



The 2020 Around-the-Clock Around-the-Globe Magnetics Conference: Invited speakers information

Name: Anjan

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Title of the talk: Spin-Orbit Effects in Spin Dynamics

Biography:

Prof. Anjan Barman obtained his Ph.D. from the Indian Association for the Cultivation of Science (Jadavpur University), Kolkata, India in 1999. He worked as Postdoctoral Fellow in Technion, Israel, University of Exeter and University of Leeds, UK and University of California Santa Cruz, USA. Subsequently, he worked as Assistant Professor in University of South Carolina Columbia, USA and Indian Institute of Technology Delhi between 2006 and 2009 before joining the S. N. Bose National Centre for Basic Sciences, Kolkata, India in 2009, where he is a Senior Professor now. Prof. Barman leads the Spintronics and Spin Dynamics Research Group here with world class laboratories with indigenously built experimental setups namely time-resolved MOKE microscope, broadband and spin-torque ferromagnetic resonance, conventional and microfocused Brillouin light scattering, THz time-domain spectrometer, to name a few. He has guided/graduated 25 PhD students and more than 50 Masters/Bachelor students. He has published nearly 200 research papers in international journals and books and a monograph titled 'Spin Dynamics and Damping in Ferromagnetic Thin Films and Nanostructures' from Springer. He is an Editorial Board Member of Scientific Reports and Reviewer of more than 30 international journals. He also reviews research grant proposals from various countries in the world. He is a recipient of Material Research Society of India Medal and an elected Fellow of Indian Academy of Sciences Bangalore.

Abstract:

Ferromagnetic/nonmagnetic (FM/NM) thin film heterostructures show a range of quantum properties, namely, perpendicular magnetic anisotropy (PMA), spin-orbit torque, spin Hall effect (SHE), Rashba effect, spin pumping, and interfacial Dzyaloshinskii-Moriya interaction. The above properties are generally controlled by the spin-orbit coupling and interface plays an essential role in controlling these properties. Besides, they have huge potential applications in new generation spintronic and magnonic devices.

Here, we present the investigation of time- and wave-vector-resolved ultrafast spin dynamics in FM/NM thin film heterostructures induced by optical, thermal and spin-orbit-torque excitation using time-resolved magneto-optical Kerr microscope and Brillouin light scattering spectroscopy. We present a

unified approach towards investigation and control of spin dynamics occurring between femtosecond and nanosecond timescales in Co/Pd multilayers with PMA [1]. We demonstrate a novel all-optical method to investigate SHE and spin Hall angle (SHA) in FM/NM bilayer [2] and show a giant SHA in β -W [3]. Further we exhibit an all-optical detection of interface spin-mixing conductance and spin transparency in Ta(W)/CoFeB heterostructures based on spin pumping [4]. We next investigate the interfacial Dzyaloshinskii-Moriya interaction (iDMI) from asymmetric spin-wave dispersion using Brillouin light scattering and show pure iDMI in NM(Ta, graphene)/FM(CoFeB, NiFe)/TaO_x, Ta) heterostructures [5-6]. The effects of variation of thicknesses of FM and NM layers and defects at the interface are discussed. Finally, we demonstrate the development of an on-demand magnonic nanostructures based on voltage controlled magnetic anisotropy. Application of spatially periodic electric fields across CoFeB/MgO interface leads to periodic modulation of magnetic anisotropy leading towards selective propagation of spin waves through different nanochannels and opening of magnonic bandgap.

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References:

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