Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Mitigation of ion-induced drift instability in electron plasma by a transverse current through the Landau-resonant layer.[1] A.A. KABANTSEV, C.F. DRISCOLL, UCSD — Experiments and theory on electron columns have characterized an *algebraic* damping of diocotron modes, caused by a flux of electrons through the resonance (critical) layer [1]. This flux-driven damping also eliminates the ion-induced *exponential* instability of diocotron modes. Our plasmas rotate at rate $\omega_{E\times B}$, and the (nominally stable) diocotron modes are described by amplitude $A_d, k_z = 0, m_\theta = 1, 2, ..$, frequency $\omega_d(m_\theta)$, and a wave/plasma critical radius $r_c(m_\theta)$, where $\omega_{E\times B}(r_c) = \omega_d/m_\theta$. External fields produce a low density (1/100) halo of electrons moving radially outward from the plasma core, with flux rate $F \equiv (-1/N_e)dN_e/dt$. We find that *algebraic* damping of the diocotron modes begins when the halo reaches the critical radius $r_c(m_\theta)$, proceeding as $A_d(\Delta t) = A_d(0) - \gamma\Delta t$, with $\gamma = \beta(m_\theta)F$. We also investigated the diocotron instability which occurs when a small number of ions are transiting the electron plasma [2]. Dissimilar bounce-averaged drifts of electrons and ions polarize the diocotron mode density perturbations, developing instability analogous to the classical flute instability. The exponential growth rate Γ is proportional to the fractional neutralization (N_i/N_e) and to the separation between electrons and ions in the wave perturbation. We have found that the *algebraic* damping can suppress the exponential ion-induced instability only for amplitudes satisfying $A_d \leq \beta F/\Gamma$. [1]A.A. Kabantsev *et al.*, PRL **112**, 115003 (2014). [2]A.A. Kabantsev and C.F. Driscoll, Fusion Sc. and Tech. **51**, 96 (2007)

[1]Supported by NSF Grant PHY-1414570, DOE Grants DE-SC0002451

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Date submitted: 14 Jul 2016 Electronic form version 1.4