Comparison of Measured Impurity Poloidal Rotation in DIII-D with Neoclassical Predictions under Low Toroidal Field Conditions

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Abstract. Predictive understanding of plasma transport is a long-term goal of fusion research. This requires testing models of plasma rotation including poloidal rotation. The present experiment was motivated by recent poloidal rotation measurements on spherical tokamaks (NSTX and MAST) which showed that the poloidal rotation of C^{+6} is much closer to the neoclassical prediction than reported results in larger aspect ratio machines such as TFTR, DIII-D, JT-60U and JET working at significantly higher toroidal field and ion temperature. We investigated whether the difference in aspect ratio (1.44 on NSTX versus 2.7 on DIII-D) could explain this. We measured C^{+6} poloidal rotation in DIII-D under conditions which matched, as best possible, those in the NSTX experiment; we matched plasma current (0.65 MA), on-axis toroidal field (0.55T), minor radius (0.6 m), and outer flux surface shape as well as the density and temperature profiles. DIII-D results from this work also show reasonable agreement with neoclassical theory. Accordingly, the different aspect ratio does not explain the previously mentioned difference in poloidal rotation results.

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