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Valley polarization in graphene with out-of-plane deformations¹ DAWEI ZHAI, NANCY SANDLER, Department of Physics and Astronomy, Ohio University — At low energy, the energy dispersion of graphene shows a conical valley structure with the conduction and valence bands touching at the Dirac points. The existence of two inequivalent Dirac points in the Brillouin zone, thus two valleys, suggests they may be used as new degrees of freedom to carry information. Several schemes based on different mechanisms have been advanced to achieve valley separation in this material, however the proposed setups remain challenging for experimental observation. In this work we investigate graphene with out-of-plane deformations- one of the most naturally occurring and practically realizable settings, as a candidate system to produce valley polarization. Local strains produced by the deformations serve as scattering potentials for electronic states. A second-order Born approximation calculation based on the continuum model reveals the existence of valley polarization and its dependence on the geometrical parameters of the deformations. We characterize the efficiency of valley filtering for different geometries and energies and discuss their implementation in currently available experimental setups.

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