Einladung zum

Wiener Physikalischen Kolloquium

Clocking the Verwey transition in magnetite: the speed limit for ultrafast switching in oxides

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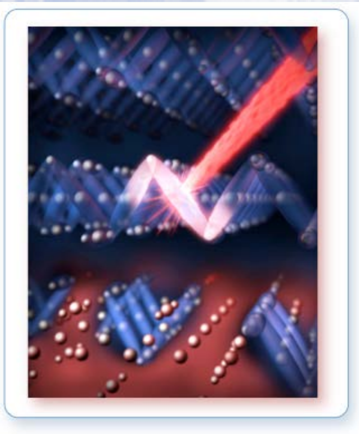
For oxide electronics to come of age, we will need convincing that the dazzling array of physical properties transition metal oxides display can be switched on and off sufficiently rapidly. Femtosecond soft X-ray probes can clock such switching speeds, simultaneously laying bare the mechanisms at work by separating out the contributions from the lattice and electronic degrees of freedom on the time axis.
In magnetite – Fe_3O_4 – electrical conduction drops two-hundred-fold below T_v, as electrons freeze into a complex pattern of charge and orbitals, as first recognized by Verwey.
Harnessing the femtosecond soft X-ray pulses from the Linac Coherent Light Source, we show that for all its complexity, the charge-orbital order of the insulating Verwey phase can give way to a metallic phase in as little as a single picosecond. This not only finally solves the riddle of the how the Verwey transition works, but also sets an encouraging speed limit in our pursuit of future oxide electronics technologies.



Picture: Artist's impression of the pump pulse annihilating trimerson in the Verwey phase, triggering the switching to a metallic phase.

Speed limit of the insulator-metal transition in magnetite
S. de Jong, R. Kukreja, C. Trabant, N. Pontius, C.F. Chang, T. Kachel, M. Beye, F. Sorgenfrei, C.H. Back, B. Bräuer, W.F. Schlotter, J.J. Turner, O. Krupin, M. Doehler, D. Zhu, M.A. Hossain, A.O. Scherz, D. Fausti, F. Novelli, M. Esposito, W.S. Lee, Y.D. Chuang, D.H. Lu, R.G. Moore, M. Yi, M. Trigo, P. Kirchmann, L. Patthey, M.S. Golden, M. Buchholz, P. Metcalf, F.Parmigiani, W. Wurth, A. Föhlisch, C. Schüßler-Langeheine and H.A. Dürr
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