Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Quasi-Particle Relaxation and Quantum Femtosecond Magnetism in Non-Equilibrium Phases of Insulating Manganites ILIAS PERAKIS, MYRON KAPETANAKIS, Department of Physics, University of Alabama at Birmingham, Birmingham, Alabama 35294, USA, PANAGIOTIS LINGOS, GEORGE BARMPARIS, Department of Physics, University of Crete, Heraklion, Crete 71003, Greece, A. PATZ, T. LI, JIGANG WANG, Ames Laboratory and Department of Physics Astronomy, Iowa State University, Ames, Iowa 50011, USA — We study the role of spin quantum fluctuations driven by photoelectrons during 100fs photo-excitation of colossal magneto-resistive manganites in anti-ferromagnetic (AFM) charge-ordered insulating states with Jahn-Teller distortions. Our mean-field calculation of composite fermion excitations demonstrates that spin fluctuations reduce the energy gap by quasi-instantaneously deforming the AFM background, thus opening a conductive electronic pathway via FM correlation. We obtain two quasi-particle bands with distinct spin-charge dynamics and dependence on lattice distortions. To connect with fs-resolved spectroscopy experiments, we note the emergence of fs magnetization in the low-temperature magneto-optical signal, with threshold dependence on laser intensity characteristic of a photo-induced phase transition. Simultaneously, the differential reflectivity shows bi-exponential relaxation, with fs component, small at low intensity, exceeding ps component above threshold for fs AFM-to-FM switching. This suggests the emergence of a non-equilibrium metallic FM phase prior to establishment of a new lattice structure, linked with quantum magnetism via spin/charge/lattice couplings for weak magnetic fields.

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Date submitted: 09 Nov 2016 Electronic form version 1.4