Intrinsic Plasma Rotation in C-Mod Internal Transport Barriers

C. L. Fiore[*], D. R. Ernst[*], J. E. Rice[*], Y. Podpaly[*], M. L. Reinke[*], M. J. Greenwald[*], J. W. Hughes[*], Y. Ma[*], I. O. Bespamyatnov[†], W. L. Rowan[†]
[*] MIT-PSFC, [†]FRC-UT Austin

Internal transport barriers in Alcator C-Mod featuring highly peaked density and pressure profiles are typically induced by the introduction of radio frequency power in the ion cyclotron range of frequencies (ICRF) with the second harmonic of the resonant frequency for minority hydrogen ions positioned off-axis at the plasma half radius on either the low or high field side of the plasma. These ITBs are formed in the absence of particle or momentum injection, and with monotonic q profiles with $q_{min} < 1$ and allow exploration of internal barrier dynamics in a reactor relevant regime. In C-Mod, a strong co-current toroidal rotation, peaked on axis, develops after the transition to H-mode in all cases. With off-axis ICRF heating, this rotation decreases in the center of the plasma and forms a well, which if strong enough, appears to lead to the development of an ITB. In cases with an ITB, the core rotation often reverses direction. A strong EXB shearing rate is observed in the region where the foot in the ITB density profile appears. Gyrokinetic analyses indicate that this shearing rate is comparable to the ion temperature gradient mode (ITG) growth rate at this location and may be responsible for stabilizing the turbulence. Earlier studies of ITBs in C-Mod suggested that decreasing R/L_{Ti} with off-axis ICRF was important in reducing the drive for the ITG turbulence and the resulting particle transport, allowing the neoclassical pinch to peak the pressure on axis. Recent experimental ion temperature and rotation data obtained from a complete scan of the ICRF resonance position across the entire C-Mod plasma will allow examination of the roles of these mechanisms in the formation of the ITB.

Work supported by US-DoE DE-FC02-99ER54512 and DE-FG03-96ER54373