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Production of Internal Transport Barriers via self-generated flows in Alcator C-Mod[1]

CATHERINE L. FIORE, MIT-PSFC

New results suggest that changes observed in the intrinsic toroidal rotation influence ITB formation in Alcator C-Mod that arise when the resonance for ICRF minority heating is positioned off-axis at or outside of the plasma half-radius. These ITBs form in a reactor relevant regime, without particle or momentum injection, with Ti≈Te, and with monotonic q profiles ($q_{min} < 1$). C-Mod H-mode plasmas exhibit strong intrinsic co-current rotation that increases with increasing stored energy without external drive. With the resonance position off-axis, the rotation decreases in the center of the plasma resulting in a radial rotation profile with a central well which deepens and moves farther off-axis when the ICRF resonance is at the plasma half-radius. This profile results in strong ExB shear ($>1.5\times10^5$ Rad/sec) in the region where the ITB foot is observed. The self generated ExB shearing increases rapidly after the H-mode transition in off-axis ICRF heated discharges, before other profile changes are observed. Gyrokinetic analyses indicate that this spontaneous shearing rate is comparable to the linear ITG growth rate at the ITB location and may be responsible for stabilizing the underlying turbulence. Detailed measurement of the ion temperature demonstrates that the radial profile also flattens as the ICRF resonance position moves off axis. This decreases R/L_{Ti} in the barrier region, lessening the drive for the ITG turbulence and the resulting particle transport. The reduction in particle transport resulting from increase in core stability allows the neoclassical pinch to peak the density and pressure on axis. This suggests that spontaneous rotation is a potential tool for plasma profile control in reactor plasmas. The experimental results and corresponding gyrokinetic study will be presented.

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