Abstract Submitted
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Particle-In-Cell Simulation and Experimental Characterization of a Cylindrical Cusped Field Plasma Thruster[1] ANDREA LUCCA FABRIS, CHRISTOPHER YOUNG, Stanford University, MARCO MANENTE, DANIELE PAVARIN, University of Padova, MARK CAPPELLI, Stanford University — This work aims to provide new insight into the physical mechanisms occurring in the discharge channel and acceleration region of a cusped field plasma thruster through a combined experimental and computational approach. Simulations are performed using the 3D particle-in-cell code F3MPIC, comprised of a PIC core coupled with a finite element electrostatic field solver over an unstructured mesh of tetrahedra. The cusped field structure is also included to resolve magnetized particle dynamics. We perform simulations with two ionization schemes: one where constant particle source rates are assigned to certain regions, and a more rigorous approach based on Monte Carlo collision events. The simulation results reveal correlations between the particle density distributions, electrostatic potential, and magnetic field topology inside the thruster discharge channel that are confirmed through experiments. Laser induced fluorescence measurements have resolved xenon ion velocities at several points near the thruster exit plane. Faraday and floating emissive probe measurements indicate this velocity field is correlated with the measured ion beam current profile and electrostatic potential field.

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