



Institute Colloquium

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

Title:

Terahertz pulse shaping and chirality control using magnetic heterostructures

Abstract:

Terahertz (THz) radiation, spanning from 0.3 - 30 THz, fills the crucial gap between the microwave and infrared spectral range. THz technology has applications in various fields, from imaging and sensing to telecommunication and biosensing. However, the full potential of these applications is often hindered by the need for precise control and manipulation of the frequency and polarization state, which typically requires external THz modulators [1]. Here, we demonstrate a hybrid THz source that overcomes this limitation by integrating two THz emitters into a single device to enable pulse shaping and chirality control of the emitted radiation without external components [2]. The two sources are a spintronic emitter (SE) [3] and a semiconductor photoconductive antenna (PCA) [4]. The two emitters respond independently to external parameters: the PCA is controlled by the applied bias voltage, while the SE is controlled by the applied magnetic field or the internal magnetic field distribution [5,6]. Moreover, a dual-wavelength excitation scheme allows for control of the relative time delay between the THz emission from each constituent. These properties of the hybrid emitter enable precise control of the mixing of the two signals to control the frequency, polarization, and chirality of the overall THz radiation. This on-chip hybrid emitter thus provides a powerful platform for engineered THz radiation with wide-ranging potential applications.

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References:

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Speaker: *Dr. Benjamin Jungfleisch*
Associate Professor of Physics and Astronomy at the University of Delaware

Short Biography of the Speaker:

Dr. Benjamin Jungfleisch is an Associate Professor of Physics and Astronomy at the University of Delaware. His research interest encompasses many magnetism-related effects, including spin-transport phenomena and spin dynamics. He received the National Science Foundation EPS CoR RII Track-4 Fellowship in 2018, the Department of Energy Early Career Research Award in 2019, and the National Science Foundation CAREER Award in 2024. Before joining the University of Delaware, he was a postdoctoral researcher at Argonne National Laboratory.

He received his M.S. and Ph.D. in Physics from the University of Kaiserslautern, Germany.



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2025



11.30 am



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