Speaker:
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Title:
Gapless spin wave transport through a quantum canted-antiferromagnet

Abstract:
The Landau levels of graphene support quantum Hall ferromagnetism, where magnetism spontaneously develops in the spin and pseudospin degrees of freedom due to strong interactions. A quantum Hall ferromagnet can support a rich variety of gapped and gapless spin wave excitations, some of which may be useful as quantum information carriers. In this talk, I will introduce an all-electrical approach to obtain the dispersion relation ω(k) of spin wave excitations in bilayer graphene, which uses transport devices that integrate a Fabry-Pérot cavity to resonantly select discrete wave vectors of the spin wave. We observed gapless, linearly dispersed spin wave excitations in the \nu = 0 Landau level of bilayer graphene using this approach. The gapless spin wave propagates with a high group velocity of several tens of km/s and maintains long-distance phase coherence. This result provides direct experimental evidence for a predicted easy-plane, canted anti-ferromagnetic order in this material and lays the foundation for the exploration of spin superfluidity. The resonant cavity technique we developed can be generalized to investigate other collective excitations of spin and pseudospin symmetry-broken ground states.