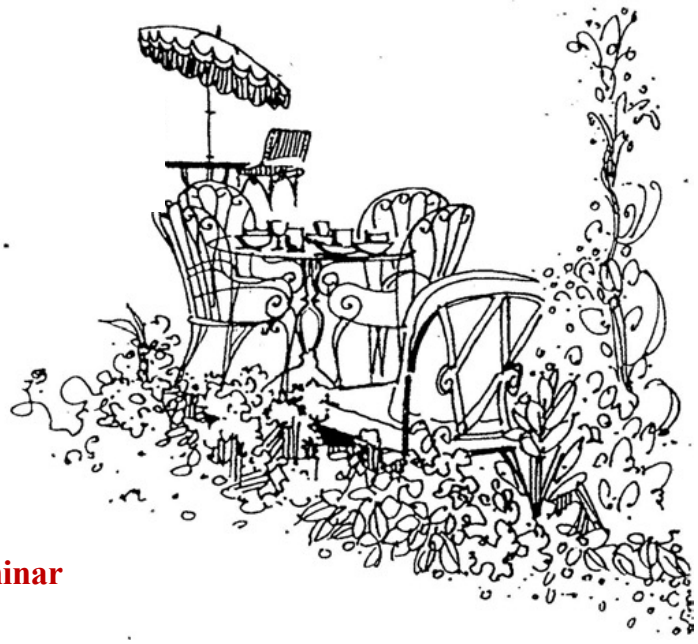
Chez Pierre

Presents ...

Monday, November 6, 2023

12:00 pm -1:00 pm

Duboc Room – 4-331



Chez Pierre Seminar

Stevan Nadj-Perge, California Institute of Technology

"Superconductivity and Strong Correlations in (un)-Twisted Graphene Multilayer Structures".

The discovery of magic-angle twisted bilayer graphene sparked unprecedented research efforts in understanding the phases of graphene-based strongly correlated electronic systems. In this talk, I will present two recent experiments from our lab focusing on addressing the nature of correlated and superconducting phases in this family of materials. First, I will discuss scanning tunneling microscopy measurements in magic-angle twisted trilayer graphene that reveal spatial signatures of Kekulé supercell reconstruction indicating the formation of the intervalley-coherent state in the filling range of 2-3 holes (electrons) per moiré site [1]. This state appears closely related to correlated insulating and superconducting phases in the system, and its slow modulation on the scale of several moiré sites is consistent with the theoretically proposed incommensurate Kekulé spiral order. In the second half of the talk, I will present a series of transport measurements focusing on the Bernal bilayer graphene placed in large displacement electric fields that show robust superconductivity at zero magnetic field when proximitized with spin-orbit inducing monolayer WSe2 [2]. By tuning the twist angle between WSe2 and the bilayer, we further demonstrate that the critical temperature of the superconducting phase is greatly affected by the induced spin-orbit coupling strength.

References:

[1] Hyunjin Kim, Youngjoon Choi, Étienne Lantagne-Hurtubise, Cyprian Lewandowski, Alex Thomson, Lingyuan Kong, Haoxin Zhou, Eli Baum, Yiran Zhang, Ludwig Holleis, Kenji Watanabe, Takashi Taniguchi, Andrea F. Young, Jason Alicea, Stevan Nadj-Perge,
Imaging inter-valley coherent order in magic-angle twisted trilayer graphene,
ArXiv:2304.10586 (2023, accepted in Nature).

[2] Yiran Zhang, Robert Polski, Alex Thomson, Étienne Lantagne-Hurtubise, Cyprian Lewandowski, Haoxin Zhou, Kenji Watanabe, Takashi Taniguchi, Jason Alicea & Stevan Nadj-Perge,
Enhanced superconductivity in spin–orbit proximitized bilayer graphene Nature **613**, 268 (2023).