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Ultrafast photo-induced melting of charge and orbital order in the manganite $Nd_{0.5}Sr_{0.5}MnO_3$ ROHIT PRASANKUMAR, ANTOINETTE TAYLOR, RICHARD AVERITT, Los Alamos National Laboratory, KONSTANTIN KAMENEV, University of Edinburgh, G. BALAKRISHNAN, D. PAUL, University of Warwick, LOS ALAMOS NATIONAL LABORATORY TEAM, UNIVERSITY OF EDINBURGH TEAM, UNIVERSITY OF WARWICK TEAM — The physics of perovskite manganites is a subject of intense research in condensed matter physics due to the interplay between charge, spin, lattice, and orbital degrees of freedom in these materials. The manganite $Nd_{0.5}Sr_{0.5}MnO_3$ is ferromagnetic below its Curie temperature (T_c) of $\sim$250 K, exhibiting colossal magnetoresistance upon application of a magnetic field. Below T_{co} $\sim$150 K, it is antiferromagnetic with charge and orbital ordering, which can be "melted" upon application of a high magnetic field. Optical conductivity measurements revealed an optical gap below T_{co}, with Drude-like behavior for $T_{co} < T < T_c$. In this work, we use an optical pump, mid-infrared probe system to investigate ultrafast dynamics in $Nd_{0.5}Sr_{0.5}MnO_3$ at 0.09 eV (within the optical gap) and 0.59 eV (outside the optical gap). As the temperature is tuned through T_c, we measure dynamics similar to those seen in previous experiments on half-metallic manganites. However, below T_{co} we observe striking changes in the dynamics, believed to be due to photo-induced melting of the charge and orbital ordered state.

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