



IFMP Seminar

Date Monday, July 20, 2026, at 14:50

REC/C213

Zoom: 633 2801 2201, Passcode: IFMP2025-6

Speaker **Shirsoprattim Chattopadhyay**

IFMP, TU Dresden

Title **Decoding a magnet's soul: The art of interrogating stray fields**

Abstract Reconstructing the underlying magnetic structure from stray-field measurements is a central inverse problem across spintronics, materials science, medicine, and geology. However the problem is notoriously ill posed — multiple solutions can fit a particular experimentally measured stray field profile. Classical Fourier inversion imposes restrictive assumptions on the sample geometry and magnifies noise, limiting its applicability for many advanced applications. This has led to more advanced machine-learning- and optimization-based algorithms in recent years to address the issue. Using physics-informed optimization, we investigate the degeneracy of the forward operator with respect to topology. In particular we show how topologically distinct textures such as skyrmions and merons can give rise to near-identical stray fields under realistic magnetometry setups, challenging the widespread use of the topological charge as a strong regularizer term in modern reconstruction methods. Next we incorporate uncertainty quantification into an Untrained Physics-Informed Neural Network (uPINN) approach by Dubois *et al*, an enhancement that instead of a single deterministic solution, tells us how confident the model is about the reconstruction, a feature previously absent in the literature. Finally, we apply a state-of-the-art differentiable micromagnetics package NeuralMag (Abert *et al*) to perform full 3D magnetization reconstruction of a complex synthetic antiferromagnetic layered structure, from NV vector-field magnetometry data. We conclude with a roadmap of future projects and exciting directions in this frontier.

Host: A. Singha