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Cupric Oxide: a model system to explain high-T_c superconductivity ?

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Cupric oxide (CuO) has recently attracted much interest as a magnetically driven multiferroic with the highest T_c (~230K). In this material a non-collinear spiral magnetic order (215K<T<230K) breaks crystal inversion symmetry, inducing ferroelectricity. We use resonant x-ray diffraction at the Cu L edges to probe the subtle changes in the Cu electronic structure occurring at the appearance of multiferroicity and test the magnetic ground-state, proposed by neutron diffraction, to be a collinear antiferromagnet. In both phases we have found a strong dependence of the diffracted intensity on the polarization of the incident light. Such dependence is totally unexpected in a simple collinear antiferromagnetic phase. In this model the Cu magnetic moment are aligned (antiferromagnetically) along the b-axis. The observed polarization dependence could reflect and be a direct measurement of the presence of orbital currents surrounding the Cu ions. Such observations are long sought proofs for theoretical model explaining the behavior of the normal state of high-T_c superconductors. Understanding such state is the key to unravel the true origin of the superconducting phase transition in cuprates materials.

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