

# SEMINAR: Tuneable screening effects in twisted graphene multilayers

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12:00 to 13:00

Seminar Room

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## **Abstract:**

Electrostatic screening is a powerful way to tune electron-electron interactions, central to phenomena like correlated insulators, charge density waves, and superconductivity. In the first part of my talk, I will present a double-layer graphene system with a large twist angle, allowing independent control over the carrier density in each layer. By doping one layer, we suppress charge inhomogeneities in the other, enabling Landau quantization at just a few mT which corresponds to the quantum mobility exceeding that of state-of-the-art GaAs 2DEGs. We also observe a robust bandgap in ultra-clean graphene and discuss its possible origins. In the second part, I will show how screening affects correlations in magic-angle TBG. In tetralayer devices with two decoupled TBG layers, doping the secondary TBG suppresses both correlated insulator gaps and superconductivity in the primary one. This highlights the role of screening in tuning correlations and offers insight into the mechanisms behind superconductivity in TBG.

## **Short Bio:**

Prof. Alexey Berdyugin received his bachelor's and master's degrees in condensed matter physics from Moscow Phystech in 2016. Next, he conducted doctoral research at the University of Manchester under the supervision of Nobel Prize laureate, Sir. Andre Geim. In 2022, Dr Berdyugin joined the National University of Singapore as an Assistant Professor, where he has received the NUS Presidential Young Professorship award, and more recently National Research Foundation (NRF) of Singapore Fellowship Award 2024. Research works of Dr Berdyugin have pioneered non-linear electron transport studies of the novel twisted heterostructures which resulted in the discovery of a novel current propagation regime, as well as electron hydrodynamic and the giant magnetoresistance effect recently discovered in high-quality graphene heterostructures.

**Hosted by:** Prof. Dr. Frank Koppens