Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

XAS measurements at LCLS: Investigating Electronic Damage at an X-Ray FEL CATHERINE GRAVES, DAVID BERNSTEIN, Stanford University, SLAC, JOSHUA TURNER, WILLIAM SCHLOTTER, HERMANN DÜRR, ANDREAS SCHERZ, JOACHIM STÖHR, SLAC — As X-ray FEL sources such as the LCLS ramp up scientific studies, the damage caused by the intense x-ray pulses has become a central question. X-ray FEL investigations of solid-state materials must consider the change in the electronic system during the x-ray pulse, in contrast to proposed biomolecular imaging experiments which must suppress atomic motion.[1] The potential electronic damage to the system is also amplified in many materials investigations which probe absorption edges. Therefore, a key need of all studies involving materials research with X-ray FELs is to mitigate or overcome the electronic damage when probing the system. We report the first x-ray absorption spectroscopy (XAS) results from LCLS, which show significant line shape changes dependent on the fluence and x-ray pulse length. We employ a technique previously developed at FLASH which also allows us to visualize the beam dispersion.[2] Our spectroscopy results from LCLS demonstrate a safe fluence and pulse length regime at which material investigations can be conducted without perturbing the ground state of the system during the probing x-ray pulse.

[1]Neutze, R. et. al. Nature 406, 752 (2000).
[2]Bernstein, D.P. et al. Appl. Phys. Lett. 95, 134102 (2009).

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Date submitted: 30 Dec 2010 Electronic form version 1.4