Abstract Submitted
for the DPP17 Meeting of
The American Physical Society

Coherent current-carrying filaments during nonlinear reconnecting ELMs and VDEs FATIMA EBRAHIMI, Princeton Plasma Physics Laboratory and Princeton University — We have examined plasmoid-mediated reconnection in a spherical tokamak using global nonlinear three-dimensional resistive MHD simulations with NIMROD. We have shown that physical current sheets/layers develop near the edge as a peeling component of ELMs or during vertical displacement events (associated with the scrape-off layer currents – halo currents), can become unstable to nonaxisymmetric 3-D current-sheet instabilities (peeling- or tearing-like) and nonlinearly form edge coherent current-carrying filaments. Time-evolving edge current sheets with reconnecting nature in NSTX and NSTX-U configurations are identified. [F. Ebrahimi, Phys. Plasmas 23, 120705 (2016); 24, 056119 (2017)] In the case of peeling-like edge localized modes, the longstanding problem of quasiperiodic ELMs cycles is explained through the relaxation of edge current via direct numerical calculations of reconnecting emf terms. For the VDEs during disruption, we show that as the plasma is vertically displaced, edge halo current sheet becomes MHD unstable and forms coherent edge current filament structures, which would eventually bleed into the walls. Our model explains some essential asymmetric physics relevant to the experimental observations. Supported by DOE grants DE-SC0010565, DE-AC02-09CH11466.

Fatima Ebrahimi
Princeton Plasma Physics Laboratory

Date submitted: 14 Jul 2017 Electronic form version 1.4