S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES
Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

21st May 2026 **4.00 PM** **ONLINE / FERMION**

SPEAKER

Dr. Atikur Rahman, Associate Professor
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TITLE OF THE TALK

Defect-Controlled Optoelectronics in 2D TMDs

ABSTRACT

Defect engineering provides a powerful platform to tailor the electronic structure, symmetry, and carrier dynamics of two-dimensional (2D) transition metal dichalcogenides (TMDs) for advanced optoelectronic applications. In this talk, I will discuss how controlled defects and structural asymmetry can be harnessed to engineer high-performance optoelectronic functionalities in TMDs.

In monolayer MoS 2 , we demonstrated that intrinsic sulfur vacancies play a crucial role in modulating charge transport. Metal precursor-assisted CVD-grown MoS 2 exhibits high field-effect mobility (>100 cm 2 V -1 s -1), which we attributed to defect-induced modification of the electronic density of states near the conduction band. I will further show how solvent-assisted cation-exchange morphotaxy enabled controlled Cu incorporation into MoS 2 , leading to stable p-type doping, strongly suppressed dark current, enhanced light-to-dark ratio, and significantly faster photoresponse.

Beyond point defects, I will present our work on screw dislocation-driven spiral WS 2 , where growth-induced structural asymmetry gave rise to a robust bulk photovoltaic effect (BPVE) without external strain or junction engineering. Strong second-harmonic generation confirmed the presence of intrinsic symmetry breaking and built-in strain in these structures. The resulting devices exhibited performance surpassing previously reported WS 2 -based BPVE systems, highlighting spiral WS 2 as a promising platform for self-powered optoelectronic and photovoltaic technologies.

These findings not only deepen our understanding of the role of defects in tailoring the properties of 2D TMD materials but also open up exciting new possibilities for developing next-generation optoelectronic and memristive devices.

HOST FACULTY

Dr. Atindra Nath Pal, Associate Professor

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