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Quantum wires and waveguides formed in graphene by strain[1]

DAWEI ZHAI, Ohio University, YONG WU, MARC BOCKRATH, University of California, Riverside, NANCY SANDLER, Ohio University — The effects of strain on the electronic and transport properties of graphene have triggered intensive theoretical investigations, which showed that graphene valley filters might be achieved by strain engineering. However, little experimental progress has been made in implementing these ideas. Here we report transport studies of graphene on top of hexagonal boron nitride with out-of-plane strained folds. Differential conductance measurements across the linear strain region reveal distinct transport regimes as the gate voltage is changed. For some samples, Coulomb blockade-characteristic of quantum dot behavior- is observed, while others show Fabry-Perot type resonances with higher transmission. The data is consistent with results from a Dirac model including pseudo-scalar and pseudo-magnetic fields produced by a finite length strained fold. Theoretical results for the dependence of energy level spacing on the geometric factors of the fold, as well as on the incident energy and angle of carriers for both types of samples are presented. Because these devices constitute the first step towards a practical realization of valley filters with graphene, implications for valley polarization properties of transmitted currents and appropriate modifications for device setups are discussed.

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