Abstract Submitted
for the DPP15 Meeting of
The American Physical Society

A Novel Explanation of the Greenwald Density Limit–Thermal-Resistive Tearing Mode QIAN TENG, DYLAN BRENNAN, LUIS DELGADO-APARICIO, DAVID GATES, Princeton Plasma Physics Lab, JOSH SWERDLOW, none, ROSCOE WHITE, Princeton Plasma Physics Lab — R.B. White et. al. showed that the asymmetry of a magnetic island created by a tearing mode is crucial to understand its evolution. An island is thermally isolated, the internal temperature given by the balance of radiation loss and Ohmic heating. When radiation loss from the island dominates, the cooling of the island, coupled to the asymmetry, can cause rapid growth, leading to a potential mechanism to explain the Greenwald density limit. In this work we successfully reproduced the density limit with experiment-relevant parameters using this model. Using simple equilibrium profiles and assuming internal inductance evolution with density, we simulated the equilibrium evolution as a function of density. The modeling of internal inductance is motivated by D.A. Gates and L. Delgado-Aparicio's finding that the density limit is accompanied with internal inductance increasing. Given reasonable numbers for geometric size, electric and magnetic field, we calculated power balance inside island. The simulation showed local power balance criterion agrees with the density limit within 2%. The very sharp limit is determined by the strong dependence of radiative loss on density. Next work is to use a toroidal model and experimentally obtained equilibria to compare with experiments directly.

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Date submitted: 14 Jul 2015 Electronic form version 1.4