

PhD proposal draft

August 2020

1 Exo-planet atmospheres

1.1 Please describe your proposed project, including the basic research question(s) you seek to address, and your research approaches/methodologies:

There is an abundance of exoplanets in our universe (we have currently only observed 4000) and the study of exoplanets has become a very active area of research as strikingly different planets to the ones in our solar system could be observed and studied. The alien atmospheres of these planets are of particular interest as exoplanetary properties such as mass, radii and orbital dynamics can be learnt from a planets atmosphere. A large variety of complex physical and chemical processes occur in these exoplanetary atmospheres such as electric currents, super-sonic winds and radiation which can be better understood by learning about a planets atmosphere. A very popular research topic is currently finding possible signs of life on exoplanets which is heavily reliant on the understanding of a planets atmosphere.

This research will have a focus on modelling the occurrence and stability of atmospheric jets on exoplanets. Atmospheric jets are usually the largest structures in an atmosphere and therefore learning the dynamics of jets aids vastly in understanding a planets atmosphere.

Tools from mathematics, statistics and physics will be used to model the jets. A stochastically forced governing equation of fluid motion will be analysed numerically using time-scale separation between the fast and slow variables in the system. Transitions states and transition probabilities can then be computed for various jet configurations.

1.2 Please describe the relevance of the project to your external (non-university) partner organisation, and how this project provides a route to real-world impact

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1.3 In relation to EPSRC objectives

1.3.1 The context of the research:

1.3.2 The aims and objectives of the research:

1.3.3 The novelty of the research methodology (if any):

1.3.4 The potential impact, applications, and benefits:

1.3.5 How the research relates to the EPSRC remit:

2 Plasma

2.1 Please describe your proposed project, including the basic research question(s) you seek to address, and your research approaches/methodologies:

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2.3 In relation to EPSRC objectives

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