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Ultrafast Dynamics near the M-edge in Chromium BRIAN MCFARLAND, JIAN-XIN ZHU, ROHIT PRASANKUMAR, GEORGE RODRIGUEZ, RICHARD SANDBERG, ANTOINETTE TAYLOR, DMITRY YAROTSKI, Los Alamos Natl Lab — The exploration of element specific ultrafast spin dynamics in transition metals has been extended by recent advances in table top VUV sources based on high harmonic generation. These sources provide femtosecond time resolution at photon energies that span the magnetism sensitive 3p to 3d band absorption (M-edge) in these materials. The time scale of spin dynamics determines the fundamental limits of magnetic data recording and gives insight into magnetoelectric coupling mechanisms in complex functional materials. Though there have been multiple time-resolved studies on ferromagnetic systems, antiferromagnetic (AFM) dynamics remains largely unexplored. As an AFM test system we choose chromium and measure transient reflectivity for photon energies spanning the chromium M-edge. Picosecond dynamics are measured throughout the spectrum of the VUV probe beam after excitation by an IR laser pulse. A dramatic difference is observed in the transient magnetic linear absorption dichroism of chromium for photon energies above and below the M-edge ($\sim$ 46 eV) as temperature is varied through the AFM transition. While a decrease in reflectivity is seen below the M-edge we find an increase in reflectivity above the edge. We attribute this variation to interplay between electronic and magnetic responses and discuss its relation to ultrafast magnetic ordering dynamics.

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