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The dynamic response of high pressure phase of Si using phase contrast imaging and X-ray diffraction H.J. LEE, E. GALTIER, Z. XING, A. GLEASON, E. GRANADOS, F. TAVELLA, SLAC National Accelerator Laboratory, A. SCHROPP, F. SEIBOTH, C. SCHROER, DESY, Germany, A. HIGGINBOTHAM, Univ. York, UK, S. BROWN, B. ARNOLD, R. CURIEL, D. PETERSWRIGHT, A. FRY, B. NAGLER, SLAC National Accelerator Laboratory —
Static compression studies have revealed that crystalline silicon undergoes phase transitions from a cubic diamond structure to a variety of phases including body-centered tetragonal phase, an orthorhombic phase, and a hexagonal primitive phase [1]. However, the dynamic response of silicon at high pressure is not well understood. Phase contrast imaging has proven to be a powerful tool for probing density changes caused by the shock propagation into a material [2, 3]. With respect to the elastic and plastic compression, we image shock waves in Si with high spatial resolution using the LCLS X-ray free electron laser and Matter in Extreme Conditions instrument. In this study, the long pulse optical laser with pseudoflat top shape creates high pressures up to 60 GPa. We also measure the crystal structure by observing the X-ray diffraction orthogonal to the shock propagation direction over a range of pressure. In this talk, we will present the capability of simultaneously performing phase contrast imaging and in situ X-ray diffraction during shock loading and will discuss the dynamic response of Si in high pressure phases [1] Jamieson, Science, 139, 762 (1963); Hu et al. Phys. Rev.B 34, 4679 (1986) [2] B. Nagler et al. J. Synchrotron Rad. 22 (2015) doi: 10.1107/S1600577515004865 [3] A. Schropp et al. Scientific Reports 5, 11089 (2015) doi:10.1038/srep11089

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