Theory of quantum matter

Jeudi 10 Fevrier 2022, 14 :00
LPTHE, INSP Jussieu 22-23 3-17 and online (zoom link at the end of the abstract)
Domaines : math-ph

Titre : *Tunable valley currents in aligned bilayer graphene/BN*

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Résumé : *The relative angular alignment between 2D layers of a van der Waals (vdW) heterostructure can dramatically alter its fundamental properties[1]. A striking example is the recent observation of strongly correlated states and intrinsic superconductivity in twisted bilayer graphene[2]. Another remarkable effect of angular layer alignment, predicted for certain vdW heterostructures, is the emergence of phases of matter with non-trivial topological properties, where charge carriers flow without dissipation, being protected against perturbations. In graphene aligned with boron nitride (BN), such a phase has been predicted, with topological protection linked not to the spin, as commonly observed, but rather to the valley degree of freedom.*

The experimental observations of these topological valley currents [3] has been largely put in question by theorist, results of numerical simulation [4] and recent scanning SQUID results[5]. In these, the observed non-local signal have been attributed mostly to localized states on the edge of graphene. In this talk, we will show how these two pictures are not incompatible and can be reconciliated if we take the angular layer alignment into account.

[1] Ribeiro-Palau et al., Science 361 (2018), 690 [2] Cao et al., Nature 556 (2018) 43. [3] Gorbachev et al., Science 436 (2014), 448; Komatsu et al., Science Advances 4 (2018) eaaq0194 [4] J M Marmolejo-Tejada et al., J. Phys. Mater. 1 (2018) 015006 [5] A. Aharon-Steinberg et al., Nature 593 (2021), 528

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