Abstract Submitted
for the DPP12 Meeting of
The American Physical Society

Examination of Ion Beam Acceleration in A High Power-Low Pressure and Gas Flow Rates Argon Plasma Created in the MadHeX Helicon Source[1] YUNG-TA SUNG, MICHAEL DEVINNEY, JOHN SCHARER, Department of Electrical and Computer Engineering, University of Wisconsin-Madison — The modified MadHeX experimental system consists of a Pyrex tube connected to a stainless steel chamber with an axial magnetic nozzle field, variable up to 1 kG at the source region that has been upgraded to minimize neutral reflux and reduce neutral concentrations in the chamber. A half-turn double-helix antenna is used to excite helicon waves in the source. An ion beam of energy, E = 160 eV at 500 W RF power, has been observed in a low flowing argon plasma formed in the expanding region with a 340 G magnetic field. The role of plasma positive "self-bias" and the effects of boundary conditions are discussed. The measured density decrease factor of 18 at 100 W RF power across the expansion region yields a higher ion acceleration and agrees with a conservation-of-flux calculation. The effect of lower flow rates and pressures, higher RF powers and magnetic field strength dependence on the ion beam acceleration, plasma potential, electron density and temperature are further explored. The axial ion velocity distribution function and temperatures at higher powers are observed by argon 668 nm laser induced fluorescence with density measurements by interferometry. The electron energy distribution and its possible non-Maxwellian tail are examined using optical emission spectroscopy (ADAS and Vlcek models).

[1]Supported by AFOSR and the UW-Madison.

Yung-Ta Sung
Department of Electrical and Computer Engineering,
University of Wisconsin-Madison

Date submitted: 12 Jul 2012 Electronic form version 1.4