Séminaire Valla FATEMI

Vendredi 11 Mai 2018 à 11h00

Salle réunion du LSI – bat 83-2034
Ecole polytechnique – Batiment 83

Gate-Accessible Superconductivity and Helical Modes in Monolayer WTe2

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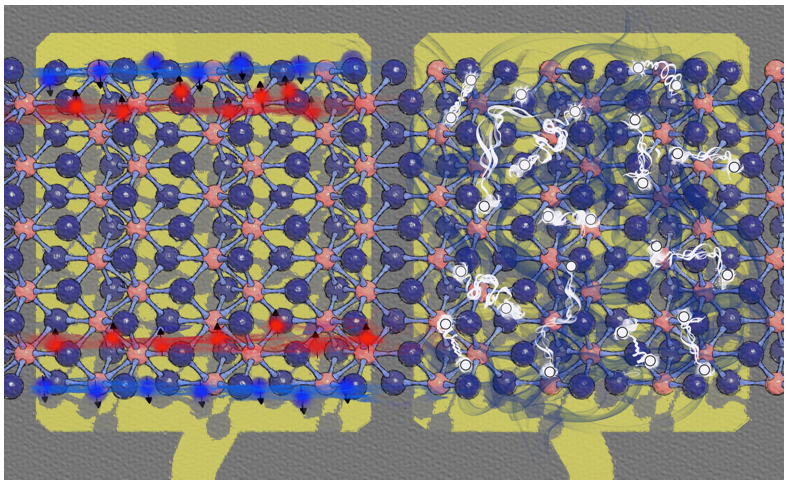

Quantum materials research aims to uncover exotic physics and new approaches toward applied technologies. Two-dimensional crystals consisting of individual layers of van der Waals materials provide an exciting platform to study topological and correlated electronic states. These same crystals can be flexibly restacked into van der Waals heterostructures, which enable clean interfaces between heterogeneous materials. Such heterostructures enable the isolation and protection of air-sensitive 2D materials as well as provide new degrees of freedom for tailoring electronic structure and interactions. In this talk, I will present our experimental work studying quantum electronic transport in monolayer WTe2. First, un-doped monolayer WTe2 exhibits behaviors characteristic of a 2D topological insulator, including edge mode transport approaching the quantum of conductance up to nearly 100 Kelvin. Second, we have discovered that the same monolayers display superconductivity at exceptionally low carrier density, accessible by local field-effect gating through a low-κ dielectric. The concurrence of electrostatically accessible superconductor and topological insulator phases in the same 2D crystal allows us to envision monolayer WTe2 as the platform for a new model of gate-configurable topological electronic devices. I will also briefly discuss our results on twisted bilayer graphene, a new platform for strongly correlated physics.

(1) S. Wu, V. Fatemi, Q. D. Gibson, K. Watanabe, T. Taniguchi, R. J. Cava, P. Jarillo-Herrero, Observation of the quantum spin Hall effect up to 100 kelvin in a monolayer crystal. Science **79**, 76–79 (2018).
(2) Y. Cao, V. Fatemi, S. Fang, K. Watanabe, T. Taniguchi, E. Kaxiras & P. Jarillo-Herrero, Correlated Insulator Behaviour at Half-Filling in Magic Angle Graphene Superlattices, Nature **556** 80-84 (2018).
(3) Y. Cao, V. Fatemi, S. Fang, K. Watanabe, T. Taniguchi, E. Kaxiras & P. Jarillo-Herrero, Unconventional superconductivity in magic-angle graphene superlattices. Nature **556**, 43–50(2018).