Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

High-Voltage Discharge in Air and Nitrogen, Guided by Femtosecond Laser[1] SERGEY LEONOV, JIHT RAS, JAMES MICHAEL, RICHARD MILES, MICHAIL SHNEIDER, Princeton University, MICHAIL SHURUPOV, JIHT RAS, JIHT RAS TEAM, PRINCETON UNIVERSITY TEAM — The ability of a low energy (El<2mJ), femtosecond laser pulse to modify a high energy (Ed>1J), high voltage discharge is examined in detail. The geometry and breakdown voltage of a long filamentary submicrosecond high-voltage pulse discharge are studied by noting the effect on initial streamer formation, the breakdown location and overall geometry, and through voltage and current waveforms. The laser pulse is focused in the inter-electrode gap, producing a weakly-ionized plasma filament and effectively decreasing the high voltage breakdown and the geometry of both the initial streamer formation and the high voltage filamentary breakdown. The electric pulse is characterized by rapid voltage rise, dU/dt>2×10E11 V/s. High voltage breakdown results in a current pulse of 30-80ns with voltage amplitude of up to 120kV. The guiding effect is considered for delay times up to 100mcs. The initial stage of breakdown – development a streamer tree – was observed in detail. Tests were performed in air and nitrogen to better illuminate the physical mechanism of our observed laser-based guiding, particularly at small (less 2mcs) and large (up to 100mcs) delays. The largest decrease in the breakdown voltage occurs at early time, and the effect remains significant in pure nitrogen at delay times up to 5mcs. Both gas kinetic and gasdynamic analyses are used to determine the effects due to ionization and density drops in both air and nitrogen.

[1]Work is supported by AFOSR.

Sergey Leonov
JIHT RAS

Date submitted: 08 Jun 2012 Electronic form version 1.4