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Spin transport in graphene

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Conventional electronic transistors involve the control of electronic charge at the nanoscale to realize memory, logic and communication functions. All these electronic charges, however, also carry a spin that remains unutilized in present commercial devices. This has motivated the search for new materials that propagate spin-polarized currents over large distances. Among the most promising materials for spintronics has been graphene. Micron-scale spin relaxation lengths have been previously demonstrated in single-layer graphene. Recently, we showed that bilayer graphene is a far more interesting candidate for spintronics. By fabricating spin valves on bilayer graphene we have achieved at room temperature spin relaxation times up to 2 nanoseconds, which are an order of magnitude higher than for single layer graphene [1]. Furthermore, the spin-relaxation time scales inversely with the mobility of BLG sample. This indicates the importance of D'yakonov-Perel' spin scattering in BLG. Last not but least, the presence of an electric field tunable band gap in bilayer graphene makes it particularly appealing. Our work provides fundamental insight into the unique properties of bilayer graphene for spintronic applications. Remarkably, a similar difference between single layer and bilayer graphene is also observed in large area graphene grown by the CVD method on copper. These results demonstrate the potential of CVD graphene in realistic spintronics devices [2].

[1] T - Y. Yang et al., Observation of Long Spin-Relaxation Times in Bilayer Graphene at Room Temperature, PRL (2011).
[2] A. Avsar et al., Towards Wafer Scale Fabrication of Graphene Based Spin Valve Devices, Nano Lett. (2011).