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Effects of the q Profile on Toroidal Rotation in Alcator C-Mod LHCD Plasmas

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In future magnetic fusion devices, external momentum input from neutral beam injection will be low, and to reap the benefits of rotation, such as stabilization of deleterious MHD modes and shear suppression of turbulence, utilizing radio frequency drive and understanding self-generated flow would be prudent. Changes in the core toroidal rotation profiles following injection of lower hybrid (LH) waves have been documented in Alcator C-Mod plasmas. Shot by shot scans of LH input power have been performed at fixed magnetic field and electron density for several plasma currents. For sawtoothed target plasmas, if the input power is low enough that the central safety factor q_0 remains below 1, the change in the core rotation is in the counter-current direction, consistent in sign, magnitude and LH power scaling with direct momentum input from the LH waves. If the power level is high enough that there are significant changes to the q profile, including the termination of sawtooth oscillations, the change in the toroidal rotation is in the co-current direction, consistent with changes in sign of the momentum flux through the residual stress and its dependence on the current density profile. The direction of the rotation changes depends on whether q_0 is below or above unity, and seemingly not on the magnetic shear, nor the Ohmic confinement regime of the target plasma.

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