



Weekly Seminar

Berryogenesis: spontaneous out-of-equilibrium plasmonic magnetism

Justin Song

Division of Physics and Applied Physics, NTU Singapore



Time: 4: 00 pm, May.22, 2019 (Wednesday)

时间: 2019年5月22日 (周三) 下午4:00

Venue: Room W563, Physics building, Peking University

地点: 北京大学物理楼, 西563会议室

Abstract

Spontaneous symmetry breaking lies at the heart of the description of interacting phases of matter. Here we argue that a driven interacting system subject to a linearly polarized (achiral) driving field can spontaneously magnetize (acquire chirality). In particular, we find when a metal is driven close to its plasmon resonance, it hosts strong internal ac fields that enable Berryogenesis: the spontaneous generation of a self-induced Bloch band Berry flux, which supports and is sustained by a circulating plasmonic motion, even for a linear polarized driving field. This non-equilibrium phase transition occurs above a critical driving amplitude, and depending on system parameters, can enter the spontaneously magnetized state in either a discontinuous or continuous fashion. Berryogenesis relies on nontrivial interband coherences for electronic states near the Fermi energy generated by ac fields readily found in a wide variety of multiband systems. We anticipate that graphene devices, in particular, which can host high quality plasmons, provide a natural and easily available platform to achieve Berryogenesis and spontaneous non-equilibrium (plasmon-mediated) magnetization in present-day devices, e.g., those based on graphene plasmonics. If we have time, we will also discuss other manifestations of non-trivial quantum geometry in Dirac systems.

About the speaker

Justin Song is a condensed matter theorist working on unraveling the unusual electronic behavior of quantum materials. He is particularly interested the interplay between Berry phases/quantum geometry and its interplay with interacting correlated electronic systems particularly in two-dimensional materials; other interests include plasmonics, out-of-equilibrium quantum phases and unconventional transport. He is Provost's chair in physics and a Nanyang assistant professor at NTU; he is also a senior scientist at the institute of high performance computing. Previously he was a Burke fellow at Caltech, and received his PhD from Harvard in 2014. He is the recipient of a number of awards including the Young Scientist Award (2017), a National Research Foundation Fellowship (2016), Sherman Fairchild Prize/Burke Fellowship (2014).