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Turbulence in fusion and astrophysical plasmas: Grid-based gyrokinetics on exascale systems with GENE[1] GABRIELE MERLO, University of Texas at Austin, FRANK JENKO, University of Texas at Austin; Max-Planck Institute for Plasma Physics, BRYCE ALLEN, University of Chicago, ALEJANDRO BANON NAVARRO, Max-Planck Institute for Plasma Physics, TILMAN DANNERT, Computing Centre of the Max-Planck Society and the Max-Planck Institute for Plasma Physics, DENIS JAREMA, DANIEL TOLD, Max-Planck Institute for Plasma Physics — It is widely recognized that turbulence is an important and exciting frontier topic of both basic and applied plasma physics - as well as of many neighboring fields of science. Numerous aspects of this paradigmatic example of nonlinear multiscale dynamics remain to be better understood. Meanwhile, for both laboratory and natural plasmas, an impressive combination of new experimental and observational data and new computational capabilities have and will become available. Thus, we are facing a unique window of opportunity to push the boundaries of our grasp of plasma turbulence. In this context, a main goal is to further unravel its crucial role in phenomena like cross-field transport of mass, momentum, and heat, particle acceleration and propagation, and plasma heating. Future challenges and opportunities in this vibrant area of research - on the brink of the exascale era - will be described, with a focus on the grid-based gyrokinetic turbulence code GENE.

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Gabriele Merlo
University of Texas at Austin

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