Abstract Submitted
for the GEC14 Meeting of
The American Physical Society

Tailoring plasma properties through the non-linear frequency coupling of odd harmonics ANDREW GIBSON, Centre for Plasma Physics, Queen's University Belfast, Belfast, BT7 1NN, ARTHUR GREB, York Plasma Institute, Department of Physics, University of York, York, YO10 5DD, WILLIAM GRAHAM, Centre for Plasma Physics, Queen's University Belfast, Belfast, BT7 1NN, TIMO GANS, York Plasma Institute, Department of Physics, University of York, York, YO10 5DD — Multiple frequency plasma sources are commonplace in plasma based nano-fabrication. However the control of plasma properties in these discharges is often limited by a poor understanding of the non-linear coupling between the frequencies. Thus investigations of this non-linear coupling are crucial for achieving better control of plasma processes and optimising process outcomes. Presented here is a study of plasma excitation by two coupled odd harmonics (13.56 and 40.68 MHz) using a 1D fluid model of a symmetric capacitively coupled plasma. Non-linear frequency coupling is found to minimise the average plasma potential when both frequencies contribute equally to the voltage waveform. Furthermore, varying the phase between the frequencies can further decrease the average plasma potential, without having a significant effect on the ion density. This effect allows for control of the sheath potential at both electrodes simultaneously, independent of the ion density. As such the use of odd harmonics offers a novel method of plasma control that maintains the symmetry of the discharge. This is in contrast to plasma control techniques utilising the electrical asymmetry effect where the sheath potential is decreased at one electrode by increasing it at the opposing electrode.

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Date submitted: 13 Jun 2014 Electronic form version 1.4