Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Topological properties of artificial graphene assembled by atom manipulation[1] WONHEE KO, WARREN MAR, KENJIRO K. GOMES, HARI C. MANOHARAN, Stanford University — Graphene exhibits special electronic properties stemming from its two-dimensional (2D) structure and embedded relativistic Dirac cones. However, many proposed topologically ordered ground states remain elusive in conventional measurements due to the difficulty in arranging the necessary quantum textures into natural graphene. By exploiting atomic manipulation with a custom-built ultrastable scanning tunneling microscope, we have constructed graphene-like structures by arranging molecules to create a honeycomb lattice of electrons drawn from normal 2D surface states. Spectroscopy reveals a spectacular transformation of nonrelativistic massive 2D electrons into massless Dirac fermions carrying a chiral pseudospin symmetry. We demonstrate the tailoring of this new class of graphene to reveal signature topological properties: an energy gap and emergent mass created by breaking the pseudospin symmetry or changing the hopping term non-uniformly with a Kekulé bond distortion; gauge fields generated by applying atomically engineered strains; and the condensation of electrons into quantum Hall-like states and topologically confined phases.

[1]Supported by the DOE, Office of Basic Energy Sciences, Division of Material Science and Engineering under contract DE-AC02-76SF00515

Wonhee Ko
Stanford University

Date submitted: 19 Nov 2010

Electronic form version 1.4