Boulder Fluid Dynamics Seminar Series

Tuesday, July 14, 2015
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado at Boulder

Picosecond Ballistic Imaging of Ligament Structures in the Near-Nozzle Region of Diesel Sprays

Jason Porter, *Colorado School of Mines*

This talk will discuss a ballistic imaging technique used to probe structures in the near-orifice region of high-pressure diesel sprays. Through the use of an ultra-fast shutter, the ballistic imaging technique captures photons that have passed through an optically dense spray with minimal scattering events. Rejection of scattered light produces an image of the true structure of the spray. Scattered photons are in effect noise added to the small number of ballistic photons that carry image information that shows the complex liquid structures within the spray. The detailed structures captured using ballistic images can improve spray breakup models by providing experimental evidence for comparison with simulations. Improved understanding of the break-up region of fuel sprays enables better control of droplet size distribution, evaporation, and downstream mixing in diesel sprays, with potentially profound implications for improved diesel cycle efficiency and reduced emissions.

Dual Frequency Comb Spectroscopy of High Temperature Water Vapor Absorption: Testing and Improving Spectral Databases for Use in Coal Gasification

Paul Schroeder, *University of Colorado, Boulder*

Coal gasification is a promising technology for the efficient use of coal resources worldwide. The gasification process takes place at high pressures and temperatures, up to 50 bar at 1700K, so the chemical kinetics are difficult to study and not well known. These kinetics parameters are valuable for the utilization of gasification technology. In situ water vapor measurements provide a window into these processes, but require high fidelity spectral databases for the interpretation of absorption data from unknown environments. We present high resolution (0.003 cm^{-1}), broadband (353 cm^{-1}) measurements of water vapor in a controlled high temperature optical cell up to 1300K using fully resolved dual frequency comb spectroscopy referenced to the NIST atomic frequency standard. The measurements cover ~2100 measurable transitions of water vapor. The immediate uses of these measurements are two-fold – the evaluation of existing high temperature spectral databases, and the improvement of these databases through direct measurement of individual line parameters. In this talk, we will focus on a comparison of our high resolution data to ideal models generated from the HITEMP2010 and HITRAN2012 databases.