Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Electron heating via the self excited plasma series resonance in multi-frequency capacitive plasmas STEVEN BRANDT, EDMUND SCHUENGEL, West Virginia University, ZOLTAN DONKO, IHOR KOROLOV, ARANKA DERZSI, Hungarian Academy of Sciences, JULIAN SCHULZE, West Virginia University — In a combined approach of PIC/MCC simulations and a theoretical model based on an equivalent circuit, the self-excitation of Plasma Series Resonance (PSR) oscillations and their effect on the electron heating in geometrically symmetric capacitively coupled radio frequency (CCRF) plasmas driven by multiple consecutive harmonics of 13.56 MHz is investigated. The discharge symmetry is controlled via the Electrical Asymmetry Effect, i.e. by varying the total number of harmonics and tuning the phase shifts between them. It is demonstrated that PSR oscillations of the electron current density will be self-excited, if (i) the charge-voltage relation of the plasma sheaths deviates from a simple quadratic behavior and if (ii) the inductance of the plasma bulk exhibits a temporal modulation. Both effects are neglected in existing models of the PSR, but found to be crucial here. The effect of the PSR self-excitation on other plasma parameters, such as the potential profile, is illustrated by applying Fourier analysis. High frequency oscillations in the entire spectrum between the applied frequencies and the local electron plasma frequency are observed. The electron heating is demonstrated to be strongly enhanced by the PSR and complex electron heating dynamics are observed.

Julian Schulze
West Virginia University

Date submitted: 11 Jun 2015 Electronic form version 1.4