Magnetohydrodynamic modelling of waves in the suns atmosphere

A Data Management Plan created using DMPonline

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Project abstract:

The research I will carry out during my PhD studies focuses on the problem of phase mixing in partially ionised plasmas. It is well known that the existence of transverse gradients in the wave speed (or magnetic field) leads to the formation of large spatial gradients through the process of phase mixing. In a simple geometry with a straight, uniform magnetic field and a nonuniform density profile, Heyvaerts \& Priest (1983) showed that the heating rate is inversely proportional to the cube root of the magnetic Reynolds number. However, subsequent studies have highlighted that this does not provide an adequate enhancement in the heating rate to balance radiative losses unless artificially large dissipation coefficients are implemented (e.g. Cargill et al. 2016; Pagano \& De Moortel 2017; Prokopyszyn \& Hood 2019). The plasma in the lower solar atmosphere (photosphere and chromosphere) has a temperature where the plasma is not completely ionised, meaning that at all times the solar atmosphere is made of a mixture of ionised and neutral particles that interact with each other via short and long-range collisions. In these plasmas the ambipolar diffusion (thanks to the disassociation of charged particles via collisions) is several orders of magnitude larger than the normal Cowling resistivity, large enough to explain the radiative loss of the chromosphere. The problem of phase mixing in partially ionised plasmas will be investigated in single and two-fluid models, depending whether the frequencies

involved in dynamics are comparable or not with the collisional frequency between ions and neutrals. Furthermore, I will investigate the efficiency of phase mixing in terms of the composition of the plasma (degree of ionisation) and on the strength of collisional coupling between particles. Finally, the last topic of my research will be the analysis of phase mixing in partially ionised plasma, when the effect of a component-differentiated background equilibrium flow is taken into account.

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Copyright information:

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Data types

Specify the types of data the research will generate.

The research will not generate data

Data preservation

Specify which data will be preserved and how.

Not applicable.

Specify the software and metadata implications.

I will use Jupyter notebooks to run python scripts, but these won't involve data sets

Specify for how long the data will be preserved.

Not applicable.

Data sharing

Specify and justify which data will have value to others and should be shared.

Not applicable.

Specify and justify the length of any proprietary period.

Not applicable

Specify how data will be shared

Not applicable.

Resources

Specify and justify any resources required to preserve and share the data.

Not applicable.