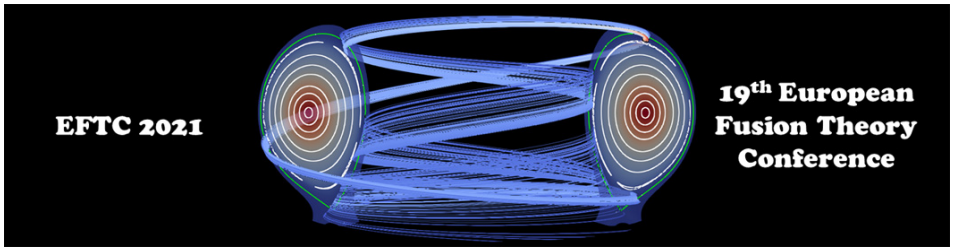

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A non-twisting flux tube for local gyrokinetic simulations

Monday, 11 October 2021 14:30 (30 minutes)

Local gyrokinetic simulations use a field-aligned domain that twists due to the magnetic shear of the background magnetic equilibrium. However, if the magnetic shear is strong and/or the domain is long, the twist can become so extreme that it fails to properly resolve the turbulence. In this work, we derive and implement the non-twisting flux tube, a local simulation domain that remains rectangular at all parallel locations. Convergence and run time tests indicate that it can calculate the heat flux more efficiently than the conventional flux tube. For one test case, it was 30 times less computationally expensive and we found no case for which it was more expensive. It is most advantageous when the magnetic shear is high and the domain includes at least two regions of turbulent drive, which makes it potentially useful for pedestal simulations, stellarator simulations, and tokamak simulations with several poloidal turns. It also more accurately models the inboard midplane when the magnetic shear is large. Additionally, we show how the non-twisting flux tube can be generalized to allow further optimization and control of the simulation domain. Lastly, we will explore the possibility of using the non-twisting flux tube to elegantly and efficiently include arbitrary radial variation in the safety factor profile, thereby blurring the distinction between local and global simulations.

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