

Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Ultraviolet Rayleigh scatter imaging in atmospheric microdischarges for spatial temperature profiles¹ JAMES CAPLINGER, UES, Inc., STEVEN ADAMS, Air Force Research Laboratory, AMBER HENSLEY, BOYD TOLSON, UES, Inc. — Spatially resolved temperature measurements within a microdischarge in atmospheric pressure air have been conducted using Rayleigh scattering of a pulsed ultraviolet laser. The scatter image intensity along the laser beam axis is proportional to the background gas target density and thus, according to the ideal gas law, is inversely proportional to gas translational temperature. By measuring the scatter image with and without a discharge, the temperature was determined in 1-dimension along the laser beam passing radially through the discharge. The 1-dimensional scattering intensity profiles were then used to generate 2-dimensional cross-sectional slices of temperature by transitioning the height of the laser beam. The cross-sectional temperature profiles exhibited a high degree of cylindrical symmetry with the radial width of the high temperature region expanding with increasing discharge current. Peak temperatures determined by Rayleigh scattering for each current were compared to temperatures derived from standard optical emission spectral analyses of N₂(C-B) bands, where the calculated rotational temperatures from emission were in reasonable agreement with the Rayleigh translational temperature profiles.

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Date submitted: 09 Jul 2014

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