S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

6th December,2022 **4.00 PM** **ONLINE/ FERMION**

SPEAKER

Dr. Arnab Bose,
Postdoctoral Fellow, Dept. of Physics,
Johannes Gutenberg Universität, Mainz

TITLE OF THE TALK

ELECTRIC FIELD INDUCED NOVEL SPIN-CURRENT GENERATION

ABSTRACT

Recently a new type of magnetic material is theoretically proposed, referred to as "altermagnet" that exhibits the properties of both ferromagnet and antiferromagnet depending upon the direction of the current flow with respect to the crystal axis [1,2]. We report the first experimental evidence of strongly crystal axis-dependent unconventional transverse spin-current generation by the altermagnet RuO_2 [3]. This unconventional spin-current is the key to the implementation of high-density nonvolatile magnetic memories. Further, we comparatively study the transverse spin-current generation by applying electric current and thermal gradient in the heavy metal with large spin-orbit coupling which reveals that the nonequilibrium electric field is a fundamental driving force that can generate the transverse spin-current even in the absence of a net electric current [4] from the spin Berry curvature.

Reference

[1] R. González-Hernández, L. Šmejkal, K. Výborný, Y. Yahagi, J. Sinova, T. Jungwirth, and J. Železný, Efficient Electrical Spin Splitter Based on Nonrelativistic Collinear Antiferromagnetism, Phys. Rev. Lett. 126, 127701 (2021).
[2] L. Šmejkal, J. Sinova, and T. Jungwirth, Emerging Research Landscape of Altermagnetism, ArXiv: 2204.10844, 1 (2022).
[3] A. Bose, N. J. Schreiber, R. Jain, D.-F. Shao, H. P. Nair, J. Sun, X. S. Zhang, D. A. Muller, E. Y. Tsymbal, D. G. Schlom, and D. C. Ralph, Tilted Spin Current Generated by the Collinear Antiferromagnet Ruthenium Dioxide, Nat. Electron. 5, 267 (2022).
[4] A. Bose, R. Jain, J. J. Bauer, R. A. Buhrman, C. A. Ross, and D. C. Ralph, Origin of Transverse Voltages Generated by Thermal Gradients and Electric Fields in Ferrimagnetic-Insulator/Heavy-Metal Bilayers, Phys. Rev. B 105, L100408 (2022).

HOST FACULTY

Prof. Anjan Barman, Sr. Professor

****