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Ultrafast X-ray Studies on the Dynamics of Structural Transitions

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Understanding the processes which dictate physical properties such as strength, elasticity, plasticity, and the kinetics of phase transformation/crystallization requires studies at the relevant length-scales (e.g., interatomic spacing and grain size) and time-scales (e.g., phonon period). Experiments performed at the Matter in Extreme Conditions end-station at the Linac Coherent Light Source, SLAC combine a laser-driven dynamic compression pump and X-ray free electron laser probe. To showcase some of the capabilities of this end-station, we present time-resolved structural and/or electronic transformations in a suite of materials over a pressure range of a few to tens of GPa, including: 1) quartz/fused silica, 2) water, 3) Fe-bearing pyroxene, 4) iron and 5) titanium .