Condensed Matter Physics Seminar Series

Fractional filling states in multilayer graphene

Marc Bockrath
OSU

Thin graphite flakes behave as two-dimensional conductors in sufficiently high magnetic fields, with quantum Hall states extended throughout the bulk of the flake for low doping, and confined to the surfaces for large doping. I will discuss our observation of half-integer fractional quantum Hall states at large total filling factors. These single-component states likely stem from Pfaffian wavefunctions derived from those in graphene bilayers, which are predicted to host nonabelian quasiparticles. The facile integration of graphite with top and back surface gates makes this an excellent system to explore device geometries capable of manipulating such quasiparticles. Moreover, we have shown that incompressible states form at 1/3 fractional filling factors in twisted bilayer graphene at angles larger than the magic one that are strongly dominant over integer fillings. These results are in agreement with a strong-coupling theory based on Coulomb interactions between electrons occupying three-lobed Wannier orbitals, leading to novel symmetry-broken phases with distinct charge, spin, and valley order.

Marc Bockrath is currently Professor of Physics at the Ohio State University. His research interests are focused on nanoscale electronics and mechanics. Bockrath has been active in this research area for approximately 25 years. Recently Bockrath has been investigating the properties of two-dimensional materials. Bockrath received his B.S. (1993) from the Massachusetts Institute of Technology and Ph.D. (1999) in Physics from the University of California, Berkeley. Bockrath has been honored by awards including the 2005 ONR Young Investigator Award and the 2006 Sloan Award.

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4-330 PAB

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