Contribution ID: **23** Type: **Talk**

The Verwey transition ultrafast: lattice and charge/orbital order go neck and neck

Monday 4 April 2011 10:00 (20 minutes)

At 120K magnetite Fe3O4 undergoes a metal-to-insulator transition, the Verwey transition. It is accompanied by a transition from a charge/orbital ordered state with a monoclinic symmetry to a high temperature cubic phase without electronic order. Until today the question whether this transition is mainly driven by the lattice or by electronic degrees of freedom remains unanswered.

We studied this transition using time-resolved soft x-ray diffraction at the free electron laser LCLS in Stanford. After selectively exciting the electronic system by an infrared fs-laser pulse from below the transition temperature we get direct insight into the "melting" of charge and orbital order by doing the diffraction resonantly at the Iron L3 and the Oxygen K edges. Complementary, the response of the lattice is probed using purely structural reflections.

Surprisingly, the data show that both a change of lattice symmetry and the quenching of charge/orbital order occur unexpectedly fast on a sub 200 fs timescale. Moreover, the measurements suggest the formation of a new transient phase after laser excitation, which has not been observed in thermal equilibrium before.

Primary author: PONTIUS, Niko (Helmholtz-Zentrum Berlin für Materialien und Energie)

Co-authors: FÖHLISCH, A. (Helmholtz-Zentrum Berlin für Materialien und Energie); BRÄUER, B. (SLAC); SCHÜSSLER-LANGEHEINE, C. (Helmholtz-Zentrum Berlin für Materialien und Energie); TRABANT, C. (University Köln); CHANG, C.-F. (University Köln); ZHU, D. (SLAC); SORGENFREI, F. (University Hamburg); DÜRR, H. A. (SLAC); BEYE, M. (Helmholtz-Zentrum Berlin für Materialien und Energie); DÖHLER, M. (University Köln); KUKREJA, R. (SLAC); HOSSAIN, S. (SLAC); DE JONG, S. (SLAC); KACHEL, T. (Helmholtz-Zentrum Berlin für Materialien und Energie); SCHLOTTER, W. (SLAC); WURTH, W. (University Hamburg); LEE, W.-S. (SLAC)

Presenter: PONTIUS, Niko (Helmholtz-Zentrum Berlin für Materialien und Energie)

Session Classification: New opportunities with x-ray FELs