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Formation and Expansion of Core Transport Barriers in Negative Central Shear Discharges in the DIII–D Tokamak[1]

K.H. BURRELL AND THE DIII–D CORE TRANSPORT AND CORE FLUCTUATIONS WORKING GROUP, General Atomics — The essential physics of the barrier formation appears to be decorrelation of turbulence through sheared E × B flow. Theory predicts that the location of the core transport barrier is given by a balance between turbulence decorrelation and instability, with the latter typically increasing with minor radius in the plasma. By increasing the power and angular momentum input, it should be possible to move the barrier to larger minor radius. Experiments show that this is indeed the case, although a key limit on the expansion is given by MHD beta limits related to the steep pressure gradients formed during the expansion process. By slowly increasing the input power, core transport barriers have been formed and expanded for periods up to 1.0 s, avoiding the global MHD limits. The final duration of the core barrier phase was limited by basic current diffusion, which ultimately produced q=1 on axis. The resulting sawtooth MHD oscillations destroyed the core transport barrier.Detailed experimental results on barrier formation and expansion will be presented.

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