Photo-induced Quantum Phase Transition and Magnetic Solitons in the Perovskite GdSrMnO

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Tokura[1] has reported the photo-induced insulator-metal transition in the perovskite PrCaMnO. The photo-excitation above the charge gap in the charge-orbital ordered state can cause the hopping of the electrons or holes into the neighboring site, hence forming magnetic solitons in the regular charge-orbital ordered state. Matsubara et al.[2] have investigated the ultrafast spin and charge dynamics in the course of a photo-induced phase transition from an insulator with short-range charge order and orbital order to a ferromagnetic metal in perovskite-type GdSrMnO.The photo-induced dynamic magnetic effect has been studied in the II-VI-based diluted magnetic semiconductors(DMS) and III-V-based DMS, and interesting phenomena such as the photo-induced magnetic polaron have been discovered. These works stimulated us to the study of the carrier-induced magnetic solitons, which is an interesting and challenging subject. The present author[3] has discussed the insulator-metal transition and large magnetoresistance effects in DMS, using the gauge-invariant Lagrangian density for the photo-induced magnetic solitons. In addition, the present author[4] has discussed the percolation-like insulator-metal transition, the conduction mechanism, and localization of photo-induced magnetic solitons with hole in the perovskite PrCaMnO. In this study, we shall discuss photo-induced insulator-ferromagnetic metal transition and localization of the photo-induced magnetic solitons in the perovskite GdSrMnO, extending the previous formula.

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