Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Enhancement of charge ordering by dynamic electron-phonon interaction ANDREJ SINGER, Department of Physics, University of California San Diego, ERIC FULLERTON, Center for Memory and Recording Research, University of California San Diego, OLEG SHPYRKO, Department of Physics, University of California San Diego — Symmetry breaking and emergence of order is one of the most fascinating phenomena in condensed matter physics and leads to a plethora of intriguing ground states such as in antiferromagnets, Mott insulators, superconductors, and density-wave systems. Exploiting non-equilibrium dynamics of matter following ultrafast external excitation can provide even more striking routes to symmetry-lowered, ordered states, for instance, by accessing hidden equilibrium states in the free-energy landscape or dynamic stabilization of non-equilibrium states. This is remarkable because ultrafast excitation typically creates disorder, reduces the order parameter, and raises the symmetry. Here, we demonstrate for the case of antiferromagnetic chromium that moderate photo-excitation can transiently enhance the charge-density-wave (CDW) order by up to 30% above its equilibrium value, while strong excitation leads to an oscillating, large-amplitude CDW state that persists above the equilibrium transition temperature. Both effects result from dynamic electron-phonon interaction, which provides an efficient mechanism to selectively transform a broad excitation of the electronic order into a well defined, long-lived coherent lattice vibration. This mechanism may be exploited to transiently enhance the order parameter in other systems with coupled electronic and lattice orders. The data was collected at the x-ray free electron laser LCLS at SLAC.

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Date submitted: 05 Nov 2015 Electronic form version 1.4