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Zero-magnetic-field anomalous Hall effect in strained graphene systems

Graphene systems have received growing attention as it can manifest itself in insulating, metallic, and even superconducting states by the band structure engineering. Here, we demonstrate a new approach to create non-trivial band structure from conventional two-dimensional materials such as graphene via patterned lattice deformation [1]. We observe the pseudo-planar Hall effect and non-linear Hall effect in a corrugated graphene system under time reversal symmetry. This deformation strains graphene to induce pseudo-magnetic fields and break the spatial inversion symmetry, which results in the distorted Dirac cones with Rashba-like valley-orbit coupling and the momentum-space Berry curvature dipole. This new technique provides a unique platform to modify the band structure and warp the Fermi circles in van der Waal materials via patterned mechanical deformation.

References

[1] Sheng-Chin Ho, Ching-Hao Chang, Shun-Chung Lo, Yu-Chiang Hsieh, Thi-Hai-Yen Vu, Carmine Ortix and Tse-Ming Chen, (2019) submitted for publication

Figures

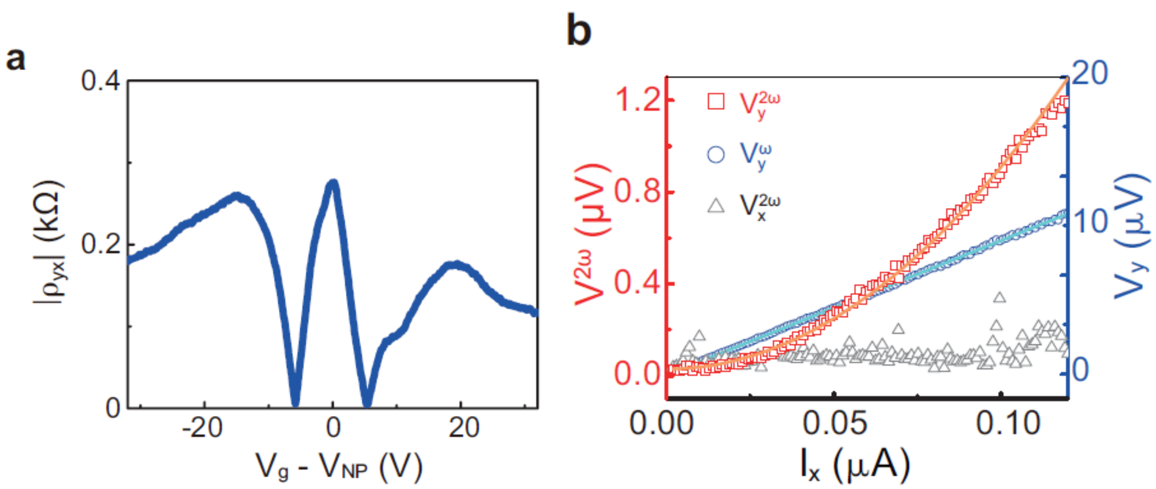

Figure 1: The observation of pseudo-planar Hall effect and non-linear Hall effect in corrugated graphene systems. a, The pseudo-magnetoresistance as a function of the gate voltage in the absence of magnetic field. b, The I-V characteristics of first-harmonic Hall voltage (blue circle), second-harmonic Hall voltage (red square) and second-harmonic longitudinal voltage (grey triangle) in the absence of magnetic field. The first- and second-harmonic Hall voltage are well fitted by a linear and quadratic function shown in light blue and orange curves. Figures are adapted from ref.[1].