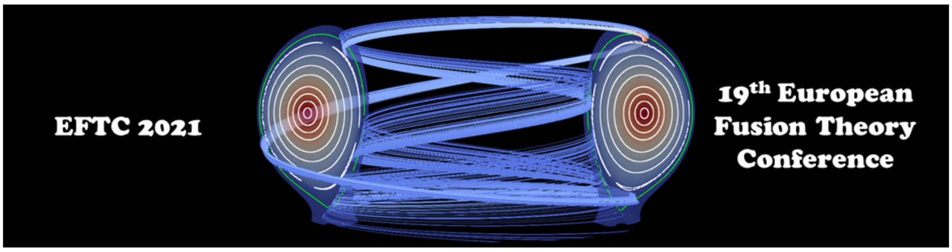

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Electrostatic gyrokinetic simulations in Wendelstein 7-X geometry: benchmark between the codes stella and GENE

Content

Experimental results in the first campaigns [1,2] of Wendelstein 7-X (W7-X) have shown that, due to the optimization of the magnetic configuration with respect to neoclassical transport, turbulence is essential to understand and predict the total particle and energy fluxes. This has motivated much work on gyrokinetic modelling in order to interpret the already available experimental results and to prepare the next experimental campaigns. Thus, it is desirable to have a sufficiently complete, documented and well-verified set of linear and nonlinear gyrokinetic simulations in W7-X geometry against which new codes or upgrades of existing codes can be tested and benchmarked. This work is an attempt to provide such a set of simulations through a comprehensive benchmark between the recently developed code stella [3] and the well-established code GENE [4] in W7-X geometry. It consists of linear and nonlinear collisionless electrostatic flux-tube simulations, organized into five different 'tests'. They include stability analyses of linear ITGs and density-gradient-driven TEMs, computation of the collisionless relaxation of zonal potential perturbations and calculation of ITG-driven heat fluxes. As different magnetic field lines are not equivalent in stellarator geometry, simulations in two different flux tubes are provided, clarifying the similarities and differences between the stability features in both of them.

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Primary author: GONZÁLEZ-JEREZ, Antonio (CIEMAT)

Co-authors: XANTHOPOULOS, Pavlos (Max Planck Institute); GARCÍA-REGAÑA, José Manuel (CIEMAT); CALVO, Iván; ALCUSÓN, Jorge (Max Planck Institute); BAÑÓN-NAVARRO, Alejandro (Max Planck Institute); BARNES, Michael (Rudolf Peierls Centre for Theoretical Physics); PARRA, Felix I (Rudolf Peierls Centre for Theoretical Physics, University of Oxford); GEIGER, Joachim (Max Planck Institute)

Presenter: GONZÁLEZ-JEREZ, Antonio (CIEMAT)

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