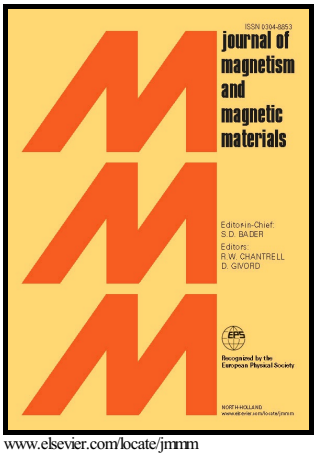
Author's Accepted Manuscript

Spin-orbit interactions and magnetic phase transitions

Subrata Chakraborty, Amrendra Vijay



www.elsevier.com/locate/jmmm

PII: S0304-8853(16)31149-0
DOI: http://dx.doi.org/10.1016/j.jmmm.2016.06.044
Reference: MAGMA61565

To appear in: *Journal of Magnetism and Magnetic Materials*

Received date: 9 February 2016
Accepted date: 18 June 2016

Cite this article as: Subrata Chakraborty and Amrendra Vijay, Spin-orbi interactions and magnetic phase transitions, *Journal of Magnetism and Magneti Materials,* http://dx.doi.org/10.1016/j.jmmm.2016.06.044

This is a PDF file of an unedited manuscript that has been accepted fo publication. As a service to our customers we are providing this early version o the manuscript. The manuscript will undergo copyediting, typesetting, an review of the resulting galley proof before it is published in its final citable form Please note that during the production process errors may be discovered whic could affect the content, and all legal disclaimers that apply to the journal pertain

ACCEPTED MANUSCRIPT

Spin-Orbit Interactions and Magnetic Phase Transitions

Subrata Chakraborty and Amrendra Vijay*

Department of Chemistry, Indian Institute of Technology Madras, Chennai 600036, India

(Dated: June 21, 2016)

Abstract

With the spin-orbit interaction (λ) as a tuning parameter, we show a non-trivial quantum phase transition that unambiguously links the ferromagnetic (F) and antiferromagnetic (AF) phases of the spin system wherein the Heisenberg isotropic exchange is positive. Using a spin-only exchange Hamiltonian that also faithfully accounts for the spin-orbit interactions and the double-time Green function formalism of quantum statistical mechanics, we obtain an implicit analytical expression for the average magnetization. As expected, the high temperature phase is paramagnetic (P). For $\lambda = 0$, the spin system displays a P-F transition. If the spin-orbit interaction is not quenched ($\lambda \neq 0$), the susceptibility curves reveal a robust P-AF transition. The present λ-mediated F-AF phase transition arises due to the broken inversion symmetry in the effective spin-only Hamiltonian. This is physically distinct from the Néel-VanVleck-Anderson mechanism, which posits a negative Heisenberg isotropic exchange for the existence of the AF phase, and thus offers a new perspective on quantum magnetism and other analogous complex systems.

Accepted manuscript

* Correspondence to:avijay@iitm.ac.in

Download English Version:

https://daneshyari.com/en/article/8154920

Download Persian Version:

https://daneshyari.com/article/8154920

Daneshyari.com