Abstract Submitted
for the DPP14 Meeting of
The American Physical Society

Validation of critical gradient model for fast ion relaxation in NSTX JEFF LESTZ, NIKOLAI GORELENKOV, MARIO PODESTÀ, Princeton Plasma Physics Laboratory — Confinement of energetic particles (EP) is essential to optimize performance of present day tokamaks and future fusion devices. With superalfvénic velocities, EP interact resonantly with Toroidal Alfvén Eigenmodes (TAEs), resulting in enhanced radial transport and particle loss. A reduced quasi-linear "critical gradient model" (CGM) has been developed by Ghantous to account for this interaction, and was previously validated against DIII-D demonstrating surprising agreement.[1] The CGM uses linear instability theory to calculate the fast ion pressure gradient corresponding to marginal TAE stability. Integration of this gradient determines the relaxed fast ion profile and losses. This work focuses on applying the CGM to an NSTX plasma, using neutral beam injection for its validation. Thorough confinement studies were done with the help of TRANSP code in order to infer the EP radial diffusion rates consistent with the plasma performance in experiments. The analysis found typical radial diffusion of ~ 1 m^2/s, with a transient peak value of ~ 8 m^2/s. As a relatively fast code, the CGM can be used for predictive modelling of EP profiles in future devices such as ITER.

[1]K. Ghantous et al., Phys. Plasmas 19, 092511 (2012)

Jeff Lestz
Princeton Plasma Physics Laboratory

Date submitted: 11 Jul 2014 Electronic form version 1.4