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Low temperature spin glass transition in Gallium ferrite single crystals SOMDUTTA MUKHERJEE, RAJEEV GUPTA, Department of Physics, Indian Institute of Technology Kanpur, ASHISH GARG, Materials Science and Engineering, Indian Institute of Technology Kanpur — Magnetoelectric gallium ferrite ($GaFeO_3$ or GFO) manifests close to room temperature ferrimagnetism owing to inherent cationic site disorder in an otherwise antiferromagnetic ground state structure. In GFO, Fe ions at Fe1 and Fe2 sites are antiferromagnetically coupled while Fe and Ga at Fe2 and Ga2 sites respectively are ferromagnetically coupled. Ga1 site is magnetically inactive. Here, we present a detailed study to probe phase transitions in GFO using ac and dc magnetic characterization methods to demonstrate spin glass behavior in GFO below 200 K. Our dc magnetization measurement exhibits that while GFO undergoes standard para (PM) to ferromagnetic (fM) transition at $T_c \sim 290$ K, splitting between field cooled and zero-field cooled plots is observed at low temperatures hinting at the spin-glass like behavior. Further, temperature dependent ac susceptibility measurements at different frequencies and at different dc fields demonstrate that the system exhibits a non-equilibrium canonical spin glass (SG) state below the spin glass transition temperature ~ 210 K. The spin glass state has been further characterized by memory effect and aging measurements. The origin of such a spin-glass phase is proposed to arise from a network of geometrically frustrated spin system attributed to combination of antiferromagnetic interaction among the Fe ions in the two Fe sites and Ga2 site as well as inherent cation site disorder.

Rajeev Gupta
Department of Physics, IIT Kanpur

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