

# *Chez Pierre*

Presents ...

**Monday, September 9, 2019**

**12:00pm Noon**

**MIT Room 4-331**

## **Chez Pierre Seminar**

**Jun Zhu – Pennsylvania State University**

**“Topological valleytronics in bilayer graphene”**

The advent of two-dimensional materials with hexagonal crystal symmetry offers a new electronic degree of freedom, namely valley, the manipulation and detection of which could potentially be exploited to form new many-body ground states as well as new paradigms of electronic applications. In this talk, I will describe how we create valley-momentum locked topological 1D channels, aka quantum valley Hall kink states, in Bernal stacked bilayer graphene by electrically generating inverted band structures[1]. This all-electric construction gives us the ability to realize reconfigurable ballistic waveguides and device operations that explicitly explore the valley-momentum locking of the kink states. I will show the working of a topological valley valve, which does not require valley-polarized current to operate but relies on the control of topology, and a continuously tunable electron beam splitter[2], which is akin to the function of a quantum point contact for quantum Hall edge states. The high quality and versatile control of the kink states open the door to many exciting fundamental physics inquiries in 1D. Its realization requires the development of high-precision lithography on BN/graphene/BN heterostructures. Time permitting I will touch upon other works this technique has enabled.

[1] J. Li, K. Wang, K. J. McFaul, Z. Zern, Y. F. Ren, K. Watanabe, T. Taniguchi, Z. H. Qiao, J. Zhu, “Gate-controlled topological conducting channels in bilayer graphene”, *Nature Nanotechnology*, **11**, 1060 (2016)

[2] Jing Li, Rui-Xing Zhang, Zhenxi Yin, Jianxiao Zhang, Kenji Watanabe, Takashi Taniguchi, Chaoxing Liu, Jun Zhu, “A valley valve and electron beam splitter”, *Science* **362**, 1149 (2018)

