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The role of instability-enhanced friction on electron transport in ExB discharges TREVOR LAFLEUR, PASCAL CHABERT, LPP, Ecole Polytechnique — The applied discharge voltage and magnetic field in many ExB discharges produces large electron drift velocities that can drive plasma instabilities leading to increased particle transport. Here we present self-consistent 2D particle-in-cell (PIC) simulations investigating such instabilities in typical ExB discharges such as Hall-effect thrusters. The PIC simulations preserve fundamental plasma spatial and temporal scales and do not include any artificial geometric or parametric scaling factors. Short-wavelength, high-frequency, oscillations are observed to form just a few microseconds after the discharge begins and with a Fourier spectrum that matches that for an ion acoustic-type instability (in agreement with kinetic theory). Correlated with the presence of this instability is an increased electron cross-field transport that cannot be explained by standard electron-neutral or electron-ion Coulomb collisions. By taking velocity moments of the electron distribution function in the PIC simulations, we reconstruct each term in the electron momentum conservation equation and demonstrate that "anomalous" electron transport in such discharges can be explained entirely due to an instability-enhanced friction force between electrons and ions. This friction force acts as an additional momentum loss mechanism aiding electron transport, and as an ion acceleration mechanism causing both rotation and heating.

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