

CONDENSED MATTER THEORY SEMINAR

Subject: **Spiral Orders and Textured Exciton Insulators in Moiré Materials**

Speaker: **Prof. Dr. Siddharth A. Parameswaran (Department of Physics, University of Oxford)**

Date & time: **Friday, 12th of July 2024 at 3:15 p.m.**

Venue: **Room 01.114**

Abstract:

I will discuss the interplay of interactions, topology, and symmetry in magic-angle twisted bilayer graphene, and present theoretical calculations indicating that the correlated insulating behaviour observed at integer filling of its narrow bands is driven by formation of an unusual “Incommensurate Kekulé spiral” (IKS) order. The hallmark of this order is an atomic-scale charge density wave pattern that is modulated on the longer moiré scale. These predictions were recently confirmed by a pair of spectacular scanning tunneling microscopy experiments that directly imaged the IKS order parameter in bi- and tri-layer graphene. I will then argue that the IKS phase is an instance of a broader class of “textured exciton insulators” that can arise topological bands with Chern or Euler obstructions to constructing a localized atomic limit. I will show that textured excitonic insulators cannot be adiabatically connected to a local-moment pseudospin description, and suggest other moiré materials where they may emerge.

References:

PRX 11, 041063 (2021); PRL 128, 156401 (2022); PRB 109, L201119 (2024);
arXiv: 2303.13602; arXiv: 2406.15342; arXiv: 2406.1534.