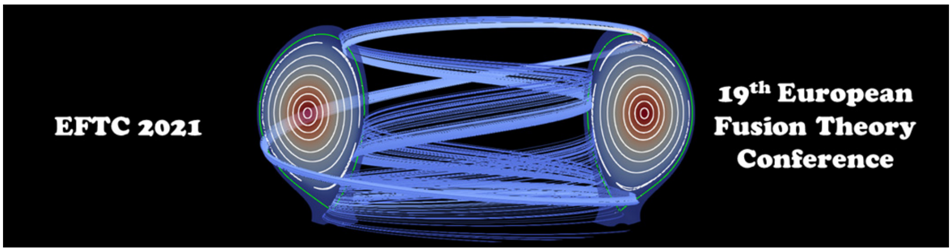


Contribution ID: **70** Type: **Invited**

# Spectrally accurate global-local gyrokinetic simulations of turbulence in tokamak plasmas

*Thursday 14 October 2021 11:40 (30 minutes)*

The suppression of turbulence in fusion plasmas, crucial to the success of next-generation tokamaks such as ITER, depends on a variety of physical mechanisms including the shearing of turbulent eddies via zonal flow and possibly the generation of intrinsic rotation. The turbulence exhibits interesting features such as avalanche structures and self-organisation, and its absence is associated with the formation of internal transport barriers. In order to successfully capture all of these effects in gyrokinetic simulation, one may need to allow for the inclusion of global effects (such as radial profile variation), as well as other often-neglected effects that are small in rho. *A careful numerical treatment is necessary to ensure that both the global and local physics are calculated accurately at reasonable expense. To that end, we develop a novel approach to gyrokinetics where multiple flux-tube simulations are coupled together in a way that consistently incorporates global profile variation while allowing the use of Fourier basis functions, thus retaining spectral accuracy. By doing so, the need for Dirichlet boundary conditions typically employed in global gyrokinetic simulation, where fluctuations are nullified at the simulation boundaries, is obviated. This results in a smooth convergence to the local periodic limit as rho* -> 0. In addition, our scale-separated approach allows the use of transport-averaged sources and sinks, offering a more physically motivated alternative to the standard sources based on Krook-type operators. Having implemented this approach in the flux-tube code stella, we study the role of transport barriers and avalanche formation in the transition region between the quiescent core and the turbulent pedestal, as well as the efficacy of intrinsic momentum generation by radial profile variation. Finally, we show that near-marginal plasmas can exhibit a radially localized Dimits shift, where strong coherent zonal flows give way to flows which are more turbulent and smaller scale.

**Author:** ST-ONGE, Denis (University of Oxford)

**Presenter:** ST-ONGE, Denis (University of Oxford)

**Session Classification:** ORAL SESSION

**Track Classification:** 3. Plasma confinement, neoclassical and turbulent plasma transport