Experimental platform using high-power laser with X-ray free-electron laser at SACLA and its capabilities for shock experiments

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Thanks to its brilliance and short pulse duration, X-ray free-electron lasers (XFELs) provide revolutionary capabilities to capture dynamics of materials on the timescales of atomic motion. On the other hand, laser-driven dynamic compression can easily generate high pressures relevant to inside planets and planetary impact phenomena. The combination of laser-driven dynamic compression pump and XFEL probe enables probing ultrafast lattice-level dynamical phenomena and transient states associated with dynamic compressions such as phase transitions, shock formation, and dynamic fractures. Recently, we have developed a new experimental platform for combinative use of an XFEL and a 100-J class laser at the SPring-8 Angstrom Compact free-electron LAser (SACLA), designed for exploring matters in extreme conditions. The platform has capabilities for X-ray diffraction (XRD) measurement, small-angle X-ray scattering (SAXS) measurement, and X-ray imaging along with auxiliary optical measurements such as velocity interferometry for any reflector (VISAR) and streaked optical pyrometer (SOP).
In this presentation, we present an overview of the newly developed platform, its current capabilities, and commissioning results.

Keywords: X-ray free-electron laser, dynamic compression, high-power laser

