Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Cooling and Laser-Induced Fluorescence of Electronically-Excited He_2 in a Supersonic Microcavity Plasma Jet RUI SU, ANDREY MIRONOV, THOMAS HOULAHAN, JR., J. GARY EDEN, University of Illinois at Urbana-Champaign, LABORATORY FOR OPTICAL PHYSICS AND ENGINEERING TEAM — Laser-induced fluorescence (LIF) resulting from transitions between different electronic states of helium dimers generated within a microcavity plasma jet was studied with rotational resolution. In particular, the $d^3\Sigma_u^+$, $e^3\Pi_g$ and $f^3\Sigma_u^+$ states, all having electronic energies above 24 eV, are populated by a microplasma in 4 bar of helium gas and rotationally cooled through supersonic expansion. Analysis of two dimensional maps (spectrograms) of dimer emission spectra as a function of distance from the nozzle orifice indicates collisional coupling during the expansion between the lowest rotational levels of the $e^3\Pi_g$, $f^3\Sigma_u^+$ states and high rotational levels (around N=11) of the $d^3\Sigma_u^+$ state (all of which are in the v = 0 vibrational state). In an attempt to verify the coupling, a scanning dye laser (centered near 596 nm) pumps the $b^3\Pi_g \rightarrow f^3\Sigma_u^+$ transition of the molecule several hundred micrometers downstream of the nozzle. As a result, the emission intensities of relevant rotational lines are observed to be enhanced. This research shows the potential of utilizing microcavity plasma jets as a tool to study and manipulate the collisional dynamics of highly-excited diatomic molecules.

Rui Su
University of Illinois at Urbana-Champaign

Date submitted: 08 Jun 2016 Electronic form version 1.4