INSTITUTE SEMINAR

3 October 2013 4.00 p.m. Venue - Fermion

Speaker: **Anjan Barman**

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Title: **Spin Waves at the Nanoscale: A New Paradigm towards On- Chip Microwave Communications**

Abstract: **Although spin waves are known for many decades, magnonics is a very young and emerging topic with both fundamental interest and application potential in spintronics. Magnons with frequencies between GHz and sub-THz have wavelengths in the deep nanoscale due to their smaller velocities and magnonics fits perfectly with nanotechnology. It promises a new era of on-chip information communication, processing and logic operations in addition to storage and memory. For magnonics to become a viable and sustainable technology it is important to create a knowledge base of excitation, manipulation and detection of spin waves in various 1-D and 2-D periodic magnetic structures. Here, we present manipulation of spin waves in optically excited and detected spin dynamics in two-dimensional ferromagnetic nano dots and nano antidots lattices. Femtosecond laser pulses are used to create hot electrons in metallic thin films and nanostructures followed by thermalization of electron and spin populations yielding a sub-picosecond demagnetization. This is followed a two-step relaxation process and excitation of spin waves and its damping, which are detected with a sub-100 fs temporal and sub-μm spatial resolutions by a home-built time-resolved magneto-optical Kerr microscope. Various aspects of the dynamics as a function of the dot size, shape, lattice constant, lattice symmetry, bias field strength and orientation have been investigated and new observations such as magnonic mode splitting, bandgap formation, tunability of bandgaps, dynamic dephasing and transition from collective to non collective dynamics are discussed based upon the experimental data and numerical simulations. We further discuss the possibilities of other modes of excitation and detection of spin waves and demonstrate band gap engineering in magnonic waveguides.**

S. Pal et al., Appl. Phys. Lett. **98**, 082501 (2011); B. Rana et al., Appl. Phys. Expr. **4**, 113003 (2011); B. Rana et al., ACS Nano, **5**, 9559 (2011), R. Mandal et al., ACS Nano **6**, 3397 (2012); S. Saha et al., Adv. Funct. Mater. **23**, 2378 (2013); S. Saha et al., Appl. Phys. Lett. **102**, 242409 (2013); B. K. Mahato et al., Appl. Phys. Lett. **102**, 192402 (2013); J. W. Klos et al, Sci. Rep. **3**, 2444 (2013).