Abstract Submitted
for the DPP13 Meeting of
The American Physical Society

Nonequilibrium electron dynamics in matter irradiated by short and intense x-ray pulses STEFAN HAU-RIEGE, Lawrence Livermore National Laboratory — X-ray free-electron lasers (XFELs) provide intense fs x-ray pulses that allow isochoric heating of solid-density matter. The large x-ray penetration depth enables uniform excitation of qualitatively thicker samples than, for example, heating by optical lasers. The primary x-ray absorption process is inner-shell photoionization, leading to the release of high-energy photoelectrons. The core-excited ions relax through fluorescence and Auger decay. The photo- and Auger-electrons equilibrate with the low-energy electrons through a cascade of inelastic scattering events. It is expected that the pulse length of XFELs may be so short that the electron system is highly nonthermal during and right after the pulse, and that a large fraction of the absorbed x-ray energy resides with the fast photo- and Auger-electrons. This leads to nonequilibrium ionization states and calls standard equilibrium models to describe the effects of the plasma environment on the atomic states into question, which, in turn, has important implications for designing and analyzing plasma experiments at XFELs. In this presentation we will review the mechanisms and time scales for the distribution of energy among the electrons as a function of pulse energy, pulse length, and sample geometry.

Stefan Hau-Riege
Lawrence Livermore National Laboratory

Date submitted: 08 Jul 2013 Electronic form version 1.4