

Novel optical tools for quantitative measurements of physical properties in diamond anvil cells

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Physical properties at high pressure are of special interest in geophysics. This is because the properties of Earth's mantle and core largely determine the rate and efficiency of all important geological process operating in the deep interior. However, experimental constraints of the relevant physical properties at high pressure and temperature conditions often pose a great challenge due to the miniscule sample volume available for probing. To overcome this challenge, my colleagues and I are developing a suite of spectroscopic methods that use an ultra-bright white laser as a probe for diverse physical properties of the mantle and core. In novel spectroscopic experiments performed at high pressure and temperature we strive to better constrain the thermal and electrical conductivity of the Earth's mantle and core as well as the density, viscosity, and chemical speciation of silicate melts. In my seminar, I will showcase the spectroscopic studies of the deep Earth that are made possible by white-laser spectroscopy. Our future results may provide critical input for (1) quantifying water delivery to the transition zone, (2) clarifying the thermal conductivity at the base of the mantle and in the core, (3) modeling properties and chemical speciation of the magma ocean.