Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Spontaneous Raman Scattering Measurements of Vibrational Non-Equilibrium in High-Speed Jets[1] HEATH REISING, TIMOTHY HALLER, NOEL CLEMENS, PHILIP VARGHESE, The University of Texas at Austin — Vibrational non-equilibrium is detected and quantified in a high-speed jet using spontaneous Raman scattering. The non-equilibrium is induced by rapid mixing of the different temperature streams of the jet and coflow which are approximately 500 K and 1000 K, respectively. Simultaneous measurements of vibrational and rotational temperatures are made using fits of time-averaged high-resolution Stokes spectra of both N_2 and O_2 to high fidelity models of the spectrum. Independent measurements of these two species temperatures show good agreement in rotational temperature while the vibrational temperatures show only N_2 to have a strong non-equilibrium. This suggests that vibrational energy transfer between these two molecules is very inefficient at these conditions. Work is being conducted to extend the technique to single-shot measurements by employing a multiple-pass cell to increase the incident laser fluence in the measurement volume. This new capability will allow for statistics of vibrational temperature to be quantified. The instantaneous nature of the measurements will also allow the technique to be applied in regions of large temperature fluctuations, such as the base of a lifted turbulent jet flame, where time-average measurements are not valid.

[1]This work was supported by funding from the Air Force Office of Scientific Research

Heath Reising
The University of Texas at Austin

Date submitted: 01 Aug 2016 Electronic form version 1.4