Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Verwey Transition in Magnetite: How fast does an insulator become a metal? ROOPALI KUKREJA, S. DE JONG, W.F. SCHLOTTER, J. TURNER, W.S. LEE, Y.D. CHUANG, H.A. DURR, SLAC National Accelerator Laboratory, CA, USA, N. PONTIUS, T. KACHEL, A. FOHLISCH, Helmholtz-Zentrum Berlin for Materialien und Energie, Berlin, Germany, F. SORGENFREI, M. BEYE, W. WURTH, DESY, Hamburg, Germany, C. TRABANT, C.F. CHANG, C. SCHUSSLER-LANGAHEINE, Universatit zu Koln, Institute of Physics, Koln, Germany — Magnetite (Fe3O4), is the first oxide where a relationship between electrical conductivity and fluctuating/localized charges was observed, with a drop in conductivity by two orders of magnitude at TV=123K. The Verwey transition is accompanied by a structural change from monoclinic to cubic symmetry. Despite decades of research and indications that charge and orbital ordering play an important role, the mechanism behind the Verwey transition is yet unclear. Recently, three-Fe-site lattice distortions called trimerons have been identified as the true microscopic face of electronic order in low temperature insulating phase. We studied the real time response of insulating magnetite to optical excitation with ultrafast soft X-ray scattering. We discover this to be a two-step process. After an initial femtosecond destruction of individual trimerons in the corresponding lattice, we observe a phase separation into residual insulating trimeron and cubic metallic phases on a 1.0 ± 0.2 picosecond timescale.

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Date submitted: 12 Dec 2012 Electronic form version 1.4