Acquisition of an Impulsive Stimulated Light Scattering (ISLS) system for elasticity and thermal conductivity studies

Elasticity and thermal conductivity of planetary materials are among the most fundamental parameters that govern how seismic waves travel and how heat is exchanged in the interior of the Earth. In order to investigate these properties of planetary materials at relevant pressure-temperature conditions of the deep Earth, an Impulsive Stimulated Light Scattering system will be established and integrated with high-pressure diamond anvil cells for *in situ* measurements with variation of pressure, temperature, and composition in the Mineral Physics Laboratory at the Department of Geological Sciences, the University of Texas at Austin. This spectroscopic technique has long been an essential tool for studying elasticity and thermal diffusivity in materials sciences and condensed matter physics, and its potentials will be fully exploited in earth science research through this instrumentation acquisition. These studies will improve our understanding of deep-Earth seismic and geodynamic structures and chemical compositions through new knowledge of elastic and transport properties of planetary materials under extreme environments. Interpretation of deep-Earth seismic structures requires knowledge of the elastic properties of component materials, whereas thermal conductivity plays an essential role in understanding the dynamic processes in the deep Earth. It is therefore a primary goal of the mineral physics research to ascertain the sound velocities and thermal conductivities of planetary materials under relevant conditions.

Results from studies under this acquisition will thus broadly impact the fields of geophysics and geodynamics because new aspects of elastic and thermal conductivity information are needed to model satisfactorily the seismic, mineralogical, and geodynamic behavior of the deep Earth. Additionally, the system is well suited to study liquids, which are of great importance to the understanding of the properties of volatiles, CO_2 sequestration, and other hydrothermal activities relevant to shallower depth of the crust. Under the initiatives of the project, students and postdoctoral researchers will have unique research opportunities to use the advanced laser spectroscopic technique to obtain laboratory results needed to decipher seismic and geochemical observations of the planet's interior. This will contribute to the education of the next generation of independent researchers with a thorough knowledge of the Earth's deep interior. Outreach activities in this award focus on exposing K-12^{th} graders to deep-Earth research by involving in the outreach summer programs. Results from this award will be disseminated broadly through teaching, seminars, conferences, and peer-reviewed publications.