Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Non-linear frequency coupling in dual radio-frequency atmospheric pressure plasmas[1] JOCHEN WASKOENIG, TIMO GANS, Centre for Plasma Physics, Queens University Belfast, BT7 1NN Belfast, Northern Ireland, UK — Dual frequency operation provides additional control over power coupling and ionization mechanisms in radio-frequency driven atmospheric pressure plasmas. The tailored electron dynamics allows manipulation of mode transitions and plasma chemistry. Numerical simulations, benchmarked against experiments using phase resolved optical emission spectroscopy, reveal that plasma ionization, and associated mode transitions, are governed through frequency coupling in the dynamics of the plasma boundary sheath. Ionization in low-power mode is determined by the non-linear coupling of electron heating and the momentary local plasma density. Ionization in high-power mode is driven by electron avalanches during phases of transient high electric fields within the boundary sheath. The transition between these distinctly different modes is controlled by the total voltage of both frequency components. Under certain conditions it is observed that plasmas operated in helium with small admixtures of oxygen can contain significant densities of negative ions influencing the sheath dynamics and creating transient double layers.

[1]Support: Science and Innovation Award by EPSRC.

Timo Gans
Centre for Plasma Physics, Queens University Belfast,
BT7 1NN Belfast, Northern Ireland, UK

Date submitted: 12 Jun 2009 Electronic form version 1.4