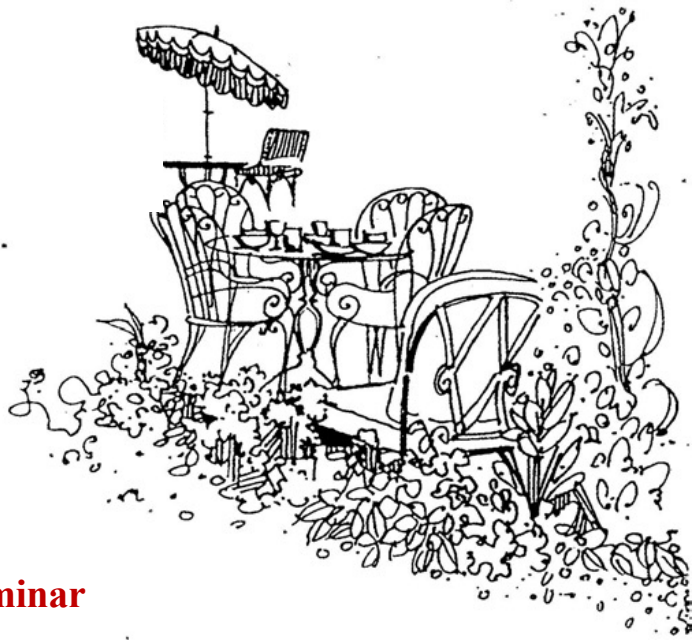
Chez Pierre

Presents …

Monday, February 27, 2023

12:00pm Noon

Duboc Room – 4-331



Chez Pierre Seminar

Javier Sanchez-Yamagishi, UC Irvine

"Squeezing 3D to 2D: ultrathin bismuth crystals grown inside an atomically-flat van der Waals mold"

In a helical conductor, the spin orientation of a carrier is tied to its direction of propagation, enabling the electrical generation and detection of spin polarization. Bismuth is known to host helical states at its surfaces and edges, which have been explored extensively by STM and ARPES. However, transport measurements of these helical boundary modes have been limited by difficulties in growing thin films of bismuth with low disorder.

We have developed a new way to make ultrathin crystals of bismuth by growing them within a nanoscale mold made of van der Waals (vdW) materials. The resulting bismuth single-crystals are ultraflat due to being templated by the atomically-flat vdW mold. We measure quantum oscillations originating from the electron and hole pockets of the 111 surface, which have yet to be observed in transport measurements of MBE-grown films. We ascribe the improvement to the substantially flatter crystal surfaces of the vdW-molded bismuth.

These crystals are enabling us to study the intrinsic transport properties of thin bismuth, where transport through helical boundary modes can be isolated. I will also discuss our application of the vdW-mold technique to the growth of other materials.

Time permitting, I will also briefly discuss our recent work in producing mechanically-tunable vdW heterostructure devices, as well as our investigation of phonon amplification effects in graphene.

1) *"Ultrathin crystals of bismuth grown inside atomically-smooth van der Waals materials"* Chen … JSY
https://arxiv.org/abs/2211.07681

2) *"Mechanically-reconfigurable van der Waals devices via low-friction gold sliding"* Barabas … JSY
https://arxiv.org/abs/2212.02536

Bio: Javier Sanchez-Yamagishi is an Assistant Professor in the Department of Physics & Astronomy at the University of California, Irvine. His lab studies quantum electronic transport in van der Waals and topological materials with a special emphasis on developing new nanofabrication and measurement techniques. Previously, he was a postdoctoral fellow at the Harvard Quantum Optics Center, where he explored the application of spin qubits as nanoscale magnetometers for 2D materials. He did his PhD at MIT studying the electronic properties of twisted graphene heterostructures.