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Particle-in-cell simulations of discharges with intense electron emission[1]

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In many plasma devices, the plasma is bounded by walls which emit electrons due to secondary electron emission or thermionic emission. At low pressures, the electron mean free path exceeds the plasma dimensions, and the emitted electrons accelerated by the intense electric field of the near-wall sheath propagate through the plasma as an electron beam. The beam dynamics in a finite length system is different from theoretical predictions for infinite or periodic plasmas. This presentation gives a summary of numerical studies of beam-plasma interaction in Hall thrusters and dc discharges carried out with a particle-in-cell code [1]. The code resolves one spatial coordinate and three velocity components, it is based on the direct implicit algorithm [2], the electron-to-ion mass ratio is realistic, numerous collisions between electrons and neutrals and the Coulomb collisions are included, code performance is enhanced with the help of MPI parallelization. The following effects are discussed: vanishing of the two-stream instability due to modification of the bulk electron velocity distribution [3], sheath instability in Hall thrusters [4], intermittency and multiple regimes of the two-stream instability in dc discharges.

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