Characterizing turbulent transport in ASDEX Upgrade L-mode plasmas via nonlinear gyrokinetic simulations

D. Told, F. Jenko, T. Görler, F. J. Casson, E. Fable, and the ASDEX Upgrade Team

Max-Planck-Institut für Plasmaphysik, Garching D-85748, Germany

E-Mail: dtold@ipp.mpg.de

The nature and level of turbulent transport in the outer core of L-mode discharges performed at the ASDEX Upgrade tokamak [1] are examined. Previously, it was found that for an L-mode discharge of the DIII-D tokamak [2] gyrokinetic simulations were unable to reproduce the experimental ion heat flux, underestimating it by almost an order of magnitude [3]. Employing the GENE gyrokinetic turbulence code [4,5], an extensive nonlinear study has been performed for L-mode discharges of ASDEX Upgrade in order to cross-check this observation. It is shown that no systematic underprediction can be found in these simulations—instead, discrepancies with respect to experimental transport levels are small enough to be resolved within the uncertainties of the experimental profiles. In addition, the applicability of quasilinear models to such plasmas is tested by comparing various properties of the satured turbulent state to those of the underlying linear microinstabilities, and good agreement is found at least up to 90% of the minor radius. Quasilinear transport models should thus, in principle, remain applicable even for such parameters, provided that their nonlinear saturation models are appropriately generalized. Further activities targeting L-mode plasmas in other machines are discussed in order to complement and extend the ASDEX Upgrade results.

---

[1] A. Kallenbach et al., Nucl. Fusion 51, 094012 (2011)

[2] J. L. Luxon and L. G. Davis, Fusion Technol. 8, 441 (1985)

[3] C. Holland et al., Phys. Plasmas 16, 052301 (2009)

[4] F. Jenko et al., Phys. Plasmas 7, 1904 (2000).

[5] T. Görler et al., J. Comput. Phys. 230, 7053 (2011).