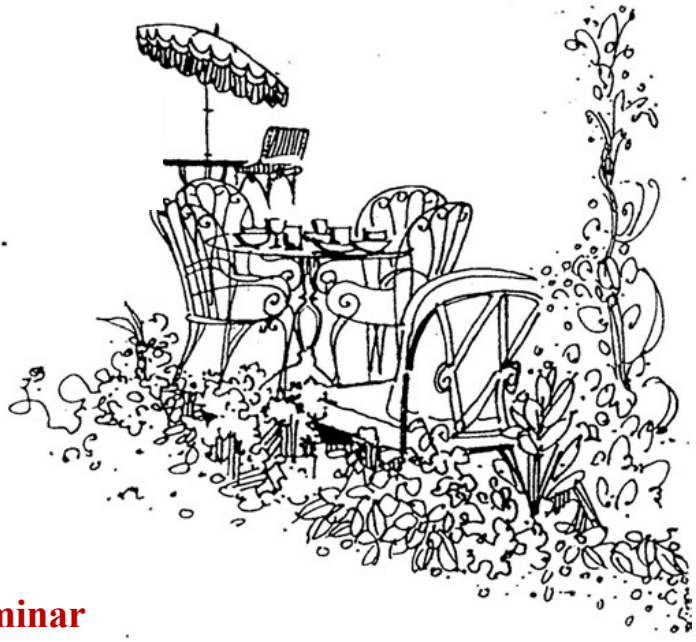
Chez Pierre

Presents ...

Monday, November 27, 2023

12:00 pm -1:00 pm

Duboc Room – 4-331



Chez Pierre Seminar

Jun Zhu, Penn State University

"Many-body ground states and collective excitations in a tunable 2D system".

The Landau levels (LLs) of a two-dimensional electron system support a plethora of fascinating many-body ground states and collective low-energy excitations, thanks to enhanced electron-electron interactions and the characteristics of the LL wave functions. The n=1 LL is particularly fascinating as it hosts even-denominator fractional quantum Hall states and other exotic topological orders that are potentially useful in topological quantum computation. In this talk, I will describe a few recent experiments of ours in Bernal-stacked bilayer graphene, which is a remarkably tunable platform for exploring emergent phenomena. In particular, an electric displacement field-tuned valley degree of freedom acts as an SU(2) pseudospin. A new even-denominator fractional quantum Hall state is observed at low D-field and is found to be spontaneously valley polarization in the limit of vanishing valley Zeeman energy. Our measurements show that even-denominator fractional quantum Hall states in bilayer graphene are accompanied by the Levin-Halperin daughter states of either the Pfaffian or the anti-Pfaffian order. Further, at filling factor 7/5, a new fractional quantum Hall state develops at the coincidence of the N=1 and N=0 LLs. Its appearance points to an unusual type of two-component fractional quantum Hall state.

K. Huang, H. Fu, Danielle Reifsnyder Hickey, Nasim Alem, Xi Lin, K. Watanabe, T. Taniguchi, J. Zhu, "Valley Isospin Controlled Fractional Quantum Hall States in Bilayer Graphene", Physical Review X 12, 031019 (2022). Phys. Rev. X 12, 049901 (2022)

Levin and Halperin, PRB, 79, 205301 (2009)