Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Instabilities in Hall $\mathbf{E} \times \mathbf{B}$ discharges with complex magnetic field configurations. A. SMOLYAKOV, O. KOSHKAROV, W FRIAS, I. ROMADANOV, O. CHAPURIN, University of Saskatchewan, M. UMANSKY, Lawrence Livermore National Laboratory, USA, Y. RAITSES, I. KAGANOVICH, Princeton Plasma Physics Laboratory, USA — Hall plasmas with electron $\mathbf{E}\times\mathbf{B}$ drift exhibit wide range of unstable modes affecting operation and performance of various devices, e.g. such as magnetrons and Hall thrusters. The plasma density, magnetic field and temperature gradients are important source of various gradient-drift and lower-hybrid instabilities across wide range of spatial and temporal scales. The electron response is critically sensitive to the electron dynamics along the magnetic field which has a characteristic frequency scale $k_{\parallel}v_{Te}$. The motion across magnetic field occurs on a slower time scale due to $E \times B$ drift/magnetic drift and/or electron inertial/collisional drifts. The ratio of the transverse to the parallel times scale affects electron dynamics and change the conditions and nature of the instabilities in a significant manner. The nonlinear fluid 3D model has been developed that takes into account both perpendicular and parallel dynamics. Few illustrative examples are considered for the instabilities in various regimes and results of nonlinear simulations in 3D geometries are presented.

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Date submitted: 11 Jun 2016 Electronic form version 1.4