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Local spontaneous time-reversal symmetry breaking and interacting Dirac fermions in strained CVD-grown graphene on copper R.T.-P. WU, M.L. TEAGUE, H. CHU, D.A. BOYD, N.-C. YEH, Dept. of Physics, Caltech, Pasadena, CA 91125, M.W. BOCKRATH, Dept. of Physics and Astronomy, Univ. of California, Riverside, CA 92521 — Atomically resolved imaging and spectroscopy of CVD-grown graphene on Cu are studied using scanning tunneling microscopy and spectroscopy. Under strain-induced giant pseudomagnetic fields (B_S), quantized Landau levels are manifested by peaks of density of states (DOS) at quantized energies. While global time-reversal symmetry is preserved, local spontaneous time-reversal symmetry breaking (TRSB) for the two inequivalent lattice sites due to opposite B_S directions is evidenced by the presence or absence of the zero-mode tunneling conductance peak, confirming theoretical predictions for gauge fields in graphene causing local TRSB while preserving the chiral symmetry. Additionally, the finding of both integer and fractional quantum Hall states due to strain-induced B_S may be attributed to significant short-range Coulomb interactions of Dirac fermions in graphene mediated by the underlying Cu substrate, which yields an onsite Coulomb interaction $U \sim 3.2$ eV larger than the nearest-neighbor hopping energy $t \sim 2.8$ eV. Finally, effects on the DOS of graphene due to pseudomagnetic fields are compared with those due to applied fields. This work was supported by NSF.

- [X] Prefer Oral Session
- [ ] Prefer Poster Session

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