ITER predictions using the GYRO verified and experimentally validated TGLF transport model

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Abstract. The trapped gyro-Landau fluid (TGLF) transport model computes the quasi-linear particle and energy driftwave fluxes in tokamaks with shaped geometry, finite aspect ratio, and collisions. The TGLF particle and energy fluxes have been successfully *verified* against a large database of collisionless nonlinear gyrokinetic simulations using the GYRO code. Using a new collision model in TGLF, we find remarkable agreement between the TGLF quasi-linear fluxes and 64 new GYRO nonlinear simulations with electron-ion collisions. In validating TGLF against DIII-D and JET H-mode and hybrid discharges we find the temperature and density profiles are in excellent agreement with the measured profiles. ITER projections using TGLF show that the fusion gains are somewhat more pessimistic than the previous GLF23 results primarily due to finite aspect ratio effects included only in TGLF. The synergistic effects of density peaking, finite β, and $E \times B$ shear due to finite toroidal rotation lead to significant increases in fusion power above a reduced physics ITER base case. The TGLF results for ITER are confirmed using nonlinear GYRO simulations in place of TGLF to predict the temperature profiles within the TGYRO transport code.

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