Chez Pierre

Presents ...

Monday, April 13, 2020

12:00pm Noon

Broadcast via Zoom

Chez Pierre Seminar

Hiroki Isobe – Massachusetts Institute of Technology

"High-frequency rectification via chiral Bloch electrons"

Continual improvements in two-dimensional materials have opened a new venue in quantum material science. Represented by graphene and transition metal dichalcogenides, high-quality samples, together with progress in fabrication techniques, unlocked the potential as a building block in electronics in the next generation. As a step, we propose a new mechanism for high-frequency rectification that utilizes an intrinsic property of those quantum crystals. Rectification is a process that converts oscillating electric fields to direct current. Existing rectifiers rely on semiconductor junctions, which suffer from fundamental limitations for small-voltage and high-frequency inputs, namely a voltage smaller than millivolts and a frequency higher than gigahertz. Skew scattering mechanism that we reveal for the second-order response circumvents the known issues for high-frequency rectification. Our calculations show large and tunable rectification effects in graphene multilayers. It demonstrates the possibility of realizing high-frequency rectifiers by rational material design and quantum wave function engineering.