

P1.1038 Turbulence in open field-line helical plasmas: Fluid v. gyrokinetic

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See the full abstract here:

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Helical magnetic field devices, such as the Helimak (University of Texas) and TORPEX (EPFL), provide a useful environment for refining our understanding of open fieldline toroidal systems and testing both new and old codes. These devices have important ingredients of tokamak scrape-off-layer turbulence: parallel transport onto sheaths, turbulent cross-field transport, curvature and ∇B drifts, and interaction with plasma-facing materials. The Helimak has been simulated using full-f fluid models for many years [1], and despite the simplified geometry and relatively high collisionality of its plasmas, predictive capability is still unattained and interesting open questions remain. We direct newer tools to these longstanding objectives. The two-fluid turbulence code GDB [2] and the continuum gyrokinetic code Gkeyll [3] have both been employed to simulate low ion temperature Helimak plasmas. In this work we offer complementary descriptions of the blobby, interchange and drift-resistive fluctuations existing in the Helimak. A first of its kind comparison between fluid and gyrokinetic turbulence calculations in open field lines is presented, as well as the experimental data for corresponding experiments. This dual GDB-Gkeyll analysis offers insight into what additional kinetic effects, if any, can be discerned in a low temperature plasma. By comparing against GDB we also identify improvements to the gyrokinetic model in order to converge to correct collisional results, an important aspect of tokamak modeling already underway with Gkeyll [4].

[1] B. Li, et. al., Phys. Plasmas 16, 082510 (2009).

[2] B. Zhu, et al., Comp. Phys. Comm. 232, 4658 (2017).

[3] T. Bernard, et. al., Gyrokinetic continuum simulations of plasma turbulence in the Texas Helimak, submitted to Phys. Plasmas (arXiv:1812.05703).

[4] E. L. Shi, et. al., Phys. Plasmas 26, 012307 (2019).

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