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Neoclassical toroidal rotation in a tokamak plasma. RICHARD KING, WESTON STACEY, Georgia Institute of Technology — Rotation is important in tokamaks because of its effects on confinement and stability. This work evaluates the effectiveness of neoclassical gyroviscous theory in determining the toroidal rotation magnitude and profile in tokamak plasmas, by comparison with DIII-D experiment. We find that when the poloidal dependence, upon which the gyroviscosity depends, is adequately represented, the toroidal rotation is over-predicted to within only a factor of two or less of measured values. In order to make this evaluation, a numerical method for predicting with high accuracy the two-dimensional rotation and density profiles of a multiple species plasma was developed. We developed a conforming spectral Galerkin strategy using a streamline potential decomposition of the velocity. In this method, the velocities and densities are expanded poloidally in a Fourier series and radially in Bessel functions. Our results show promise for this approach and suggest that resulting two-dimensional neoclassical calculations of toroidal rotation may be within a factor of two of experimental values.

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