A Simple Model of Cross-Field Diffusion in Hall Thrusters based on Turbulence Energy Cascade MARK A. CAPPELLI, EUNSUN CHA, Stanford Univ, EDUARDO FERNANDEZ, Eckerd College — We present a Hall plasma thruster model based on turbulence energy cascade to smaller scales characterized by the electrons gyro-radius. We employ scaling arguments originally developed for viscous energy dissipation in turbulent fluid mechanics with the assumption that the electron scattering rate is expected to scale as the strain-rate in the electron fluid, and that the size of the largest turbulent eddies scale as the electron gyro-radius and local drift velocity. Using this framework, expressions are derived for the entropy production rate which can be used in an independent entropy transport equation from which the transport coefficient can be derived. Alternatively, if one assumes that the main source of electron energy dissipation is turbulent energy cascade, then the energy dissipation replaces the Ohmic heating term in the electron energy equation. We will present the general results of this analysis, as well as initial results obtained from 2-D hybrid simulations that incorporate this model and its variants.

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