Abstract Submitted
for the DPP16 Meeting of
The American Physical Society

Model of ELM suppression by RMPs in DIII-D[1] J.D. CALLEN, U. Wisc., R. NAZIKIAN, N.M. FERRARO, PPPL, M.T. BEIDLER, C.C. HEGNA, U. Wisc., R.J. LA HAYE, C. PAZ-SOLDAN, GA — Recent DIII-D experiments [1,2] explored effects of resonant magnetic perturbations (RMPs) near the minimum applied n=2 RMP amplitude required for ELM suppression in ITER-relevant low collisionality pedestals. Comprehensive tokamak forced magnetic reconnection (FMR) theory is used to describe and quantify the many physical processes involved in stages of RMP effects and an ELM crash response that lead to bifurcation into an ELM-suppressed state: 1) in ELMing equilibrium, flow-screening is strong with little magnetic reconnection; 2) the RMP at q=8/2 penetrates via FMR induced by an ELM crash and locks toroidal flow to the lab frame (like error field mode locking); 3) the ELM crash provides a 8/2 seed island (like NTMs) governed by a modified Rutherford equation; 4) if the total 8/2 RMP is large enough the internal tearing response and flow bifurcate and grow; and 5) flutter transport [3] reduces pedestal top gradients which stabilizes P-B modes and hence suppresses ELMs. This analysis is for discharge 158115 in DIII-D [1,2]; its potential universality is yet to be determined. [1] C. Paz-Soldan et al., Phys. Rev. Lett. 114, 105001 (2015); [2] R. Nazikian et al., Phys. Rev. Lett. 114, 105002 (2015); [3] J.D. Callen, C.C. Hegna and A.J. Cole, Nucl. Fusion 53, 113015 (2013).

[1]Work supported by OFES/DOE under DE-FG02-92ER54139, DE-FG02-86ER53218, DE-AC02-09CH11466 and DE-FC02-04ER54698.

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Date submitted: 15 Jul 2016 Electronic form version 1.4