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Neutral Depletion and Ion Acceleration in a Flowing High-Power Argon Helicon Plasma C. MARK DENNING, MATT WIEBOLD, JOHN SCHARER, University of Wisconsin-Madison — Steady state measurements are performed on an argon helicon plasma with a static axial magnetic nozzle field (1 kG source, 1.5 kG nozzle peak)[1]. Flow rates are between 22 and 150 sccm with incident 13.56 MHz rf power levels of between 300 and 3000 W. Collisional-radiative (CR) models for Ar II and Ar I are used to spectroscopically determine the electron temperature (T_e) and the neutral density, respectively. The electron density (n_e) is measured with 105 GHz microwave interferometry and is an input to the CR models. In regions of low neutral depletion, where the ions are collisional with neutrals, T_e remains constant while n_e rises linearly with increasing power. In collisionless, high depletion regions, T_e rises linearly with power while n_e remains constrained. Regions of pressure balance and pressure gradients are present, and evidence of axially accelerated ion flows is observed. The ion energy distribution function is measured using tunable diode laser-induced fluorescence to determine the effect of neutral depletion on the axial ion velocity. Research supported by AFOSR Grant No. FA9550-06-1-0172. [1] C. M. Denning, M. Wiebold, J. Scharer, accepted for publication, Phys. Plasmas, 2008.

C. Mark Denning
University of Wisconsin-Madison

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