Relaxation times of charges and spins of La$_{0.7}$Ca$_{0.3}$MnO$_3$ CHENG-CHUNG CHI$^2$, HSIN-CHIA HO, THIAM HONG GOH, Department of Physics, National Tsing Hua University, Hsinchu, Taiwan, SHENG-FU HORNG, Department of Electric Engineering, National Tsing Hua University, Hsinchu, Taiwan — The time-resolved photoreflectance and MOKE measurements are used to measure the charge and spin dynamics of La$_{0.7}$Ca$_{0.3}$MnO$_3$, a typical colossal magnetoresistance material (CMR). We have directly observed the transient behaviors of charges and spins at temperatures above and below its ferromagnetic transition temperature $T_C$ (about 250 K) and in the presence of an external magnetic field ranging from 0 to 6 T. It is surprising that the relaxation time of spins created by a circularly polarized laser pulse is extremely fast at $T > T_C$. It is about 130 fs and much faster than the charge carrier relaxation times inferred from the transient reflectance measurements. At $T < T_C$, relaxation of spins becomes more complicated. The relaxation starts with a fast time similar to that of above $T_C$, then follows with a much slower relaxation time of 64 ps towards a level lower than its original level. The original equilibrium is finally reached about 5 ns later. This complicated relaxation processes of the spins can be explained by a strong spin-spin interactions and the supercooling effect induced by the circularly polarized pump laser.

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