Proposed Advisor: Dr. Jeffrey C. Owrutsky

Lab Location: NRL (Washington DC)

Research Description: The objective of this program is to understand molecular dynamical processes in the 50 femtosecond to nanosecond time regime. These are investigated using ultrafast spectroscopy to reveal the temporal, spectral, and structural evolution in molecular dissociation and energy relaxation for excited state and radical species and other nonequilibrium conditions in the gas and liquid phases and at interfaces. Recent work has focuses on (1) ultrafast dynamics of vibrational relaxation and photodissociation processes in gas, liquid and interfacial environments; (2) ultrafast studies of relaxation phenomena in complex liquids, including reverse micelles and ionic liquids; and (3) fabrication and optical studies of plasmonic and other nanostructured materials.
Experiments involve using femtosecond laser (40-100 fs) pulses to prepare excited species and similar delayed probe pulses to the temporal evolution of the subsequent processes by transient absorption, multiphoton ionization, second harmonic generation, or sum frequency generation. Various nonlinear optical mixing schemes are used to create tunable ultrafast pulses from 190 nm to 9 μm.
Facilities include several regeneratively-amplified, mode-locked titanium: sapphire lasers; optical parametric amplifiers; spectrometers, single elements and multichannel detectors, microscope near infrared to near uv spectrometers, micro-FTIR, micro-Raman, computers interfaced for experimental control, data acquisition, and analysis.

Keywords: Molecular dynamics; Vibrational relaxation; Femtosecond; Ultrafast, Laser spectroscopy; Molecular spectroscopy; Photodissociation; Energy transfer; Interfaces; Nanomaterials, Plasmonics.

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