Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Study of microplasmas from GHz to THz JOSÉ GREGÓRIO, ALAN R. HOSKINSON, STEPHEN PARSONS , JEFFREY HOPWOOD, Tufts University — We present a study of atmospheric-pressure microplasmas sustained from 0.5 GHz to 0.5 THz with continuous excitation frequencies. A fluid model shows the existence of electron plasma resonances in a highly collisional microplasma. At 0.5 GHz the behavior is similar to a typical rf collisional discharge. As frequency increases at constant power density we observe a decrease in the discharge voltage from greater than 100 volts to less than 10 volts. This minimum voltage amplitude is attained when electron temporal inertia delays the discharge current to be in phase with the applied voltage. Above this frequency the plasma develops resonant regions where the excitation frequency equals the local plasma frequency. In these volumes the instantaneous quasi-neutrality is perturbed and intense internal currents emerge ensuring a low voltage operation range. This enhanced plasma heating mechanism vanishes when the excitation frequency is larger than the local plasma frequency everywhere in the plasma volume. For a typical peak electron density of 5×10^{20} m^{-3} this condition corresponds to $\sim$ 0.2 THz.

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Date submitted: 17 Jun 2015 Electronic form version 1.4