Proximity-induced Magnetism and Spin-orbit Coupling in Graphene/$V_xW_{1-x}Se_2$ Heterostructure

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Graphene has shown great potential as an elementary building block of future spintronic devices. Its high carrier mobility and intrinsically low spin-orbit coupling (SOC) lead to long spin diffusion length, making graphene an ideal spin-channel material. Moreover, its atomic thickness promotes proximity-induced effects that provide new ways to control spin transport [1]. For instance, graphene in contact with semiconducting transition metal dichalcogenides (e. g. WSe_2) develops a proximity SOC and a complex spin texture. Such a modification results in anisotropic spin relaxation [2] and allows to efficiently interconvert charge and spin-currents [1,3,4]. Alternatively, interfacing graphene with magnetic materials induces exchange splitting [5], possibly allowing gate-tuneable spin-polarized currents. Doping TMDCs with magnetic atoms has been reported to induce long-range magnetism up to room temperature. In particular, $V_xW_{1-x}Se_2$ shows (anti-)ferromagnetic behaviour depending on the doping level [6]. By performing nonlocal spin precession measurements, we observe signatures of magnetism together with proximity-induced SOC in graphene/$V_xW_{1-x}Se_2$ heterostructure and investigate the interplay of these two effects.

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References

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Figures

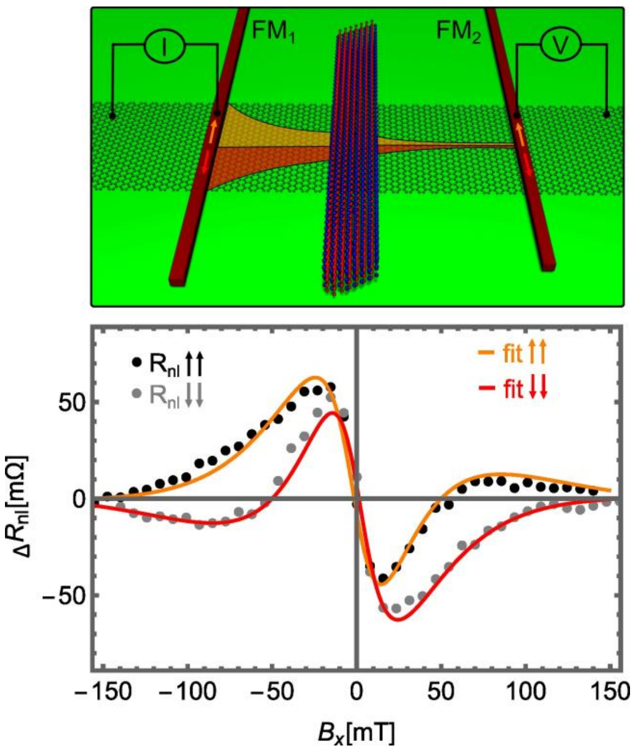

Figure 1: Schematics of the measurement configuration of lateral spin-valve made of $V_xW_{1-x}Se_2$ partially covering graphene channel, and two ferromagnetic electrodes used as spin injector (FM_1) and detector (FM_2), respectively (Top). Representative spin-precession curves obtained by measuring nonlocal resistance as a function of magnetic field applied along graphene channel (Bottom). Arrows indicate magnetization of the ferromagnetic electrodes.