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New Constraints on the Earth's Core From Global Correlation Wavefield

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Recently, we have constructed new images of the Earth's correlation wavefield using the coda of globally recorded large earthquakes, stacking the cross-correlation of multiple pairs of waveforms. Our method revealed many of the apparent seismic phases sampling the Earth's core that have not previously been observed in either traditional earthquake seismology or previous cross-correlation studies. Some of these seismic phases are: PKPPcPPKP (KcK), PcPPKPPKPPcP (cKKc), PKIKPPKIKPPKIKP (I3), PKIKPPKIKPPKIKPPKIKP (I4) and PKIKPPKIKPPKIKPPKIKPPKIKP (I5). We proposed a principle that explains both apparent arrivals comparable to those in the regular seismic wavefield and the previously unobserved and unexplained phases. This insight into the mechanism producing Earth's correlation wavefield has far reaching implications for seismology of the Earth's core since it provides a new view of the seismic wavefield and allows efficient extraction of seismic signals that might lie below the typical noise level in conventional earthquake seismology. One such reticent signal presents the Holy Grail of global observational seismology, the PKJKP waves or shear waves through the Earth's inner core, whose unequivocal observation would provide much needed constraints on the rigidity of the Earth's inner core.