SRI International

Home Institutions and Research Projects of REU Program Participants — 1998 & 1997

The SRI REU program assigns each student to work with a staff professional on a separate research project. Typically these projects are a sub-task on a larger research program of the mentor. Some of these projects are independent with the mentor overseeing the students progress on a daily basis. More than half of the projects involve the student working in the laboratory side-by-side with a Ph.D. staff member. Here the data collection task is more collaborative than independent. Since the student projects are each individually supervised, the SRI program can accommodate students with different starting and ending dates.

1998 REU Students & Program Directors

1998 REU Projects at SRI

Student from University of California Riverside
Mentors: Drs Gregory P. Smith and Jay B. Jeffries
Project: Impacts of Computer Modeling on the Reduction of Pollution from Combustion
Description: NO_x effluent from combustion is an important atmospheric pollutant. Computer models of detailed combustion chemistry are used to identify the reaction pathways and the NO_x precursor intermediate free radical species. The reduction of NO_x by the addition of other fuels to natural gas is investigated.

Student from Wheaton College
Mentors: Dr Michael Coggiola
Project: Evaluation of a Pulsed Valve for a Time-of-Flight Mass Spectrometer for Dioxin Detection in the Atmosphere
Description: Dioxins are one of the most hazardous chemicals produced by waste incineration and there is no current detection technology that can selectively detect these species with sufficient sensitivity to insure compliance with emission regulations. A real-time continuous emission monitor using resonance enhanced multi-photon ionization and time-of-flight mass spectroscopy is under development. The sensitivity is critically dependent on the design of the pulsed gas inlet to the instrument. The variation of sensitivity with inlet design is investigated.

Student from University of Florida
Mentors: Dr Phil Cosby
Project: Electron Impact Dissociation of CF
Description: Electron impact dissociation cross sections for CF are measured with a crossed molecular beam-electron beam apparatus. Such cross sections are crucial to model plasma processes used by the semiconductor industry.

Student from Haverford College
Mentors: Dr Leah Williams
Project: Uptake of Acetone and Nitric Acid on Sulfuric Acid Surfaces
Description: Temperature controlled sulfuric acid surfaces in a Knudson cell reactor were exposed to gas phase acetone and nitric acid. The cell is sampled by molecular beam mass spectroscopy. The uptake of the target gas on the surface is measured from the change in the mass spectrometer signals.

Student from Portland State University
Mentors: Drs Bob Robertson, Jean Lacoursiere, and Richard Copeland
Project: Ozone in Solid Oxygen: A High Energy Density Rocket Fuel
Description: The storage of ozone in matrices of solid oxygen has been proposed as a high energy density fuel. Samples of solid oxygen are grown in a cryostat with optical access. Pulsed laser dissociation of oxygen in the matrix produces atomic oxygen some of which recombines to make ozone. The ozone density and storage time are monitored with Fourier transform infrared spectroscopy.

Student from West Virginia Wesleyan College
Mentors: Dr Robert Schmitt
Project: Molecular Modeling and the Decomposition of AlH_3
Description: The production and decomposition of AlH_3 was empirically studied. This material is being considered as a possible component in a new generation of rocket fuels. Therefore, the long-term stability of the material must be determined. An apparatus to measure the thermal decomposition rates over times of many days was designed and tested. These results were compared to estimates from a commercial molecular modeling program.

Student from Southern Oregon University
Mentors: Drs Martina Gerken and Gregory Faris
Project: Recovering Optical Information from Patterns of Photon
Description: Visually opaque media such as milk, emulsions, colloidal suspensoins, human tissue, and sea water are all turbid media: they do not strongly absorb light, but they also do not transmit light well. The turbidity is a result of the characteristic short scattering length of visible photons. Recovering information from the photon migration in turbid media offer the possibility of applications such as non-invasive cancer detection or blood flow monitoring. Applications of Monte Carlo simulations to light scattering measurements in turbid media are investigated.

Student from Coe College
Mentors: Dr Gregory Faris
Project: Simulated Brillouin Scattering: Experimental Setup to Analysis
Description: Supercritical fluid transitions of hydrocarbon fuels is studied using stimulated Brillouin scattering. As temperature changes, these fuels decompose and the conditions for supercritical fluid flow change. An investigation of stimulated Brillouin scattering as a real time detector for the supercritical fluid transition.

Student from Marquette University
Mentors: Drs Ensook Hwang, Tom Slanger, and Richard Copeland
Project: Spectroscopy, Collisional Energy Transfer, and Aeronomic Interest of the $^5\Pi_g$ State of O_2
Description: Recently a new electronic state of O_2 has been identified. The $^5\Pi_g$state may be important to the chemistry of the mesosphere of the earth. Measurements of the collisional quenching and detailed

spectroscopic constants are performed using laser excitation and resonance enhanced multi-photon ionization.

1997 REU Participants

Yale University
Collisional Energy Transfer in O_2 Studied with Resonance Enhanced Multi-Photon Ionization
Experiments were performed on collisional processes important in airglow phenomena. Tunable pulsed dye lasers were used to excite and monitor the molecules important in the atmosphere.

Colby College
Frequency Domain Measurements of Absorption and Scattering Coefficients in Dense Media
Optical techniques to perform imaging through highly scattering media such as human tissue are studied using a photon density wave (also called frequency domain) technique coupled with tomographic reconstruction to perform imaging. This new approach may be useful for locating tumors or hemorrhages in the body, as well as for underwater imaging.

University of Missouri-Rolla
Extremely Intense MPI for Surface Analysis: Predicting Laser Ionization Volumes and Measuring Velocity Distributions of Ablated Neutral Atoms
Experiments to understand the underlying physics of species-selective laser-based surface analysis technique developed at SRI.

University of Massachusetts
Exploration of Absorption and Other Properties of Organic and Organo-Metallic Porous Crystals by Molecular Modeling
Design of materials with exotic properties using molecular modeling to select the particular combination of metals and acids to design materials with specific pore sizes.

Pepperdine University
The Heterogeneous Reaction Between Nitric Acid and Simulated Stratospheric Soot Surfaces
Reactions on particle surfaces play an important role in many areas of atmospheric chemistry from stratospheric ozone depletion to acid rain. We use several different techniques in the laboratory to measure reaction rates on surfaces representative of atmospheric particles.

Denison University
High Sensitivity Detection of Upconverting Phosphor Particles
Investigations of upconverting phosphors as reporters (detectable labels) for biomedical diagnostics and imaging. Applications include immunoassay and DNA hybridization (e.g., blood or DNA testing), surgical imaging, and cancer detection and diagnosis. The upconverting phosphors are unique in that when they are excited in the infrared, they emit at visible wavelengths.

University of California, Berkeley
Mobility of Energetic O_x in Solid Oxygen
Energized solid oxygen has been proposed as a component of the next generation of rocket fuels. When solid oxygen is irradiated with ultraviolet laser light, energetic species such as ozone are formed and trapped in the solid.

Oberlin College
NO(a quartet-pi) Spectroscopy: Line Intensity Measurements
The electronically excited states of the O_2 and NO molecules have interesting roles to play in the chemistry and physics of the atmospheric regions between 50 and 150 km, both in the earth's atmosphere and that of Venus. We are applying modern laser-based experimental tools to aid us in investigating the behavior of these transient entities.

Brown University

Tracing the Transition of Normal Cells to Cancer Cells with cDNA Libraries

Isolate and identify genes from different lines of human tumor cells using laser based mass spectroscopy techniques.