Photodissociation of small aromatic species in the gas-phase and liquid-phase microdroplets

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Biography
Adam completed undergraduate and Honours at the University of Adelaide then a PhD at University of Melbourne. Next was a postdoc at University of California Berkeley/Lawrence Berkeley National Labs. He commenced his independent career at the University of Wollongong in 2008 where he runs the Laser Chemistry Laboratory and teaches chemistry. His research focuses on understanding chemistry in combustion environments, liquid microdroplets and in the gas-phase using lasers, mass spectrometry and synchrotron techniques.

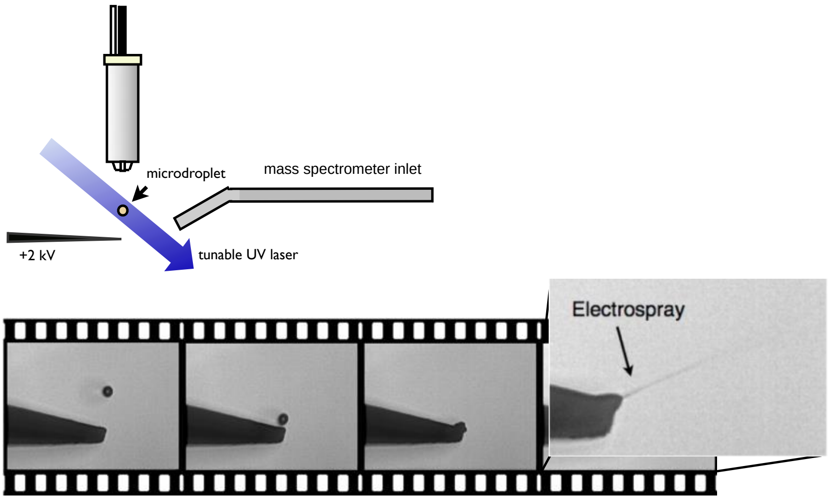
Abstract
Photons initiate chemical action by exciting molecules to more active bound states or by breaking bonds to create reactive products. Fundamental insights into these processes has, for example:

- led to a useful understanding of atmospheric photochemistry (like haze formation and ozone depletion/creation)
- aided the mitigation of inefficiencies in organic-sensitized solar cells
- directed targeted photodynamic therapies in biological systems.

To make further inroads and master the photochemistry underpinning these applications, fundamental questions remain to be answered – the particular directions of our research group are the wavelength dependent photodissociation channels and photoproduct characterisation of molecules both in the gas and liquid phase.

Two techniques will be described in this presentation – one that couples tunable UV-vis laser radiation to a linear ion trap for gas-phase action spectroscopy of ions and the second instrument unites single microdroplet generation techniques, laser photolysis and mass spectrometry for rapid-acquisition of liquid-phase action spectroscopy. Our new single-droplet desorption strategy is shown in the figure below where a single droplet impinges on a thin needle held at 2 kV. The subsequent electrospray is sampled by a mass spectrometer. This is done one droplet at a time: one droplet, one laser pulse, one spectrum.

The gas-phase and liquid-phase photodissociation spectra of small aromatics are compared to probe the effect of the solvent. Dissociation in these systems can be facilitated by ground state unimolecular rearrangement following rapid interconversion from excited state(s) and this process is studied in both phases. Also, using the microdroplet apparatus, the fate of photogenerated phenyl and benzyl-type aromatic radicals is explored in various solvents. The droplet photodissociation apparatus allows rapid surveys of liquid-phase chemistry in seconds using only picolitres (pL) of sample.



Key Words
Laser, radial chemistry, mass spectrometry, photodissociation, spectroscopy