Abstract Submitted
for the SHOCK05 Meeting of
The American Physical Society

The Study of Shock Waves and Laser Excited Lattice Dynamics using Ultrafast X-ray Diffraction DAVID J. FUNK, G.L. FISHER, D.E. HOF, H.J. LEE, D. LIM, Q. MCCULLOCH, C.A. MESEROLE, D.S. MOORE, J. ROBERTS, J.B. WORKMAN, A.J. TAYLOR, Los Alamos National Laboratory, N. HUR, S.-W. CHEONG, Rutgers University, J. WARK, Clarendon Laboratory, Oxford — We have studied the picosecond lattice dynamics of optically pumped hexagonal manganite LuMnO3 using ultrafast x-ray diffraction. The results show a shift and broadening of the diffraction curve due to the stimulated lattice expansion. To understand the transient response of the lattice, the measured time- and angle-resolved diffraction curves are compared with a theoretical calculation based on dynamical diffraction theory modified for the hexagonal crystal structure of LuMnO3. Our simulations reveal that a large coupling coefficient between the a-b plane and the c-axis (c13) is required to the data. We compare this result to our previous coherent phonon studies of LuMnO3 using optical pump-probe spectroscopy. We have also performed preliminary experiments of shock waves traversing thin (approximately one micron) metal single-crystals, characterizing the shock wave using ultrafast spatial interferometry and with ultrafast x-ray diffraction. A summary of our current results will be presented.

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Date submitted: 11 Apr 2005 Electronic form version 1.4