Seminar, Department of Physical Sciences, Bose Institute, Kolkata

Engineering excitonic many body physics in transition-metal dichalcogenides

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Abstract: Transition metal dichalcogenides (TMDs) provide an exceptional platform for exploring strongly interacting excitonic quasiparticles and engineering their properties for next generation optoelectronic, valleytronic, and quantum photonic technologies. In this talk, I will present our recent efforts to manipulate excitonic many body states through plasmonic, structural, electrical, and strain engineering. First, I will discuss plasmon mediated light matter interactions in a monolayer (ML) TMD (WS2), where localized surface plasmons enable the observation of optically forbidden dark trions at elevated temperatures together with unconventional negative valley polarization dynamics. I will then show how Mn intercalation tailors the excitonic landscape and electronic band structure of TMDs, followed by our discovery of a new exciton recombination pathway in extremely hole doped charge tunable ML TMDs. Next, I will focus on exciton transport in ML TMDs. Using advanced spatiotemporal optical spectroscopy, we investigate strain-controlled exciton transport and exciton diffusion/transport at high exciton densities, where hot biexciton populations generate halo like emission profiles. Finally, I will present our recent observation of an unusual super ballistic exciton transport regime in extremely electron doped monolayer TMDs. These studies demonstrate how plasmonic coupling, electrostatic doping, and strain can be harnessed to control excitonic interactions across multiple length and time scales, opening new opportunities for excitonic circuitry, valleytronic devices, and quantum photonic technologies.

- **Date/time: August 18, 2026 (Tuesday) at 03:00 PM**
- **Venue: Room 204, Physics Seminar Room, (Second floor, UAC, BI)**