



## ICTS Condensed Matter Seminar (HYBRID)

**Title** : Electrically tunable magnetism in Van der Waals heterostructures

**Speaker** : Shubhayu Chatterjee (Carnegie Mellon University, USA)

**Date** : Wednesday, 8<sup>th</sup> November 2023

**Time** : 11:30 AM (IST)

**Abstract** : Controlling magnetism via electric fields can aid information storage and transfer using spin-degrees of freedom, thereby avoiding Joule heating and paving the way for energy-efficient devices. However, magnetism in most materials arise due to a combination of Coulomb repulsion and Fermi statistics, neither of which can be directly controlled by electric fields. Recently, electrically tunable orbital magnetism has been observed in twisted graphene systems, raising hopes that such control may be tunably realized in Van der Waals heterostructures. In this talk, we will discuss two potential material platforms for such control. First, we will consider twisted transition metal dichalcogenide (TMD) homobilayers, and identify, via analytical arguments and exact diagonalization, a robust multiferroic insulator with co-existing ferro-electricity and magnetism over a range of twist angles. In this case, tuning electrical polarization by electric fields can be used to control magnetism. Second, we will propose and analyze chiral few-layered graphene encapsulated by TMDs (no twisting) to induce spin-orbit coupling, and show that one may use electric fields to selectively flip either spin or orbital magnetism that is present spontaneously due to interaction-induced spin and/or valley polarization.

Based on arXiv: 2210.14918 and 2303.04855

**Venue** : Offline: Madhava Lecture Hall

Online: Please click on the below link to join the seminar

<https://zoom.us/j/97402537811?pwd=Ui8yckgvMnZuOXk3YTc4cDMrUFBTZz09>