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Examination of Ion Beam Acceleration and Self-Bias Effect in the Modified MadHeX Plasma Source with Conducting and Insulating Upstream Boundary Conditions[1] YUNG-TA SUNG, MICHAEL DEVINNEY, JOHN SCHARER, University of Wisconsin - Madison — The MadHeX experiment consists of a Pyrex tube connected to a stainless steel magnetic field expansion chamber (expansion ratio $R_E = 4.5$) has been upgraded with an axial magnetic mirror field and an additional magnet in the transition region. This configuration enhances electron temperature and ionization fraction and minimizes neutral reflux. A half-turn double-helix antenna is used to excite electrostatic or inductive regime waves in the source. An ion beam of energy, E = 160 eV at 500 W RF power, has been observed in a low pressure (0.3 mtorr) argon plasma formed in the expansion region with a 340 G magnetic field with a R=1.4 nozzle. The effects of upstream end plate boundary conditions on the plasma self-bias and ion beam acceleration are discussed. The effect of lower flow rates and pressures, higher RF powers (500 W-8 kW) and magnetic field strength dependence on the ion beam acceleration, plasma potential, electron density and temperature are explored. The axial ion velocity distribution function and temperatures at higher powers are observed by argon 668 nm laser induced fluorescence with density measurements obtained by mm wave interferometry. The EEDF and non-Maxwellian tail are examined using optical emission spectroscopy.

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