Is turbulence actually reduced at the tokamak edge pedestal?†

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It has been suggested that the sudden transition between states of low and high confinement, the L-H transition, involves the reduction of turbulence by sheared radial electric fields. Thus, neoclassical theory is expected to capture low order phenomena, such as pedestal flows. Nevertheless, high confinement mode edge pedestals on Alcator C-Mod exhibit significantly stronger poloidal asymmetry than predicted by the most comprehensive neoclassical theoretical models developed to date, in both boron density and temperature.

We propose a novel self-consistent neoclassical model that allows us to capture these poloidal asymmetries. It is worth pointing out two of the key physical phenomena included. First, inertial effects can prevent ion-impurity temperature equilibration, since impurities are allowed to reach sonic speeds. Second, the diamagnetic drift contribution is allowed to be comparable to the poloidal and toroidal flows used to measure the radial electric field, for both impurities and background ions. The additional poloidal variation of the diamagnetic drift permits obtaining stronger impurity density in-out asymmetries than given just by the magnetic field. We conclude that these extensions in neoclassical theory successfully capture the strong experimental poloidal impurity temperature and density variation, providing a more realistic model for pedestal observations without the need of invoking anomalous transport.

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