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Anomalous transport in a magnetized plasma column under laboratory conditions[1] ROMAIN LUCKEN, ANTOINE TAVANT, ANNE BOURDON, Laboratoire de Physique des Plasmas, MIKE LIEBERMAN, University of California Berkeley, PASCAL CHABERT, Laboratoire de Physique des Plasmas —
The problem of instability-enhanced plasma transport in low-temperature magnetized discharges is addressed using two-dimensional particle-in-cell (PIC) simulations of a magnetized plasma column for ion Knudsen numbers between 0.3 and 1, and magnetic fields ranging from 0 to 40 mT. The influence of the type of gas (argon, xenon, and helium) is investigated, with and without accounting for the effect of the magnetic field on the ions. The spectral analysis of the data generated by the various PIC runs when the instability triggers was shown to agree with a dispersion relation coming from linearized fluid equations. An anomalous collision frequency depending only on the electron cyclotron frequency and the electron plasma frequency was found, yielding accurate predictions of the flux of ions at the walls through an anisotropic model of the plasma transport that applies for all magnetization regimes. It is demonstrated that the effect of the magnetic field totally saturates when the instability controls the plasma transport, setting a limit to magnetic confinement in laboratory plasmas.

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