

Spectroscopy and scattering experiments on flat liquid jets

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The dynamics of photoexcited solute molecules and the properties of liquid interfaces are studied by carrying out spectroscopy and scattering experiments on flat liquid water jets. In one set of experiments, solute dynamics are probed using time-resolved photoelectron spectroscopy in which molecules are photoexcited with a femtosecond UV pulse and photoionized with a time-delayed femtosecond XUV pulse (at 21.7 eV). The time-dependent photoelectron spectra provide a unique probe of the relaxation of photoexcited neutral and anionic species in aqueous solution. Results will be presented for bromouracil and bromouridine, the phenolate anion, and 4-bromophenolate. These experiments probe the competition among the various relaxation pathways including internal conversion, dissociation, and electron ejection.

In complementary experiments, the liquid interface is explored in molecular beam scattering experiments from flat liquid jets of cold salty water (-50 °C, 8 m LiBr). In contrast to cylindrical jets, flat jets provide a large target area and well-defined surface normal, both of which are highly advantageous for scattering experiments. Product angular and translational energy distributions are measured for rare gas and molecular scatterers. The competition between impulsive scattering (IS) and thermal desorption is measured, and the energy loss in the IS channel is characterized using a soft-sphere model. Results are sensitive to both the scatterer identity and its collision energy.