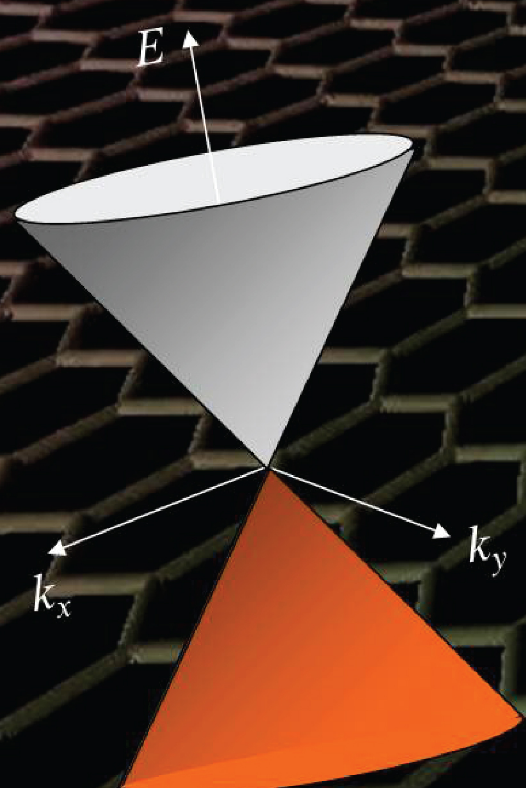
Philip Kim

"Spin and Pseudo-Spin in Graphene"



Graphene, a single atomic layer of graphite, has provided physicists opportunities to explore an interesting analogy to relativistic quantum mechanics. The unique electronic band structure of the graphene lattice yields a linear energy dispersion relation where the Fermi velocity replaces the role of the speed of light, and pseudo spin degree of freedom for the orbital wavefunction replaces the role of real spin in usual Dirac Fermion spectrum. The exotic quantum transport behavior discovered in these materials, such as the unusual half-integer quantum Hall effect and the Klein tunneling effect, are a direct consequence of the pseudo-spin rotation in graphene. Interacting systems with internal symmetries will tend to break those symmetries in order to lower their energy. In graphene, the strong Coulomb interactions and approximate spin-pseudo spin symmetry are predicted to lead to a variety of quantum Hall ferromagnetic ground states and excitations which manifest as integer quantum Hall plateaus appearing within a graphene. This presentation will discuss a variety of experimental evidence that supports the importance of spin and pseudo-spin structures in graphene at the strong quantum limit.

Philip Kim received his B.S and M.A in physics at Seoul National University in 1990 and 1992, respectively. He received his Ph.D. in Applied Physics from Harvard University in 1999. He was Miller Postdoctoral Fellow in Physics from the University of California, Berkeley, from 1999-2001. In 2002, he joined the Department of Physics at Columbia University as a faculty member, where he is now a Professor of Physics. Professor Kim is a world-leading scientist in the area of materials research, specifically experimental condensed matter physics with an emphasis on the physical properties and applications of nanoscale low-dimensional materials. The focus of his research is the mesoscopic investigation of transport phenomena, particularly electric, thermal, and thermoelectrical properties of low-dimensional nanoscale materials. In recent years he has demonstrated novel transport phenomena in low-dimensional graphitic nanomaterials such as carbon nanotubes and graphene. Kim has published more than 100 well-cited papers in professional journals and has received numerous honors and awards, including the Dresden Barkhausen Award (2011), an IBM Faculty Fellowship (2009), the Ho-Am Science Prize (2008), a Columbia University Distinguished Faculty Award (2007), and a National Science Foundation Faculty Career Award (2004). He is a Fellow of the American Physical Society (2007).

Wednesday, April 4, 2012 | 3:00 p.m.

Bldg. 402 | APS Auditorium
Argonne National Laboratory

APS COLLOQUIUM