Cross-Machine Validation of TGLF and GENE on Alcator C-Mod and ASDEX Upgrade

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A cross machine validation study of the turbulent transport code TGLF [1] is performed with experimental data from Alcator C-Mod and ASDEX Upgrade. As validation of gyrokinetic and gyro-fluid codes becomes more widespread, the importance of validating these codes across machines becomes increasingly evident, with the ultimate goal of building confidence in predictions for future machines. In particular, cases for which ion-scale models robustly under-predict electron heat transport have been identified on Alcator C-Mod, requiring multi-scale effects to achieve agreement [2], but previously had not been identified on ASDEX Upgrade. Recent work has also shown that rigorous validation requires comparison of many experimental parameters to simulations, not only heat fluxes [3, 4]. This study therefore compares experimental electron and ion heat fluxes, electron temperature fluctuations (measured with CECE), and perturbative thermal diffusivity (measured with partial sawtooth heat pulses [5]) from more than 10 L-mode discharges on Alcator C-Mod and ASDEX Upgrade to the outputs of both ion-scale and multi-scale TGLF simulations, run within the VITALS framework [6]. A few cases are also compared with the gyrokinetic code GENE [7]. Results to date show good agreement between experiment and multi-scale TGLF on most discharges from both devices, but disagreement with ion-scale TGLF in some cases on both devices, though the disagreement is more prevalent on Alcator C-Mod. The dominant turbulent mode at low wavenumber may, in part, differentiate these cases.

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