PROJECT TITLE: Probing mantle dynamics with seismic anisotropy

DTP Research Theme(s): Dynamic Earth

Lead Institution: Bristol University

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Project keywords: Seismology, seismic anisotropy, mantle dynamics, mineralogy

Project Background

The dynamic behaviour of our planet is ultimately driven by the convection of its interior. While we can connect the pattern of mantle downwelling to subduction at destructive plate margins, the style of upwelling away from plate boundaries remains enigmatic. Upwelling links the deep mantle to the surface and regulates Earth’s outgassing, a fundamental control on the atmosphere and habitability. Large magmatic outpourings are an extreme manifestation of upwelling, and these have been related to major geological events such as supercontinent breakup and mass extinction. Upwellings are fundamentally controlled by the deep mantle, and in order to understand them we need a holistic understanding of mantle circulation. Geodynamic models are capable of simulating mantle convection for realistic mineralogies, but observations are required to test the vast range of potential models. Alongside constraints from geochemistry and geomagnetism, seismology provides a view into the otherwise inaccessible mantle depths. In particular, seismic anisotropy provides a means of assessing dynamics and flow in the deep Earth.

Project Aims and Methods

Bristol and Cardiff are part of a recently-funded NERC Consortium (MC2) to build a new generation of geodynamic models of mantle, constrained by a range of observations both at the surface and at depth. This PhD project will work alongside the MC2 project to provide complementary observations and models, and to capitalise on opportunities arising. The student will benefit from joining a multi-disciplinary (geophysics, tectonics, mineral physics), multi-institutional community, joining a significant cohort of PhD students and PDRAs working on related problems around a central concept, both in Bristol and Cardiff and in other partner institutes. The PhD project aims centre on the use of seismic anisotropy to help constrain dynamic mantle convection models, but there is significant scope for flexibility depending on the interests of the student, offering the chance for focussing on different aspects of this (for example, observational seismology, forward waveform modelling, links with geodynamics and mineral physics and development of analysis techniques).
Candidate requirements
This project would suit a candidate with a strong physics and/or mathematics background. Some geophysics knowledge would be advantageous, as would experience with programming (especially in a scientific context), numerical methods and scientific computing.
We welcome and encourage student applications from under-represented groups, and value a diverse research environment.

Training
The student will gain an advance skillset in the forward modelling and processing of seismic data for global geophysical applications. This is a highly transferrable skill, with parallels in industrial geophysics and signal processing for many applications. The student will also gain a broad range of knowledge of deep Earth geophysics more generally. On the technical side, the student will also get valuable experience with numerical methods and software development, especially in high-performance computing environments (such as the national supercomputer, ARCHER2). The student will also have access to a very wide range of University and DTP provisioned courses which will further enhance research and transferable skills. The student would be expected to attend at least one large international conference, and one international workshop, as well as visiting expert colleagues in the UK.

Background reading and references

Useful links
http://www.bristol.ac.uk/earthsciences/courses/postgraduate/

Bristol NERC GW4+ DTP Prospectus:
https://www.bristol.ac.uk/study/postgraduate/research/great-western-four-doctoral-training-partnership-nerc/

How to apply to the University of Bristol:
http://www.bristol.ac.uk/study/postgraduate/apply/

Please note: If you wish to apply for more than one project please contact the Bristol NERC GW4+ DTP Administrator to find out the process for doing this.

The application deadline is Tuesday 9 January 2024 at 2359 GMT. Interviews will take place from 26 February to 8 March 2024.

For more information about the NERC GW4+ Doctoral Training Partnership please visit
https://www.nercgw4plus.ac.uk

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