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Spin transport in graphene interfaced with strong spin-orbit materials

Owing to its small spin-orbit coupling (SOC), graphene has proven to be an efficient carrier of spin [1], making it promising for spintronics applications. However, a small SOC prevents the active manipulation or generation of spin currents. Recent work has thus focused on interfacing graphene with high-SOC materials such as transition metal dichalcogenides (TMDCs) or topological insulators (TIs), in the hope of inducing strong SOC in graphene while maintaining its superior charge transport properties [2-5].

In this talk, I will present our group's recent efforts to describe the nature of SOC and spin transport induced in graphene by proximity to TMDCs and TIs. We find that spin transport in these systems is distinguished by a giant spin lifetime anisotropy, with spins oriented in the graphene plane relaxing much faster than spins pointing out of the plane [6,7]. This anisotropy arises from the specific nature of the SOC induced in the graphene layer, which depends on the symmetry of the graphene/TMDC or TI interface. In addition to serving as a probe of SOC induced in graphene, giant spin lifetime anisotropy may also prove useful for spintronics, for example serving as an orientation-dependent spin filter.

References

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Figures

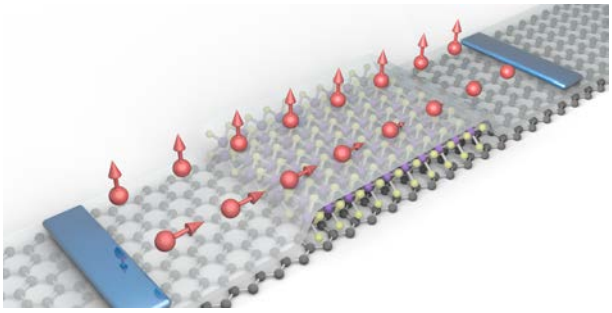

Figure 1: Schematic of anisotropic spin relaxation in a graphene/TMDC heterostructure.