

Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

PIXIE3D simulations of nonlinear saturation of MHD modes

IOANNIS KERAMIDAS, LUIS CHACON, XIAN-ZHU TANG, Los Alamos National Laboratory — The break-up of flux surfaces and the onset of global field line stochasticity provide a natural path for enhanced transport loss thus leading to the thermal quench during a tokamak disruption. In the parallel transport dominated regime, field-line qualities, such as the magnetic connection length of the open field lines that start in the core but terminate on the first wall and divertor plates, play an essential role in setting the transport level. The nonlinear saturation of MHD modes is the primary route to local and global field line stochasticity. Here, we use the nonlinear 3D MHD code, PIXIE3D, to perform initial value simulations from tokamak equilibria of ITER and existing machines that are unstable to a variety of large scale MHD modes, such as (1,1) kink, double tearing, tearing, and external kink. By using a simulation boundary that closely tracks the first wall, we include the plasma response from both inside and outside the magnetic separatrix. With the NEMATO field-line tracing code, we further quantify the properties of the disrupted magnetic topology, calculating quantities such as field-line connection lengths, Lyapunov exponents of neighbouring field lines, and particle diffusion coefficients.

Ioannis Keramidas
Los Alamos National Laboratory

Date submitted: 25 Jun 2020

Electronic form version 1.4