Pedestal Turbulence Dynamics, and Response to Application of RMP, G. McKee, Z. Yan, *U. Wisconsin*, R. Nazikian, *PPPL*, C. Paz-Soldan, *General Atomics*. X. Xu, *Lawrence Livermore National Laboratory*, Z. Lin, *University of California-Irvine*.

Long-wavelength fluctuations are found to influence outer-core and pedestal transport behavior as well as the H-mode pedestal structure in DIII-D plasmas. Measurements of density fluctuations are obtained with a 2D BES array covering the radial zone $\sim 0.8 < \rho \leq 1.0$ as well as other fast measurements in ELM'ing H-mode and RMP ELM-suppressed plasmas. Inter-ELM pedestal fluctuations often exhibit two independent but co-existing and counter-propagating low-k turbulence modes that overlap spatially. Turbulence and transport have been observed to increase significantly in the pedestal and outer core region in response to application of resonant and non-resonant radial magnetic perturbations [1]. This increased transport appears to play a critical role in the global pedestal response that reduces pressure gradients, leading to ELM mitigation and/or suppression. The evolution of turbulence during the transition from conventional ELM'ing H-mode to ELM-suppressed state is characterized. Effects of impurities will also be examined. A key goal is to identify the origin of the transport response, its dependence on proximity to resonant conditions, and if and how it will extrapolate to burning plasmas. Analytical theories [2] have proposed that zonal flows undergo increased damping in the presence of radial magnetic fields, leading to less zonal flow shearing and increased turbulence and transport. This mechanism would be consistent with the measured "fast" response (~1 ms or less) of the turbulence amplitude to modulation of the RMP amplitude, which suggests that the turbulence response is not solely a reaction to changing gradients and quasi-static (non-zonal flow) ExB shear, which doesn't change on this fast time scale. A toroidal rotation threshold is observed below which ELM suppression does not readily occur with RMP for a given B_r/B_T amplitude, suggesting that a minimum finite rotation is required for suppression. Also, the q-profile and specifically the location of low-order rational q-surfaces (11/3, 10/3, 9/3) results in clear changes in local turbulence amplitude. The dynamics of turbulence, measured fast poloidal flows and quasi-equilibrium ExB flows are investigated during a slow plasma current/q_{95} ramp during application of fixed n=3 radial magnetic field perturbations to investigate the mechanism(s) behind turbulence and transport response to applied radial fields. Turbulence undergoes a rapid change in amplitude near low-order rational surfaces by both increasing and then quickly decreasing as the surface passes by fixed channels. Results will be compared with nonlinear gyrokinetic simulations performed with GTC [3] and GENE [4] simulations, which have demonstrated apparently inconsistent results, to search for signatures of turbulence and zonal flow changes.

1) G. McKee et al., Nuclear Fusion **53**, 113011 (2013)
2) M. Leconte, P.H. Diamond, Nuclear Fusion **18**, 082309 (2011)
3) I. Holod, Nuclear Fusion **57**, 016005 (2017)
4) T. Bird, "The Geometric Consequences of RMPs: equilibrium, stability, transport", General Atomics, Pedestal and ELM Control, April 7, 2014.

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