Extrinsic spin Hall effect in graphene

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We show that extrinsic spin Hall effect can be engineered in monolayer graphene by decoration with small doses of adatoms, molecules or nano-particles originating local spin-orbit perturbations [1]. The analysis of the single impurity scattering problem shows that intrinsic and Rashba spin-orbit local couplings enhance the spin Hall effect via skew scattering of charge carriers in the resonant regime. The solution of the transport equations for a random ensemble of spin-orbit impurities discloses that giant spin Hall currents are within the reach of current state-of-the-art in device fabrication. The extrinsic spin Hall effect is found to be robust with respect to thermal fluctuations and disorder averaging. Our findings suggest that functionalized graphene systems can be used to design spintronic integrated circuits with SHE-based spin-polarized current activation and control.

[1] A. Ferreira, T. G. Rappoport, M. A. Cazalilla, and A. H. Castro Neto, pre-print: http://arxiv.org/abs/1304.7511