Abstract Submitted
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The role of charge and orbital order for the Verwey transition in Fe_3O_4 S. DE JONG, R. KUKREJA, M. HOSSAIN, C. BACK, A. SCHERZ, D. ZHU, W. SCHLOTTER, J. TURNER, W. LEE, Y. CHUANG, R. MOORE, O. KRUPIN, M. TRIGO, L. PATTHEY, H. DÜRR, SLAC/ RSXS collaboration, N. PONTIUS, T. KACHEL, A. FÖHLISCH, M. BEYE, Helmholtz Zentrum Berlin, F. SORGENFREI, W. WURTH, Uni. Hamburg & CFEL, C. CHANG, M. DÖHLER, C. TRABANT, C. SCHÜSSLER-LANGEHEINE, Uni. Cologne — Magnetite, Fe_3O_4, displays a strong decrease in resistivity upon heating above $T_C = 123$ K: the Verwey transition. Since long it has been proposed that charge and orbital order (CO/OO), via Fe^{3+} and Fe^{2+} charge disproportionation, play a crucial role. However, the mechanism behind the Verwey transition to date remains unclear. Using pump-probe O K-edge resonant soft X-ray scattering at the new LCLS SXR beamline, we have studied the role of CO/OO for the Verwey transition on ultra-fast time-scales. We focus on the structurally forbidden $(00\ ^1/_2)$ peak. Upon excitation, the charge gap of 200 meV is quenched on resolution limited time-scales, < 250 fs, while we still observe a residual CO/OO signal. This may indicate the existence of a new transient state of matter, displaying charge and orbital order in coexistence with metallic behavior.

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