Abstract Submitted
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Low magnetic Prandtl number dynamos DAVID MONTGOMERY[1], Dartmouth College, PABLO MININNI[2], NCAR — Dynamo amplification by velocity fields in conducting fluids can be highly varied. Here [1] we study dynamos numerically in one of the most efficient flows found for exciting dynamo fields at low magnetic Reynolds numbers: "Roberts flow," in which the large scales are driven helically in 3D periodic boundary conditions. Three qualitatively distinct regimes are identified, depending upon mechanical Reynolds number: steady-state laminar flow, mildly unstable periodic hydrodynamic flow, and fully turbulent hydrodynamic flow. A critical magnetic Reynolds number for dynamo amplification can be identified in all three regimes, and it plateaus as the inverse magnetic Prandtl number increases (paralleling earlier results for the "Taylor-Green vortex" flow). It is over five times higher in the turbulent velocity field regime than it is for the time-averaged flow for that turbulent velocity field. Explorations are carried out both in the linear ("kinematic dynamo") and nonlinear regimes of incompressible MHD. Periodic boundary conditions appear as an undesirable limitation and we are attempting to dispense with them by a spectral method in which the fields are expanded in Chandrasekhar-Kendall spherical eigenfunctions of the curl. [1] P.D. Mininni and D.C. Montgomery, "Low magnetic Prandtl number dynamos with helical forcing," submitted to Phys. Rev. E (2005). Arxiv: physics/0505192.

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