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Three-dimensional and Sheath Boundary Effects on the Instabilities and transport in ExB Plasma Discharges[1] VINCENT MORIN, OLEKSANDR KOSHKAROV, ANDREI SMOLYAKOV, Univ of Saskatchewan, YEVGENY RAITSES, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory — Plasma devices based on the ExB drift are used for a variety of applications. However, transverse electron current due to ExB drift and diamagnetic flows are the sources of gradient-drift type instabilities which results in turbulence and anomalous transport. In the simplest case, the instabilities and resulting plasma dynamics are considered in neglect of the electron motion along the magnetic field. However, parallel electron dynamics may significantly affect the instability criteria for gradient-drift modes and result in new instabilities. In bounded systems, where the magnetic field lines are intercepted by material walls, the sheath becomes important. The sheath boundary conditions constrain the parallel electron dynamics and thus, via current closure (due to charge neutrality), modify instabilities. We consider sheath boundary conditions for dielectric walls and investigate their effect on the Simon-Hoh and lower-hybrid instabilities. The 3D eigenmode structure is investigated and the nonlinear evolution is studied with fluid simulations. The effects of boundary conditions open the way to control the instabilities via the "smart wall" boundaries which use segmented electrodes and active circuit elements to suppress the instabilities.

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