Abstract Submitted
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X-ray and optical pulse interactions via electron trapping in GaAs[1] STEPHEN DURBIN, SHIH-CHIEH LIU, Purdue University, ANTHONY DICHIARA, Advanced Photon Source, Argonne National Lab, ROBERT HENNING, Center for Advanced Radiation Sources, University of Chicago — A highly excited state of GaAs is created by the absorption of an extremely intense focused 80 ps pulse of hard x-rays at the Advanced Photon Source synchrotron. This state is probed by 2 ps laser pulses with photon energies near the semiconducting band gap, which has previously revealed x-ray induced optical transparency. Two unexpected results are found: x-ray induced luminescence is dramatically enhanced when a high intensity laser pulse precedes the x-ray pulse, and the decay of the induced transparency becomes much slower when the intensity of the subsequent probe laser is increased. Both results require that energy be stored in GaAs by the first pulse, and then released by the second pulse. We describe how this can be explained by electron trapping centers in GaAs with trapping lifetimes of a few nanoseconds. We compare these results with lifetime measurements of other excitations produced by ultrafast optical absorption. We also show how minor improvements in focusing will lead to single-pulse x-ray induced temperature jumps of thousands of Kelvin, allowing new x-ray excited dense matter states to be explored.

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