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Nonlinear ECDI and anomalous transport in  $E \times B$  discharges<sup>1</sup> SALOMON JANHUNEN, ANDREI SMOLYAKOV, OLEKSANDR CHAPURIN, Univ of Saskatchewan, DMYTRO SYDORENKO, Univ of Alberta, IGOR KAGANOVICH, YEVGENI RAITSES, Princeton Univ / PPPL — Cross-field anomalous transport is an important feature affecting the operation and performance of  $E \times B$  discharges. Instabilities excited by  $E \times B$  flow cause anomalous current to develop, characterized in the nonlinear regime by a large amplitude coherent wave driven by the energy input from the unstable cyclotron resonances. A persistent train of soliton-like waves characterized by the fundamental cyclotron wavelength appears in ion density. Simultaneously, there is inverse energy cascade toward long wavelength which is manifested by the formation of the long wavelength envelope of the wave train. It is shown that the long wavelength part of the turbulent spectrum provides a dominant contribution to anomalous electron transport. We present results from 1D3V and 2D3V PIC simulations, with finite boundaries in 2D. Influence of inhomogeneities in density and magnetic field on the development of the  $E \times B$  drift cyclotron instability is investigated, as well as the non-linear mechanisms behind the coherent structures and their interactions.

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