Contribution ID : **52** Type : **Oral**

Role of competing magnetic interactions and anisotropies in determining the ground states in magnetoelectric/multiferroic honeycomb M4Ta2O9 (M= Mn,Co,Fe and Ni)

In magnetoelectrics (ME) magnetic ordering and electric polarization (EP) coexist. The ME effect is larger, if in these materials EP is of spin origin and the coupling is strong. This coupling can be utilized in applications such as MRAMs. Although technically important, the coupling mechanism is complicated. Two types of materials fulfill this requirement: (i) Type II multiferroics (ii) Materials which lack spontaneous EP in the ground state and it is induced by an external magnetic field. The magnetic order parameter should break both time reversal and inversion symmetries [1-4]. M4A2O9 (M=Mn,Co,Fe and Ni and A=Nb,Ta) are a rare family of materials where depending on M, either (i) or (ii) are induced below the magnetic ordering [5-8]. The structure is built from an alternative stacking of two different honeycombs leading to a competition between various magnetic interactions, anisotropy and dimensionality. In order to elucidate the emergence of (i) or (ii) in M4A2O9, a comprehension of these competing interactions is essential, which in turn also necessitates the investigation of its electronic structure. In this work, we combined neutron powder diffraction, inelastic neutron scattering and theoretical methods including density functional theory to determine the magnetic structures, magnetic excitations and electronic structure of M4Ta2O9. These investigations led to a discovery of a variety of fundamental spin systems (easy-axis vs easy-plane) and excitations (gapped vs ungapped) in this family of materials, which exhibit a variety of ground states [9].

[1] D. N. Astrov, JETP 11, 708 (1960).
[2] S.-W. Cheong et al., Nat. Mater. 6, 13 (2007).
[3] M. Kenzelmann et al., PRL 95, 087206 (2005).
[4] D. Khomskii, Physics 2, 20 (2009).
[5] Y. Fang et al., Sci. Rep. 4, 3860 (2014).
[6] N. D. Khanh et al., PRB 93, 075117 (2016).
[7] A. Maignan et al., PRB 97, 161106 (R) (2018).
[8] S. N. Panja et al., PRB 98, 024410 (2018).
[9] N.Narayanan et al., accepted to be published in PRB.

Topic

Physics

Primary author(s) : NARAYANAN, Narendirakumar (Postdoc)

Co-author(s) : Mr SENYSHYN, Anatoliy (Heinz Maier-Leibnitz Zentrum (MLZ), Technische Universität München, Lichtenbergstr. 1, 85748 Garching, Germany); AVDEEV, Max (Australian Nuclear Science and Technology Organisation, Australian Centre for Neutron Scattering); HESTER, James (ANSTO); Dr LU, Teng (Research School of Chemistry, The Australian National University, ACT 2601, Australia.); Mr LIU, Zhen (Research School of Chemistry, The Australian National University, ACT 2601, Australia.); Mr FASKE, Tom (Structure Research Division, Institute for Materials Science, Darmstadt University of Technology, Alarich Weiss Strasse 2, 64287 Darmstadt, Germany.); Mr WEISE, Bruno (Leibniz Institute for Solid State and Materials Research (IFW) Dresden e.V., Helmholtzstrasse 20, D-01069 Dresden, Germany); Dr MIKHAILOVA, Daria (Leibniz Institute for Solid State and Materials Research (IFW) Dresden e.V., Helmholtzstrasse 20, D-01069 Dresden, Germany.); Prof. EHRENBERG, Helmut (Institute for Applied Materials (IAM), Karlsruhe Institute of Technology (KIT), Hermann-von-Helmholtz-Platz 1, D-76344 Eggenstein-Leopoldshafen, Germany.); MOLE, Richard (ANSTO); HUTCHISON, Wayne (The University of New South Wales); Prof. FUESS, Hartmut (Structure Research Division, Institute for Materials Science, Darmstadt University of Technology, Alarich Weiss Strasse 2, 64287 Darmstadt, Germany.); Prof. MCINTYRE, Garry J. (Australian Nuclear Science and Technology Organization); LIU, Yun (The Australian National University); YU, Dehong (Australian Nuclear Science and Technology Organisation)

Presenter(s) : NARAYANAN, Narendirakumar (Postdoc)

Session Classification : Poster Session

Track Classification : Physics