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Evidence of toroidally localized turbulence with applied 3D fields in the DIII-D tokamak

Webbing Abstract

New evidence indicates that there is significant 3D variation in density fluctuations near the boundary of weakly 3D tokamak plasmas when resonant magnetic perturbations are applied to suppress transient edge instabilities. The increase in fluctuations is concomitant with an increase in the measured density gradient, suggesting that this toroidally localized gradient increase could be a mechanism for turbulence destabilization in localized flux tubes. Two-fluid magnetohydrodynamic simulations find that, although changes to the magnetic field topology are small, there is a significant 3D variation of the density gradient within the flux surfaces that is extended along field lines. This modeling agrees qualitatively with the measurements. The observed gradient and asymmetries are proposed as a mechanism by which global profile gradients in the pedestal could be relaxed due to a local change in the 3D equilibrium. These processes may play an important role in pedestal and scrape-o\_ layer transport in ITER and other future tokamak devices with small applied 3D fields.