



**S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES**

Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

03rd January, 2023

11.00 AM

ONLINE/ FERMION

SPEAKER

**Dr. Somesh Chandra Ganguli,
Postdoctoral Researcher,
Department of Applied Physics,
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TITLE OF THE TALK

DESIGNER QUANTUM MATTER IN VAN DER WAALS HETEROSTRUCTURES

ABSTRACT

In my talk, I will show the versatility of employing van der Waals (vdW) heterostructures to engineer artificial electronic phenomena. The vdW systems has recently become de facto platform for the designer materials for its extremely clean, defect-free and atomically well-defined interfaces. These factors make it possible to combine materials with seemingly competing electronic orders such as ferromagnetism, superconductivity.

In the first part of my talk, I will describe the fabrication of designer 2-dimensional topological superconductor having 1-dimensional Majorana edge modes by combining 2D ferromagnet, namely monolayer CrBr₃ and s-wave superconductor NbSe₂ [1]. I will also demonstrate how the Moire' pattern between CrBr₃ and NbSe₂ modulates the topological band structure [2]. In the second part of my talk, I will demonstrate that Kondo coupling between 2 different geometrical phases of TaS₂, namely 1T-TaS₂ having localized magnetic moments and 1H-TaS₂ having itinerant conduction electrons generates artificial heavy fermion system [3] which mimics the behavior of compounds containing rare-earth elements with 4f or 5f electrons. Finally, I will talk about the signatures of unconventional superconductivity in monolayer transition metal dichalcogenide superconductors 1H-NbSe₂ [4] and 1H-TaS₂ [5] demonstrating the role of the dimensionality and confinement in realizing unconventional superconductivity in vdW systems.

References:

- [1] Nature 588, 424–428 (2020)
- [2] Nano Lett. 22, 1, 328–333 (2022)
- [3] Nature 599, 582–586 (2021)
- [4] Nano Lett. 2022, 22, 5, 1845–1850
- [5] arXiv:2112.07316 (<https://doi.org/10.48550/arXiv.2112.07316>)

HOST FACULTY

Prof. Priya Mahadevan, Senior Professor
