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Abstract for an Invited Paper
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Weimer Award: Reduction of core turbulence and transport in I-mode and comparisons with nonlinear gyrokinetic simulations[1]

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Understanding transport in high performance ELM-suppressed tokamak plasmas is of great interest for ITER and other future experiments. 'I-mode' regime on Alcator C-Mod, also known as 'improved L-mode' on ASDEX Upgrade, has several favorable characteristics: pedestals in electron and ion temperature, with ITER98y2 H-factors similar to and exceeding H-mode [Hubbard et al Phys. Plasmas 18, 056115 (2011)], but without a density pedestal and without impurity accumulation and without ELMs. Most research on I-mode focuses on changes in edge and pedestal turbulence/transport and stability. In this work, transport in I-mode is probed by measuring changes in *core* turbulence across L-I transitions at Alcator C-Mod and comparing with nonlinear gyrokinetic simulations. Long wavelength ($k_\theta \rho_s$ <0.5) density fluctuation levels decrease from L-mode levels by up to 30% in I-mode, and long wavelength ($k_\theta \rho_s$ <0.3) electron temperature fluctuation levels decrease by up to 70%, reaching the instrumental sensitivity limit. Gyrokinetic simulation results suggest that ExB shear in the core of these intrinsically rotating plasmas can reduce the fluctuation amplitude in I-mode. As the pedestal temperature increases across slow L-I transitions, core density fluctuations (0.40 <ρ <0.95) are reduced prior to the onset of the edge-localized (0.99<ρ <1.0) weakly coherent mode (WCM) and prior to the reduction of low-frequency turbulence in the edge/pedestal region (0.99<ρ <1.0), which suggests that effects of profile stiffness across the radius can also lead to reduced core turbulence. By comparing experimental measurements from Alcator C-Mod to nonlinear gyrokinetic simulations and to different models of profile stiffness, this talk will explore the impact of core turbulence and transport on overall I-mode confinement and on the separation of particle and heat transport in I-mode.

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