Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Periodic Evolution of a Xe I Population in an Oscillatory Discharge Captured Through Time-Synchronized Laser Induced Fluorescence Techniques[1] ANDREA LUCCA FABRIS, CHRISTOPHER YOUNG, MARK CAPPELLI, Stanford University — We track the evolution of the Xe I $6s'[1/2]_1 - 6p'[3/2]_2$ (834.68 nm air) transition lineshape in a plasma discharge oscillating at 60 Hz. Two time-synchronized laser induced fluorescence techniques based on phase sensitive detection of the fluorescence signal are demonstrated, yielding consistent results. One approach used previously involves a sample-and-hold procedure that collects fluorescence signal at a particular phase in the oscillation period and holds the average value until the following sample. The second method is based on fast switching of the fluorescence signal; only the signal collected inside the acquisition gate is sent to a lock-in amplifier for processing. Both methods rely on modulating the exciting laser beam and the latter permits operation at a much higher frequency range with reduced spectral noise density. The maximum observed peak fluorescence intensity occurs at low discharge currents, although the peak intensity drops to zero at zero discharge current. The peak intensity also decreases at the discharge current maximum. Time-varying properties of the xenon neutrals are extracted from a lineshape analysis.

[1]This work is sponsored by the U.S. Air Force Office of Scientific Research with Dr. Mitat Birkan as program manager. CVY acknowledges support from the DOE NNSA Stewardship Science Graduate Fellowship under Contract DE-FC52-08NA28752.

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Date submitted: 13 Jun 2014 Electronic form version 1.4