

NSF Award: EAR-IF 0651173
PI: Steven D. Jacobsen, Northwestern University
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Abstract

This award supports the acquisition of a digitizing oscilloscope for the Mineral Physics Laboratory in the Department of Earth and Planetary Sciences at Northwestern University. The multi-channel broadband (20-GHz) oscilloscope is capable of capturing and analyzing high-speed acoustic waveforms emitted from an ultrasonic interferometer, recently developed to determine the elastic properties of Earth and planetary materials in diamond-anvil cells at ultra-high P-T conditions (>300 km depth). The elastic properties of minerals govern the velocity of seismic waves in the Earth's mantle. Laboratory-derived elasticity data are applied in solid-Earth geophysics to interpret the observed seismic structure of the mantle in terms of constituent mineralogy and compositional variability. Recent science in the GHz-ultrasonic laboratory has focused on quantifying the effects of hydrogen impurities (water) on the elastic properties of high-pressure mantle minerals in order to test new models of a deep-Earth water cycle. The GHz-ultrasonic interferometry laboratory currently employs one postdoctoral researcher, one graduate student, and over the past two summers has trained two undergraduate students in experimental geophysics.