Magneto-elastic coupling and spin glass behavior in Gallium Ferrite

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Abstract
Multiferroic and magnetoelastic materials have drawn significant attention from the scientific community owing to the underlying interesting physics and their potential in future spintronic device applications. Gallium ferrite (GaFeO3) or GFO is a ferrimagnet and a room temperature piezoelectric material whose ferri to paramagnetic transition temperature (Tc) can be tailored to room temperature and above by manipulating the Ga to Fe ratio, thus rendering GFO as a prospective single phase room temperature magnetoelastic system. In this talk I will present our recent results on probing magneto-elastic coupling in the ferrimagnetic state of single crystalline GFO studied using temperature evolution of phonons. Estimation of magneto-elastic coupling coefficient showed an abrupt change of coupling strength across ~200 K which could be attributed to spin reordering within the ferrimagnetic state. Analysis of frequency and dc field dependent ac susceptibility studies revealed that GFO undergoes a spin glass like transition at ~ 210 K consistent with possible spin rearrangement at ~ 200 K predicted by our Raman spectroscopic study. Such magnetic spin glass behavior in GFO has been discussed in terms of inherent cationic site disorder leading to geometrical frustration among the anti-ferromagnetically arranged Fe ions residing at Fe and Ga sites.

References:

Short Biography
Prof. Gupta is currently an associate professor at Indian Institute of Technology, Kanpur. His research interests are in the broad area of condensed matter physics with emphasis on using spectroscopic tools such as Raman scattering to probe the nanoscale dynamics in novel and interesting materials. Some of the materials he has explored include multiferroics, magnetodielectrics, strongly correlated materials such as manganites, ruthenates and low dimensional systems such as semi-conducting nanowires and nanowhiskers. He has published more than 40 papers in these areas. At IIT Kanpur he has setup a laboratory to carry out Raman scattering experiments under extreme conditions of temperature and pressure. Prof. Gupta did his MS in physics from IIT Kanpur prior to pursuing a Ph.D. at Indian Institute of Science Bangalore, India.

Subsequently he carried out post-doctoral research at Penn state University and University of Illinois at Urbana Champaign. He joined IIT Kanpur in 2005 as an assistant professor in the department of physics with a concurrent appointment in the Inter Disciplinary Programme in Materials Science.

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