Numerical Study of Homogeneous Turbulence for Varying Magnetic Prandtl Number

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This poster outlines a plan and a rough schedule for the preparation and fullfilment of my MSc dissertation project. It is, of course, subject to change.

Project Description

The goal of the research is to study magnetohydrodynamic turbulence by maintaining a constant magnetic Prandtl number (Pr_M) and varying its defining parameters - Reynolds number (Re) and magnetic Reynolds number (Re_M). Doing this over a range of Pr_M it is possible to compare the results to previous findings ([1] for example). If time allows it, a study on the use of high-k forcing to inject helicity to a similar system and compare with the varying Pr_M results will be also performed.

Methodology

In order to perform the numerical calculations, the use of High Performance Computing hardware (ARCHER or eddie), will be required since the code that will be used relies heavily on parallelisation - Message Passing Interface (MPI) must be learnt to do so. To obtain the desired data a pseudospectral code which simulates a cubic box of N^3 grid points with periodic boundary conditions will be used. The output data can be analysed and compared with existing literature.

Report Structure

The report for the MSc dissertation project will include an introduction to the field of magnetohydrodynamics and to the methods required for the numerical calculations that were preformed. Benchmarking procedures to ensure the numerical calculations accurately reproduce previous results will also be included. Finally, an analysis of the performed computations will be included and commented on.

Task	Start	End
Theory review	June 1	June 10
Existing code review and learning MPI	June 10	June 24
Data acquisition	June 24	July 15
Data analysis and comparison to literature	July 15	July 31
Write report	August 1	August 14
Presentation preparation	August 14	August 16
*Weekly/Biweekly meetings		

[1] Brandenburg, A. (2014). Magnetic Prandtl number dependence of the kinetic-to-magnetic dissipation ratio. The Astrophysical Journal, 791(1), 12. Chicago