Predictions of the Near Edge Transport Shortfall in DIII-D L-mode Plasmas Using the TGLF Model

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Abstract

Previous studies of DIII-D L-mode plasmas have shown that a transport shortfall exists in that our current models of turbulent transport can significantly underestimate the energy transport in the near edge region. In this paper, the Trapped Gyro-Landau-Fluid (TGLF) drift wave transport model is used to simulate the near edge transport in a DIII-D L-mode experiment designed to explore the impact of varying the safety factor on the shortfall. We find that the shortfall systematically increases with increasing safety factor and is more pronounced for the electrons than for the ions. Within the shortfall dataset, a single high current case has been found where no transport shortfall is predicted. Reduced neutral beam injection power has been identified as the key parameter separating this discharge from other discharges exhibiting a shortfall. Further analysis shows that the energy transport in the L-mode near edge region is not stiff according to TGLF. Unlike the H-mode core region, the predicted temperature profiles are relatively more responsive to changes in auxiliary heating power. In testing the fidelity of TGLF for the near edge region we find that a recalibration of the collision model is warranted. A recalibration improves agreement between TGLF and nonlinear gyrokinetic simulations performed using the GYRO code with electron-ion collisions. The recalibration only slightly impacts the predicted shortfall.

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