Abstract Submitted
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Ion Acceleration in the Madison Helicon Experiment[1] MATT WIEBOLD, YUNG-TA SUNG, JOHN SCHARER, University of Wisconsin - Madison — The Madison Helicon Experiment consists of a 150 cm long, 10 cm inner diameter Pyrex tube connected to a stainless steel expansion chamber 60 cm long and 45 cm in diameter with an axial magnetic field, variable up to 1 kG at the source region with a nozzle profile. Supersonic ion acceleration up to $E_i = 160$ eV at 500 W, 13.56 MHz RF power have been observed in the expanding region of the source. The effect of flow rate/pressure, RF power and magnetic field strength on the ion beam acceleration and the spatial variation of the plasma potential, electron density and temperature are explored. The ion energy distribution function is obtained by a two-grid RPA, while probe diagnostics determine V_p, n_e, and T_e. The effect of the operating mode of the helicon source (E, H or W) is explored. RF plasma potential fluctuations are observed which electrons can respond to but ions cannot, leading to time-averaged acceleration of the ions and time-dependent "neutralization" of the beam. Ion acceleration occurs over $\sim 400\ \lambda_D$, and the accelerated population persists for several ion charge exchange mean free paths. Both double layer and Boltzmann expansion are considered as mechanisms responsible for the acceleration.

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