Bose Colloquium

S. N. Bose National Centre for Basic Sciences
(An Autonomous Research Institute established under DST, GOI)

Title: Laser-Induced Intersite Spin Transfer

1st December, 2023

4.00 PM

Silver Jubilee Hall

YouTube Link

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Abstract:

A thorough understanding of femtosecond magnetism will address the important questions of how fast the magnetization can be reoriented in a material and what physical processes present fundamental limits to this speed. Ultimately, light represents the fastest means to alter the state of a material since laser pulses can now be generated with extremely short temporal duration down to a few tens of attoseconds. One particularly interesting and novel scheme for the ultrafast manipulation of spins using light takes advantage of the optically-induced spin transfer (OISTR), which was recently introduced by Dewhurst et al. [1]. This microscopic mechanism is driven by a spin-selective direct optical excitation from one magnetic sublattice to another. Guided by time dependent density functional theory calculations, we are able to monitor the optically induced transient changes in different model systems, FePtMn, FeNi, and Heusler alloys in real time by time-resolved magneto-optical Kerr spectroscopy using high-harmonic generation [2-4]. Exploiting the spectral sensitivity of this measurement technique we are able to follow the ultrafast spin transfer from Fe to Ni and Mn, respectively, during the optical excitation. OISTR, therefore, opens up a new avenue towards manipulating solids on timescales only limited by the duration of the exciting light pulse, which forecasts a control of the spin dynamics on the attosecond time scale.

[1] J.K. Dewhurst et al, Nano Lett. 18 1842 (2018)
[2] M. Hofherr et al. Sci. Adv. 6 eaay8717 (2020)
[3] P. Tengdin et al , Sci. Adv. 6 eaaz1100 (2020)
[4] D. Steil et al, Phys. Rev. Research 2, 023199 (2020)

Speaker: Prof. Martin Aeschlimann
Department of Physics and Research Center OPTIMAS,
University of Kaiserslautern-Landau, Germany

Short Biography of the Speaker:

Martin Aeschlimann is a Swiss physicist. He is a professor in the department of Physics at the University of Kaiserslautern, Germany.His main research program is devoted to the investigation of ultrafast phenomena in solids, thin films and nanoparticles. This includes the combination of short pulsed laser systems with surface science technology in order to develop novel methods for measuring ultrafast relaxation processes in real time with high temporal and spatial resolution. Martin Aeschlimann received his PhD from ETH Zurich in 1989 and then did postdoc at the National Institute of Standards and Technology (NIST) and University of Rochester, USA from 1989 - 1993. Following 5 years as a senior research associate at ETH Zurich (where he completed his habilitation),he was then appointed as a professor in the University of Essen, Germany in 1998. In the year 2000 he moved to the University of Kaiserslautern, Germany as professor.

Martin Aeschlimann has been elected as a council member of the German Physical Society (DPG) several times and was an advisory board member of the Stanford linear accelerator PULSE from 2008-2010.From 2008 - 2015 he was the chair of priority program 'Ultrafast Nanooptics' of DPG and the chair for 'Condensed Matter Section' of DPG from 2015 - 2018.He has been the spokesman for the *State Research Center for Optics and Materials Sciences(OPTIMAS)* since 2008 and the chair for Transregional Collaborative Research Center '*Spin+X*' since 2016. He was the director of the *Nano Structuring Centre (NSC)* in the University of Kaiserslautern (2008 – 2021) and has been the head of the research facility called '*Laboratory for advanced spin engineering (LASE)*' in Kaiserslautern since 2014. Martin Aeschlimannhas been an editorial board member of the New Journal of Physics since 2009 and have >200 scientific publications in refereed international journals.

https://physik.rptu.de/ags/aeschlimann
https://de.wikipedia.org/wiki/Martin_Aeschlimann