Linking the seismic structure of Earth's uppermost inner core to features at the inner core boundary

At over 5000 km deep, Earth's inner core is a remote and enigmatic region of our planet. Consequently its seismic structure is difficult to study. It displays complex regional variations in seismic velocity and attenuation properties, including an east-west hemispherical asymmetry and depth-dependent anisotropy. The origin of these features is currently a topic of debate. They are likely related to growth mechanisms at the inner core boundary, where material from the liquid outer core solidifies onto the inner core's surface.

Although seismology has provided increasingly detailed observations of the upper inner core and the inner core boundary, the relationship between the two regions remains unknown. This is a result of the seismic phases which are used to study the very uppermost regions beginning to overlap as depth below the boundary decreases. Here, I will discuss my observations of the inner core hemispherical structure, including sharp hemisphere boundaries which I use to infer inner core super-rotation. I will then show how the inner core boundary displays small scale regional variations. Finally, I will present a new technique to observe the very top of the inner core, using waveform modeling to distinguish the overlapping phases. This uppermost layer bridges the gap between the deeper hemispherical structure and the inner core boundary. These new observations represent a step towards reconciling inner core boundary processes with deeper structure, and subsequently understanding the dynamics of inner core solidification.