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Electron transport in closed-drift EXB configurations - Collisional to turbulent transport JEAN-PIERRE BOEUF, LAPLACE, CNRS and University of Toulouse — In closed-drift ion sources and Hall thrusters, the presence of a magnetic field perpendicular to the electron current between an emissive cathode and the anode leads to the formation of a large electric field in the plasma, which extracts ions from the source. In typical cylindrical configurations, the external magnetic field is radial and the electric field is axial, and a large electron current, the Hall current, flows in the azimuthal EXB direction (closed-drift). In Hall thruster conditions, it is known that collisions between electrons and neutral atoms cannot explain the observed electron current across the magnetic field. We use a 1D-3V Particle-In-Cell Monte Carlo Collision (PIC-MCC) model to study electron transport in these conditions. Electron and ion trajectories are described in 3D but Poisson's equation is solved in the azimuthal direction only (with periodic boundary conditions) to study the development of instabilities in this direction. Electrons gain energy form the given axial electric field and lose energy through collisions with neutral atoms. Simulations have been performed for different gas densities, plasma densities, and applied E and B fields. We find that instabilities of the azimuthal electric field take place quickly for values of the Hall parameter larger than one. We study the properties of these instabilities, compare them with those predicted by dispersion relations obtained in similar conditions, and analyze the deviation from classical mobility due to these instabilities.

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