Refining Empirical Constraints on the Transport Properties of Earth's Core

R. STEWART MCWILLIAMS[1*], NATALIA GÓMEZ-PÉREZ[1], ZUZANA KONÔPKOVÁ[2], ALEXANDER F. GONCHAROV[3]

[1] School of Physics and Astronomy and Centre for Science at Extreme Conditions, University of Edinburgh, Peter Guthrie Tait Road, Edinburgh, UK EH9 3FD
[2] DESY Photon Science, Notkestrasse 85, DE-22607 Hamburg, Germany
[3] Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Road NW, Washington DC, 20015, USA
[*] rs.mcwilliams@ed.ac.uk

Ongoing measurements – including recent high pressure-temperature measurements in the laser-heated diamond anvil cell (Konopkova et al. and Ohta et al., Nature, 2016) – are dramatically improving the direct constraints on thermal and electrical conduction in iron and its alloys at Earth's core conditions. Such constraints are essential for assessing the operating conditions of Earth's geodynamo, evaluating the sources of dynamo energy, and relating core dynamics to Earth's thermal and geochemical evolution. However, a consistent empirical picture for transport in the core has yet to emerge, and significant discrepancies with theory and between experimental approaches remain to be resolved. We will discuss the nature of these conflicts, and review available transport measurements on core materials in this context. Recent measurements will be examined using detailed finite element models of experiments to assess sources of systematic error and develop strategies for improving measurements. We will also compare the empirical picture to theoretical expectations.