Spin relaxation in graphene induced by adatoms

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By means of a recursive Green's function method we study diffusive spin-dependent transport through graphene and graphene nanostructures.
Diffusion in graphene mainly originates from charges trapped in the substrate. In addition we assume the presence of adsorbed atoms or molecules. These are the origin of a locally fluctuating spin-orbit coupling. While both intrinsic spin-orbit interaction and spin-orbit coupling induced by electric fields or curvature are rather weak [typically O(μeV)], underneath adatoms these values can reach the height of meV.
Our results show that adatoms clearly reduce the spin relaxation time in graphene. The ones we obtain are on the order of magnitude as the ones found in experiments [O(ns)].

Depending on the type of adatom, the effect on intrinsic and extrinsic spin-orbit interaction is of different strength. We study how this influences the relaxation of in-plane or out-of-plane polarized spins.

Lastly we plan to address the questions if adatoms tend to relax spins via the Elliot-Yafet or rather via the Dyakonov-Perel mechanism.