**Speaker: Dr. Anselme F.E. Borgeaud (Postdoctoral Fellow, IESAS)**

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**Title: Probing the Earth's structure using seismic waveforms**

Since the pioneering works of Aki et al. (1977), and Dziewonski et al. (1977), travel-time tomography has been successful at revealing large-scale 3-D variations in seismic wave velocities in the Earth's mantle, which can be converted into variations in temperature and composition caused by mantle convection. Recently, due to the increase of high-quality waveform data, an increasing number of studies have been using full seismic waveforms to image the Earth's internal structure, instead of using travel times only (e.g. Bozdağ et al., 2016, published the first global tomographic model using full-waveform inversion). The use of full seismic waveforms requires the exact computation of seismic wave propagation inside the 3-D Earth, which demands significantly larger computational resources than the computation of travel times, and has been made possible due to active development in computational seismology. Full seismic waveforms together with exact simulations of the seismic wavefield offer several improvements to traditional travel time studies. First, it allows to use complex seismic phases that are difficult to identify individually on seismic records, such as those resulting from interaction with internal discontinuities, e.g., in the mantle transition zone (Borgeaud et al., 2019), or in the D'' layer at the bottom of the Earth's mantle (Borgeaud et al., 2017). Second, it allows to increase the robustness of structural parameters that are difficult to constrain using ray theory, such as seismic attenuation (Borgeaud and Deschamps, submitted), or seismic anisotropy (Borgeaud et al., 2016). In this talk, I will show how seismic waveforms, together with exact simulation of the seismic wavefield can be used to increase the resolution and robustness of 3-D models of the Earth's interior, and present applications of waveform inversion to the Earth's mantle transition zone and lowermost mantle. I will also show current developments in probabilistic waveform tomography, which allows to objectively quantify uncertainties in tomographic models and is crucial for robust interpretations in terms of temperature and composition of the Earth's mantle.