

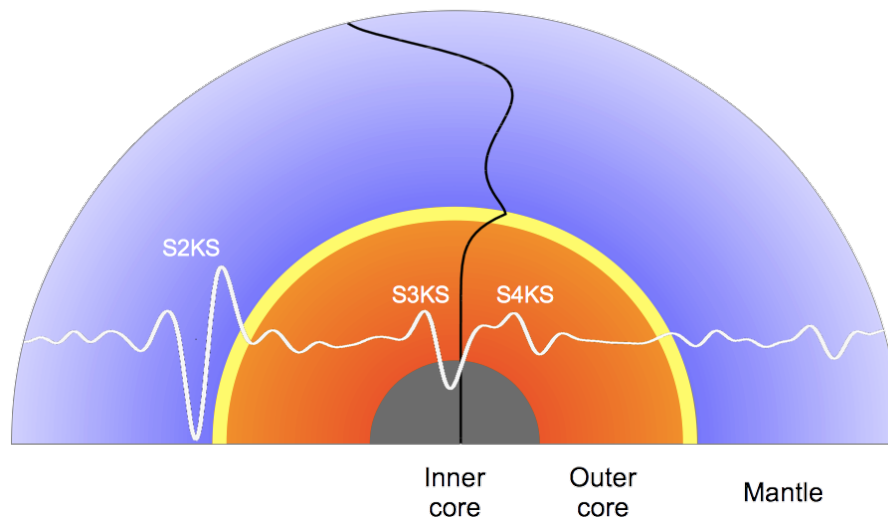
Multi-method investigations of Earth's outer core

Jessica Irving, *Princeton University*; Sanne Cottaar, *University of Cambridge*;
Vedran Lekić, *University of Maryland, College Park*; Wenbo Wu, *Princeton University*

The outer core, comprising an iron-nickel liquid with an unknown combination of light elements, is the most massive fluid region of the Earth. The outer core is important because it both provides heat for mantle convection, and generates Earth's magnetic field. Despite this, its physical properties are unknown, and mineral physics experiments and calculations are very challenging at the relevant high temperatures and pressures. The Preliminary Reference Earth Model (PREM), constructed using data including normal modes and which describes the velocity and density of the outer core, is more than three decades old and does not agree with some body-wave derived models.

We present our normal mode derived model EPOC (Elastic Parameters of the Outer Core) obtained using a Bayesian parameter space search. We assembled a dataset of more than 300 published normal mode frequencies, containing modes not used when Earth model PREM was built. Our model is parameterised using the coefficients of an isentropic Vinet Equation of State (EoS) which best fits the normal mode data, so that we are able to provide both mineralogical and seismic information about the outer core. As well as fitting the normal mode center frequency observations better than PREM, the EPOC model has velocities more consistent with body-wave derived models of the outer core, reconciling a longstanding seismological discrepancy.

We also compare our normal mode-derived model with the differential travel times of SmKS body waves. SmKS phases bounce (m-1) times on the underside of the core-mantle boundary and are therefore sensitive to the velocity at the top of the outer core. Our array-derived SmKS observations allow us to assess the travel time predictions made by the EPOC model.



A cross section of the Earth together with a normal mode radial displacement eigenfunction, which is sensitive to the seismic properties of the outer core (vertical black line) and a synthetic waveform containing SmKS signals (horizontal white line).