Department of Physics
Condensed Matter Physics
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UNIVERSITY OF OXFORD

CONDENSED MATTER SEMINAR

Thursday 5 December at 2.15pm

"Twistable electronics with dynamically rotatable heterostructures"

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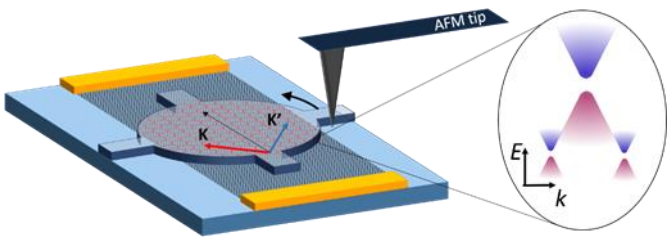
A simple, yet effective, way to modify the properties of 2D materials is by stacking them in a van der Waals heterostructures and controlling the relative angular orientation between its layers. This in situ band structure manipulation offers unique opportunities toward understanding of multiple physical phenomena and the design of novel opto-electronic devices. A striking example of this is the recent observation of strongly correlated states and intrinsic superconductivity in twisted bilayer graphene. The clearest example of the effects of angular alignment in a heterostructure is graphene on hexagonal boron nitride (BN), in which the layer orientation determines the wavelength of a superimposed moiré superlattice. The superpotential modifies the native band structure of graphene opening an energy gap and generating minigaps at higher energies. However, current techniques are limited to fabrication of samples with fixed interlayer angles. Studies of angular dependence are therefore limited to static properties, and require multiple samples, which imposes experimental challenges and introduces uncertainty due to sample-to-sample variations.

In this talk I will present a new technique which allows to modify in situ optical, mechanical and electronic properties of a BN/graphene/BN heterostructures, in this the angle between layers is changed continuously with a control better than 0.2 degrees. Combining these three measurements in the same device demonstrates the new capability to precisely tune in situ the properties of a van der Waals heterostructure. Our new experimental technique opens the possibility to study the angle-dependent properties of van der Waals heterostructures and in situ band structure engineering of 2D materials.



Host: Prof Sid Parameswaran
Simpkins Lee Room, Beecroft Building