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A zero-equation turbulent electron transport model for cross-field migration and its implementation in a 2-D hybrid plasma Hall thruster simulation[1] MARK CAPPELLI, CHRIS YOUNG, EUSNUN CHA, Stanford University, EDUARDO FERNANDEZ, Eckerd College, STANFORD PLASMA PHYSICS LABORATORY COLLABORATION, ECKERD COLLEGE COLLABORATION — We present a simple, zero-equation turbulence model for electron transport across the magnetic field of a plasma Hall thruster and integrate this model into 2-D hybrid particle-in-cell simulations of a 72 mm diameter laboratory thruster operating at 400 W. The turbulent transport model is based on the assumption that the primary means of electron energy dissipation is the turbulent eddy cascade in the electron fluid to smaller scales. Implementing the model into 2-D hybrid simulations is relatively straightforward and leverages the existing framework for solving the electron fluid equations. We find that the model captures the strong axial variation in the mobility seen in experiments. In particular, it predicts the existence of a strong transport barrier which anchors the region of plasma acceleration. The model also captures the time-averaged experimental discharge current and its fluctuations due to ionization instabilities. We observe quantitative agreement with recent laser induced fluorescence measurements of time-averaged xenon ion and neutral velocities along the channel centerline.

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