



Seminar, Department of Physical Sciences, Bose Institute, Kolkata



Probing Spin- and Valley-Dependent Phenomena in 2D Semiconductors Using Ultrafast Spectroscopy

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Abstract: Two-dimensional (2D) semiconductors exhibit unique spin- and valley-dependent properties arising from quantum confinement, strong Coulomb interactions, and spin-orbit coupling [1, 2]. These properties offer opportunities for developing future quantum, valleytronic, and spintronic devices. In this talk, I will present our recent studies on valley polarization in transition metal dichalcogenides (TMDs) and spin dynamics in 2D metal halide perovskites using helicity-resolved transient absorption spectroscopy. In MoS₂, we demonstrate prolonged valley polarization and show how vanadium doping, substrate-induced strain, and defect engineering influence intervalley coupling and valley depolarization [3, 4]. In mixed-phase Ruddlesden-Popper perovskites, we investigate how layer-number engineering affects spin- relaxation dynamics and track the evolution of spin-polarized excitons across different phases [2]. These studies highlight the role of material composition, structural properties, and defects in controlling spin- and valley-dependent phenomena in 2D semiconductors.

- **Date/time: October 30, 2026 (Friday) at 04:15 PM**
- **Venue: Room 204, Physics Seminar Room, (Second floor, UAC, BI)**

References:

1. Ashish Soni, Suman Kalyan Pal, J. Phys. D: Appl. Phys. 55 (2022) 303003.
2. Sushovan Sarkar et al., arXiv:2512.06773, 2025. <https://arxiv.org/abs/2512.06773>.
3. Dipak Maity et al., Phys. Rev. Mater. 8 (2024) 064004.
4. Ashish Soni et al., Nanoscale 17 (2025) 25727.