Physics Colloquium

Wednesday

April 4

4:00 P.M.

Rm 118 NSH

Topological phases, broken-symmetry orders and their applications in quantum devices

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The essential goal of condensed matter physics is to understand how sextillions (10E21) of electrons are organized together and form electronic materials with useful properties. Two grand organizing principles are known to human being: The first is the more familiar broken-symmetry order, as was first realized by Lev Landau. And the other is called "topological order", which explains recently discovered topological phases such as quantum Hall states and topological insulators. The physics becomes even more interesting in the so-called "correlated electron systems" where electron interaction is strong and different kinds of orders start to coexist and compete with each other. In this talk, I will discuss our recent progress in investigating these different orders in topological Kondo insulator [4,7], Majorana edge chiral state [2], two dimensional topological superconductor [5] and two dimensional van der Waals crystals [3]. By extension, I will also describe devices [1,6] that we made from these materials, as well as their potential applications in spintronics and robust quantum computers.

References:

1. "Localized Control of Curie Temperature in Perovskite Oxide Film by Capping-layer-induced Octahedral Distortion", Phys. Rev. Lett. , 119, 177203 (2017).
2. "Chiral Majorana fermion modes in a quantum anomalous Hall insulator–superconductor structure", Science, 357(6348), 294–299 (2017).
3. "Discovery of intrinsic ferromagnetism in 2D van der Waals crystals", Nature, 546, 265-269 (2017).
4. "Surface-dominated conduction up to 240 K in the Kondo insulator SmB6 under strain", Nature Materials, 16, 708-711 (2017).
5. "Time-Reversal-Symmetry-Breaking Superconductivity in Epitaxial Bismuth/Nickel Bilayers", Science Advances, 3, 3, e1602579 (2017).
6. "Radio Frequency Tunable Oscillator Device Based on SmB6 Micro-crystal", Phys. Rev. Lett. 116(16), 166603, (2016).
7. "Topological Kondo Insulators", Annual Review of Condensed Matter Physics, Volume 7 (2016).

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