Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Electron Heating in Microwave-Assisted Helicon Plasmas JOHN MCKEE, West Virginia University, UMAIR SIDDIQUI, Phase Four, ANDREW JEMIOLO, JULIANNE MCILVAIN, EARL SCIME, West Virginia University — The use of two (or more) rf sources at different frequencies is a common technique in the plasma processing industry to control ion energy characteristics separately from plasma generation. A similar approach is presented here with the focus on modifying the electron population in argon and helium plasmas. The plasma is generated by a helicon source at a frequency f 0 = 13.56 MHz. Mcrowaves of frequency f 1 = 2.45 GHz are then injected into the helicon source chamber perpendicular to the background magnetic field. The microwaves damp on the electrons via X-mode Electron Cyclotron Heating (ECH) at the upper hybrid resonance, providing additional energy input into the electrons. The effects of this secondary-source heating on electron density, temperature, and energy distribution function are examined and compared to helicon-only single source plasmas as well as numeric models suggesting that the heating is not evenly distributed but spatially localized. Optical Emission Spectroscopy (OES) is used to examine the impact of the energetic tail of the electron distribution on ion and neutral species via collisional excitation. Large enhancements of neutral spectral lines are observed with little to no enhancement of ion lines.

John McKee
West Virginia University

Date submitted: 15 Jul 2016 Electronic form version 1.4