Seismic Maps of the Earth’s core

(Proposer: Prof. Lapo Boschi)

The earth’s outer core is very likely to convect relatively rapidly, and, as a result, to be very well mixed: it is often claimed, then, that it cannot possibly be seismically heterogeneous. Seismic velocity within the core is expected to change as a function of depth alone. It has occasionally been suggested, however, that lateral structure in the outer core can exist as a consequence of convection within the outer core, which could give rise to a distinct “tangent cylinder” with radius equal to that of the inner core and centered on the rotation axis. The pattern of convection is likely to be such that the tangent cylinder would exchange no or little matter with the rest of the outer core; light elements released by solidification at the inner-outer core boundary would be trapped in the tangent cylinder, differentiating it from the rest of the outer core. This could have implications for our understanding of the earth's magnetic field, as well as the interactions between the planet's mantle and core.

This idea is supported, to some extent, by seismic data, but the depth range we are talking about is so large, and the data so few and uncertain, that it has not been possible to come up with a fully convincing model. The Ph.D. candidate will work toward the identification of such a model, taking advantage of new seismic observations and recent imaging techniques, that have not yet been used to look into the deepest region of the earth. Namely, they will take advantage (i) of the growing number of broadband seismic stations that have been, and are being installed across the globe, and (ii) of new methods in seismic interferometry, allowing to “extract” meaningful data from seismic “ambient noise” (the signal recorded by seismometers in the *absence* of earthquakes). What makes this thesis project challenging and promising is that the latter, relatively new approach has not yet been applied successfully to the deep earth. Yet, recent progress in both data and methods indicates that that is finally becoming feasible.

The Ph.D. candidate will combine ambient-noise seismology with more traditional seismic imaging techniques, building on the proposer’s expertise with deep-earth tomography. They will join a growing team of seismologists and acousticians at our department, benefitting from the interaction with similarly-minded graduate students and post-doctoral fellows.

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