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X-ray induced optical transparency and x-ray/optical photon interactions in GaAs[1] STEPHEN DURBIN, Department of Physics, Purdue University, TIM GRABER, ROB HENNING, Center for Advanced Radiation Sources, University of Chicago — An intense x-ray synchrotron pulse transforms a thin crystal of GaAs from being opaque to transparency in picoseconds for probe photon energies near the band gap energy. X-ray absorption and subsequent de-excitation processes pump a high density of electrons from the valence band into the conduction band, causing Pauli blocking of the band gap photons and hence their transmission through the bulk of the specimen. Although the GaAs photocarrier lifetime is less than 300 ps, the transmission decay time constant was as large as 2000 ps when the laser intensity was increased, an effect that can be partially understood in terms of photobleaching and the depth of x-ray absorption. Finally, the excess transmission of band gap photons due to high laser intensity could be suppressed by the onset of the x-ray pulse, evidence for x-ray quenching of laser hole burning. These effects are manifestations of x-ray/optical photon interactions mediated by their conduction band excitations in GaAs.

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