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Non-isotropic non-Maxwellian Electron Velocity Distribution Functions in Low-pressure Plasmas IGOR D. KAGANOVICH, Plasma Physics Laboratory, Princeton University, DMYTRO SYDORENKO, University of Saskatchewan, Saskatoon, Canada, YEVGENY RAITSES, PPPL, ANDREI SMOLYAKOV, University of Saskatchewan — We show that at very low pressures, the Electron Velocity Distribution Functions (EVDF) can become non-isotropic and non-Maxwellian. Specifically, plasmas in Hall thrusters are studied. Such plasmas are sustained at low neutral gas pressure, where the electron mean free path is large compared with thruster dimensions and the electron motion is almost collisionless. Particle-in-cell simulations show that electrons tend to stratify into different groups depending on their origin and confinement condition (i.e. whether they are trapped or not by the plasma potential). These different electron groups have to be treated separately, as they have completely different properties and cannot be lumped together into one Maxwellian EVDF, which is implicitly assumed by the fluid approach. Moreover, the EVDF is found to be strongly non-isotropic due to the large electric field directed parallel to the walls and high plasma losses to the wall, especially in presence of strong secondary electron emission pertaining to Hall thrusters. Typically, the temperature in the direction of the electric field is a factor of two larger than that in the direction towards the walls.

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