Local Core Turbulence Dynamics During q_{min}-Triggered Internal Transport Barriers on DIII-D

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Internal Transport Barriers (ITBs) have been observed to form in DIII-D plasmas at the appearance of low-order rational q_{min} surfaces in negative central magnetic shear L-Mode discharges. Localized density fluctuations were obtained in the core of these discharges ($0.3 < r/a < 0.7$) via the Beam Emission Spectroscopy (BES) diagnostic, which was scanned radially shot-to-shot at the outboard midplane. The BES diagnostic consists of 32 high-sensitivity channels arranged in a 5 x 6, 2-D grid observing a 5 cm x 7 cm region in the radial/poloidal plane. Density fluctuations are found to drop transiently at the appearance of the low-order rational q_{min} surfaces, concurrent with a discrete increase in electron temperature. Alfvén Eigenmodes are observed deep in the core of these discharges and overlap the turbulence spectrum inside $r/a < 0.5$. Local 2-D core turbulence characteristics (correlation lengths, correlation times, and poloidal velocities) have been measured during these discharges at the time of the ITB formation. In particular, time-resolved poloidal turbulence flow measurements, obtained via Time Delay Estimation (TDE), indicate the appearance of a poloidal velocity shear layer that propagates radially outward at the time $q_{min} = 2$. TDE techniques are also applied to resolve high-frequency velocity fluctuations to examine the possible role of zonal flows in these discharges. Related GYRO simulations suggest that a transient, localized increase in zonal flows may be responsible for triggering such ITBs [1].

[1] R.E. Waltz, et al., Phys. Plasmas **10**, 052301 (2006).

*Supported by US DOE under DE-FG02-89ER53296, DE-FG03-96ER54373 and DE-FG03-95ER54309.