Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

**Experimental Characterization of Flow Induced by a Nanosecond Surface Discharge**[1] LALIT RAJENDRAN, BHAVINI SINGH, RAVICHANDRA JAGANNATH, GEORGE SCHMIDT, PAVLOS VLACHOS, SALLY BANE, Purdue University — Nanosecond surface Dielectric Barrier Discharges (ns-DBD) have generated growing interest as a means of high speed flow control. These discharges are characterized by electrical breakdown caused by high voltage, nanosecond pulses resulting in ultra-fast heating of the surrounding air. The rapid heat release leads to generation of a shock wave and complex flow characterized by coherent vorticity and a hot gas kernel near the electrode surface. Past applications of these discharges have yielded mixed results in flow control and the reasons for success/failure of these actuators are not well understood. This is because a fundamental understanding of the induced flow field and its relation to electrode geometry and energy deposited is not available. To address this limitation, we have performed high speed Particle Image Velocimetry (PIV) and Background Oriented Schlieren (BOS) measurements on the flow induced by a single nanosecond filamentary surface discharge under quiescent conditions. We measure the vorticity and density of the hot gas kernel and create a mechanistic model of the actuator induced flow. Such a model of the actuator performance can inform the choice and deployment of these devices for flow control applications.

[1]This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Fusion Energy Sciences under Award Number DE-SC0018156

Lalit Rajendran
Purdue University

Date submitted: 02 Aug 2019 Electronic form version 1.4