Synergetic High-Pressure Studies at SLAC and PAL
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In this talk, I will briefly overview our past CAP collaboration to develop a unique static compression program at SSRL and highlight the current efforts to establish dynamic compression collaboration for synergetic usages of LCLS and PAL-XFEL. For the latter, we have successfully commissioned dynamic compression studies at PAL-XFEL in Korea by utilizing instrumentations at FXS (Femtosecond X-ray Scattering) – XSS (X-ray Scattering and Spectroscopy) beamline. As the first experiment, a polycrystalline iron foil has been illuminated by an 800 nm wavelength uncompressed optical laser with ~6 mJ in 150 ps pulse length, focused onto a 60 μm FWHM spot. The shock-compressed sample has then been probed by ca. 25 fs quasi-monoenergetic (bandwidth 0.4%) X-ray pulse at an energy of up to ~12 keV with $10^{11}$ photons per pulse, focused down to ca. 10 μm diameter using a CRL optics. The sample is positioned normal to the X-ray pulse at a distance of ca. 12 cm from a Rayonix mx225 detector in a way to cover 20 arcs up to ca. 65 degrees. Single-shot diffraction measurements were performed with ca. 50 ps increment up to two nanoseconds. We demonstrate that PAL-XFEL can provide a unique and complementary opportunity in probing ultrafast lattice dynamics with sufficient spatial and temporal resolution in intermediate pressure regime.