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In Situ 3D Coherent X-ray Diffraction Imaging of Shock Experiments: Possible? JOHN BARBER, Los Alamos National Laboratory — In traditional coherent X-ray diffraction imaging (CXDI), a 2D or quasi-2D object is illuminated by a beam of coherent X-rays to produce a diffraction pattern, which is then manipulated via a process known as iterative phase retrieval to reconstruct an image of the original 2D sample. Recently, there have been dramatic advances in methods for performing fully 3D CXDI of a sample from a single diffraction pattern [Raines et al, Nature 463 214-7 (2010)], and these methods have been used to image samples tens of microns in size using soft X-rays. In this work, I explore the theoretical possibility of applying 3D CXDI techniques to the in situ imaging of the interaction between a shock front and a polycrystal, a far more stringent problem. A delicate trade-off is required between photon energy, spot size, imaging resolution, and the dimensions of the experimental setup. In this talk, I will outline the experimental and computational requirements for performing such an experiment, and I will present images and movies from simulations of one such hypothetical experiment, including both the time-resolved X-ray diffraction patterns and the time-resolved sample imagery.

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