Abstract Submitted
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Student Excellence Award Finalist: Transition to instability-enhanced transport in weakly-ionized magnetized plasmas[1] ROMAIN LUCKEN, Laboratoire de Physique des Plasmas, UMR CNRS 7648 cole polytechnique Sorbonne Universit, 91128 Palaiseau, FRANCE (LPP), ANTOINE TAVANT, ANNE BOURDON, LPP, MIKE A. LIEBERMAN, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, California 94720, PASCAL CHABERT, LPP — An inductively coupled plasma column is simulated by an electrostatic particle-in-cell Monte-Carlo method in 2D. The size of the simulated argon discharge is taken to be a few times the ion mean free path and the magnetic field is varied from 0 to 40 mT. The results show that an instability pattern rotating in the direction of the diamagnetic drift develops at magnetic fields greater than 50 mT. This instability is a resistive drift instability triggered by collisions and it greatly enhances the plasma transport from the center to the walls. The linearized fluid transport equations show that it can develop only when the total drift velocity is larger than the Bohm speed. It is observed that the electron drift velocity always remains lower than the electron thermal velocity. This condition yields a maximum Hall parameter and a lower bound for the edge-to-center plasma density ratio of the discharge. The latter yields an effective electron collision frequency proportional to B^2. An analytical isothermal fluid model that incorporates the effective collision frequency can correctly reproduce the properties of the plasma transport at high magnetic field. The transition to this regime seems to appear when the classical electron mobility becomes lower than the ion mobility.

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