

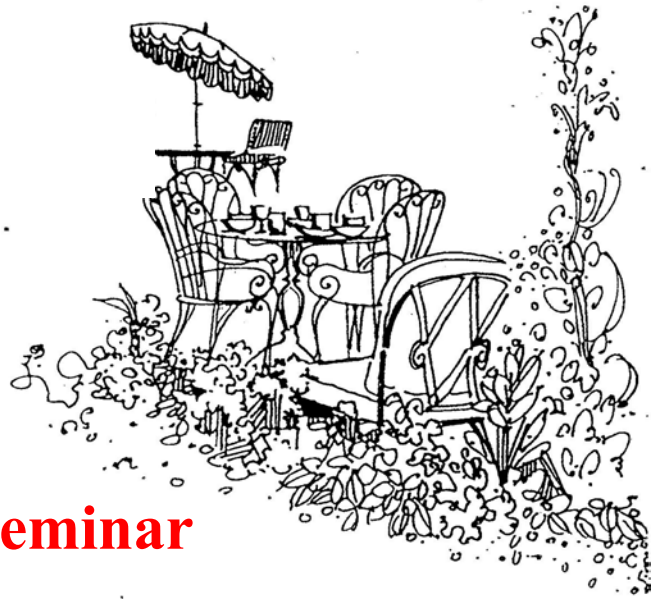
Chez Pierre

Presents ...

Monday, April 26, 2021

12:00pm Noon

Broadcast via Zoom



Chez Pierre Seminar

Michael Crommie – University of California, Berkeley

"Imaging Spinons in a 2D Gapless Quantum Spin Liquid"

Two-dimensional triangular-lattice antiferromagnets are predicted under some conditions to exhibit a quantum spin liquid ground state whose low-energy behavior is described by a spinon Fermi surface [1]. This “ghost” Fermi surface (in an otherwise insulating material) is a key concept for understanding spin liquids and their relationship to other quantum phases. Directly imaging the spinon Fermi surface, however, is difficult due to the fractional and chargeless nature of spinons. I will discuss how we have used scanning tunneling microscopy (STM) to image density fluctuations arising from a spin liquid Fermi surface in single-layer 1T-TaSe₂, a two-dimensional Mott insulator [2]. Evidence for quantum spin liquid behavior was observed in isolated single layers of 1T-TaSe₂ through long-wavelength modulations of the local density of states at Hubbard band energies. These modulations are consistent with a spinon Fermi surface instability in single-layer 1T-TaSe₂ and allow direct experimental measurement of the spinon Fermi wavevector, in agreement with theoretical predictions for a 2D quantum spin liquid [3]. Our results suggest that single-layer 1T-TaSe₂ is a useful new platform for studying novel two-dimensional quantum spin liquid phenomena.

[1] K. T. Law and P. A. Lee, PNAS 114, 6996 (2017).

[2] Y. Chen, W. Ruan, M. Wu, S. Tang, H. Ryu, H.-Z. Tsai, R. Lee, S. Kahn, F. Liou, C. Jia, O. R. Albertini, H. Xiong, T. Jia, Z. Liu, J. A. Sobota, A. Y. Liu, J. E. Moore, Z.-X. Shen, S. G. Louie, S.-K. Mo, and M. F. Crommie, Nat. Phys. (2020), <https://doi.org/10.1038/s41567-019-0744-9>.

[3] W. Y. He, X. Y. Xu, G. Chen, K. T. Law, and P. A. Lee, PRL 121, 046401 (2018).