of Ices Containing PAHs

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PAHs are ubiquitous in the interstellar medium and are expected to exist in dense molecular clouds where they are likely to be adsorbed onto dust grains, incorporated into ice mantles, or act as nucleation sites for the condensation of other species. Gas-phase PAHs absorb UV light and re-emit in the IR. In the solid phase it is expected that PAHs embedded within the ice will dissipate this energy to the surrounding molecules and facilitate chemical and desorption processes (e.g. Throner et al. 2008), hence enriching gas phase abundances and contributing to the gas-grain synergy that plays a crucial role in the star-formation process. In order to better understand this process, it is essential to understand and quantify the interaction of UV photons with PAHs in astrochemical ices and to determine their photoabsorption cross sections.

I will present recent results of VUV photoabsorption experiments carried out at the ASTRID2 Synchrotron Facility, Denmark, in the range 115 to 350 nm. We measured the spectra of pure condensed phase benzene (a model PAH), naphthalene and anthracene deposited at 24 K. Ice thicknesses were monitored using a laser interference technique in order to calculate accurate photoabsorption cross sections, as they differ significantly to that of the gas phase spectra. Upon annealing benzene ice, striking changes were observed in the spectra ≥ 75 K with the unexpected appearance of very sharp vibronic bands. I will also discuss first results of VUV spectra of benzene:water ice mixtures and layers as a function of ice thickness, mixing ratio and temperature. Initial results show significant differences in the spectra of mixed benzene:water ices at different concentrations (1:1, 1:10 and 1:100). The VUV spectra of layered samples show evidence of clumping, trapping, diffusion and delayed desorption upon annealing to desorption temperatures. These are first results and are in the process of being analysed, however they should shed light upon the complexity of the structure and morphology of ices containing 'solid' PAHs and their interaction with UV photons.

REFERENCES

Throner, J. D., Burke, D. J., Collings, M. P. Dawes, A., Holtom, P. D. Jamme, F. Kendall, P. Brown, W. A. Clark, I. P., Fraser, H. J., McCoustra, M. R. S., Mason, N. J. and Parker, A. W. (2008) *Astrophys J.*, 673, 1233