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Two-Dimensional (z-θ) Hybrid Fluid-PIC Simulation of Enhanced Cross-field Electron Transport in an Annular $\boldsymbol{E}\times\boldsymbol{B}$ Discharge

CHERYL LAM, Stanford University, EDUARDO FERNANDEZ, Eckerd College, MARK CAPPELLI, Stanford University — We use a numerical model to study quasi-coherent plasma fluctuations and their impact on cross-field electron transport. We consider the case of an annular discharge, subject to a radial magnetic field and an axial electric field. Motivated by experimental evidence of anomalously high electron mobility across the magnetic field in Hall thruster discharges, we choose a two-dimensional axial-azimuthal (z-θ) simulation geometry. The model includes a continuously-replenished heavy (Xe) neutral background, with an imposed radial magnetic field and an applied axial electric potential. We use a hybrid fluid-Particle-In-Cell treatment; the ion and neutral species are treated as collisionless particles, while the electrons are treated as a fluid continuum. Using numerical simulations to resolve the azimuthal electron dynamics, we focus on understanding the role played by fluctuations, particularly those that propagate with components perpendicular to both the applied electric and magnetic fields. Preliminary simulations predict dispersive "tilted" wave fluctuations in the plasma density and electron velocities. These fluctuations appear to contribute to an enhanced overall electron mobility, which is significantly higher than that based on classical scattering.

Cheryl Lam
Stanford University

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