“Optical Diagnostics for Plasma Kinetics Studies and High Frame Rate Imaging”

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Abstract
This talk will focus on the application of a variety of optical diagnostic methods for studies of plasma chemistry and energy transfer, relevant to aerospace flows, and to ultra-high (up to 1 MHz) frame rate Planar Laser Induced Fluorescence (PLIF) imaging. Non-equilibrium plasmas have generated much recent interest due to their potential as devices for aerodynamic flow control and enhancement of basic combustion phenomena, such as ignition and flame holding. The first portion of this talk will describe recent studies of N₂ vibrational energy loading and dynamics by picosecond Coherent Anti-Stokes Raman Spectroscopy (CARS), including measurements in a laboratory scale Mach 5 wind tunnel, as well as single and two photon Laser Induced Fluorescence (LIF) studies of plasma chemical fuel oxidation, featuring the role of metastable electronic states and super equilibrium radical pools produced by the plasma. The use of four wave mixing techniques for determination of electric field will also be presented, as will preliminary measurement of electron density by Thomson scattering.

The second portion of the talk will describe the development and application of an ultra-high frame rate imaging system based on the pulse “burst” concept, including measurements in the NASA Langley 31” Mach 10 Wind Tunnel, and a series of laboratory scale measurements.

Bio
Professor Walter R Lempert is a faculty member in the Departments of Mechanical and Aerospace Engineering and Chemistry & Biochemistry at The Ohio State University, Columbus, OH. He received his B.S. degree in Chemistry from Lehigh University in 1975 and his Ph.D. (also in Chemistry) from the University of Utah in 1981. Previously, he worked at Princeton University, NASA Langley Research Center, and as a National Research Council Post-Doctoral Fellow at the National Bureau of Standards (Gaithersburg, MD). His current research interests focus on non-equilibrium plasma physics and chemistry, optical flow and combustion diagnostics, non-equilibrium gas dynamics, and ultra-high frame rate imaging. He is the author of over 300 conference and journal papers, and is a Fellow of the American Physical Society. In 2010 he was awarded the AIAA Aerodynamic Measurement Technology Award.

An informal coffee & cookie reception will be held prior to the lecture at 2:30 p.m. in the Hostetler Student Lounge (directly in front of ARMS 3rd floor elevators).