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Helicon Plasma Injection into an IEC Thruster GEORGE H. MILEY, BEN ULMEN, AKSHATA KRISHNAMURTHY, PAUL KEUTELIAN, GEORGE CHEN, University of Illinois at Urbana-Champaign — Helicon plasma injection into an Inertial Electrostatic Confinement (IEC) thruster stage is under experimental study. Helicons are RF plasma sources using helicon waves, or low frequency whistler waves. Such inductively coupled plasmas (ICPs) produce plasma of higher density than other field-free ICPs. Permanent magnet helicon sources have been proposed for plasma generation to provide a high downstream plasma density of about 1018 m^{-3} for argon [1]. The IEC stage then provides plasma acceleration. An IEC plasma is produced as a dc glow discharge, giving a "star" or a "jet" mode (current mode of interest) on chamber pressure. To decouple the chamber pressure and the IEC cathode grid accelerating voltage, the plasma generation and plasma acceleration stages are decoupled by helicon plasma injection. Normally a symmetric cathode grid produces the star mode at lower pressures while a slightly higher pressure gives the jet mode. In this experiment an asymmetric cathode grid is used in the IEC to produce a plasma jet at pressures as low as 1.0 mTorr. This mode can be used as an advanced electric propulsion system where thrust and specific impulse are decoupled, providing variable specific impulse that enables complicated orbital maneuvers and challenging space missions.

[1] F. F. Chen and H. Torreblanca, "Large-area helicon plasma source with permanent magnets," Phys. Plasmas, 2007.

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