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Dynamo in the Taylor-Green vortex: Direct numerical simulations and modeling of MHD flows ANNICK POUQUET, NCAR, PABLO MININNI, NCAR, DAVID MONTGOMERY, Dartmouth, JEAN-FRANCOIS PINTON, ENS-Lyon, HELENE POLITANO, OCA, YANNICK PONTY, OCA — Direct numerical simulations (DNS) and Lagragian-averaged model runs (LAMHD) of three-dimensional magnetohydrodynamic turbulence are presented. The model allows for a significant reduction of computer resources at given Reynolds numbers. It correctly reproduces the growth rate of magnetic energy and captures the nonlinear saturation level; intermittency is recovered as well. Low magnetic Prandlt number dynamos are then explored combining DNS, LAMHD and Large-Eddy Simulations. The flow is forced with a Taylor-Green non-helical vortex with a well-defined structure at large scales and strong turbulent fluctuations. Dynamos are observed down to the lowest PM=0.01 that can be modeled accurately for this flow; the critical magnetic Reynolds number increases sharply with PM as turbulence sets in and then saturates; in the linear phase, the most unstable magnetic modes move to small scales as PM is decreased; a Kazantsev 3/2 spectrum develops with strong non-local nonlinear transfer; then the dynamo grows at large scales and modifies the turbulent velocity fluctuations. Other forcing including Beltrami flows are found to behave in a similar fashion.

Annick Pouquet
NCAR

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