EM2C seminar abstract:

Carbon Monoxide Dissociation Examined by Laser Absorption Spectroscopy at Near-Electronvolt Temperatures

This presentation will review recent progress in laser absorption spectroscopy, emphasizing shock-tube applications for entry studies. Recent work in my previous group at UCLA demonstrated that MHz-rate measurements by laser absorption spectroscopy can be performed by modulating DFB laser via bias-tee circuitry. This time resolution is sufficient to resolve events on the µs scale, such as high-temperature dissociation and vibrational relaxation relevant to entry conditions. Previous studies were however limited to temperatures below 5000 K. In this presentation, we develop new modulation techniques tailored to increase the scan depth and the signal-to-noise ratio of DFB lasers. These methods are applied to scan a larger set of CO lines at MHz rates and probe much higher temperatures. CO number density and temperature measurements are demonstrated in the UCLA shock tube up to 9300 K with a reduced uncertainty via a new method of Boltzmann population fit. Kinetic modeling of CO dissociation is compared to the quantitative data of this sensor and corrections of CO + CO and CO + Ar dissociation rates are proposed. In the second part of the presentation, another sensor probing temperature and number density of an electronically excited state of atomic oxygen, O($^5S^0$), is demonstrated at speeds up to 5 MHz with a single point resolution of 30 ns. As an illustration of the utility of this high-speed diagnostic for harsh environments, the measurement of the heavy particle excitation rate of O($^5S^0$) is extended beyond the temperatures available in the literature up to 12,000 K.

If time allows, this seminar will also cover:

1. An overview of the activities at UCLA in Professor Spearrin laboratory
2. Planned activities at EM2C