Notre Dame Science
Department of Physics

TAILORING DIRAC FERMIONS IN MOLECULAR GRAPHENE

Condensed Matter Seminar

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in Atom Manipulation Nanoscience, Stanford University

Tuesday, December 6, 2011
4:00 p.m. NSH 123

The dynamics of electrons in solids is tied to the band structure created by a periodic atomic potential. The design of artificial lattices, assembled through atomic manipulation, opens the door to engineer electronic band structure and to create novel quantum states. We present scanning tunneling spectroscopic measurements of a nanoassembled honeycomb lattice displaying a Dirac fermion band structure. The artificial lattice is created by atomic manipulation of single CO molecules with the scanning tunneling microscope on the surface of Cu(111). The periodic potential generated by the assembled CO molecules reshapes the band structure of the two-dimensional electron gas, present as a surface state of Cu(111), into a "molecular graphene" system. We characterize the band structure through Fourier transform analysis of impurity scattering maps. We tailor this new tunable class of graphene to reveal signature topological properties: an emergent mass and energy gap created by breaking the pseudospin symmetry with a Kekule bond distortion; gauge fields generated by applying atomically engineered strains; and the condensation of electrons into quantum Hall-like states and topologically confined phases.

All interested persons are cordially invited to attend.