Title:	A Study of Critical Behavior and Magnetocaloric Effect in Rare Earth Double Perovskites, 3d-Metal Chromites and the Ferromagnetic Weyl Semimetal Co3Sn2S2
Authors:	Ali, Anzar
Keywords:	The magnetocaloric effect 3d-Metal Chromites Ferromagnetic Weyl Semimetal Co3Sn2S2 magnetostructural transitions in NiCr2O4
Issue Date:	Mar-2020
Publisher:	IISER Mohali
Abstract:	The study of the critical behavior of magnetic systems in the vicinity of magnetic phase transitions continues to be a topic of great interest in condensed matter physics. The knowledge of critical behavior and critical exponents provides information into the nature of interactions causing the phase transition and characterize the universality class of the phase change. In this work, we first study the critical behavior in the vicinity of paramagnetic to ferromagnetic phase transition on some double perovskites A2NiMnO6 (where A = Sm, Pr, and Nd) materials. The obtained critical exponents suggest that the magnetic ions contributing to the ferromagnetic phase transition in Sm2NiMnO6 follow 3d-Heisenberg Model while long-range mean-field like interactions are responsible for the ferromagnetic phase transition in Pr2NiMnO6 and Nd2NiMnO6. The second theme of the work was to understand how to control and tune the MCE, which is a useful technology in magnetic refrigeration. We have studied specific materials like the Rare-earth double perovskites and 3d-metal Chromites, both of which contain more than one magnetic sub-lattice. By our study on these particular material families, we have been able to give general recipes to control the MCE by tuning the magnetic moment size and the nature of the magnetic exchange interactions between the two sub lattices. In the final project, we have sought to marry topological properties with MCE func tionalities. We have studied the "rotating MCE" in a ferromagnetic Weyl semi-metal Co3Sn2S2 and demonstrated that materials with anisotropic band-structures (such a Topo logical material) and anisotropic magnetic properties could be more effective in magnetic refrigeration technologies since a large magnetic entropy change can be achieved just by rotating the magnetic material in a fixed magnetic field. This is more effective compared to conventional MCE, where one needs to change the magnetic field continues to drive a magnetic entropy change.
URI:	http://hdl.handle.net/123456789/1552
Appears in Collections:	PhD-2014

Files in This Item:

File	Description	Size	Format	
Ph14006.pdf		74.87 MB	Adobe PDF	View/Open

Show full item record