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Tailoring Dirac Fermions in Molecular Graphene KENJIRO K. GOMES, WARREN MAR, WONHEE KO, CHARLIE D. CAMP, DOMINIK K. RASTAWICKI, Stanford University, FRANCISCO GUINEA, ICMM CSIC Madrid, HARI C. MANOHARAN, Stanford University — 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 create local defects in the lattice to observe the quasiparticle interference patterns that unveil the underlying band structure. We present direct comparison between the tunneling data, first-principles calculations of the band structure, and tight-binding models.

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