Spin-polarized currents in energy-gapped graphene induced by strain-enhanced spin-orbit interaction

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Abstract:
While graphene is unquestionably a material with impressive technological achievements, the goals of opening a bandgap in its electronic structure and of having control over the spin of its charge carriers remain elusive. Here, we demonstrate that enhancement of the spin-orbit interaction and an externally applied magnetic field are the required ingredients to achieve both such goals simultaneously, i.e., to introduce a spin dependence in the transport properties of graphene as well as induce an energy gap in its band-structure. We suggest two possible manners in which the effect can be achieved, namely through spin-orbit-interaction-enhancing impurities adsorbed onto sizable areas of a graphene sheet or through strain engineering the graphene sheet in a superlattice structure.