Tunable spin to charge interconversion in graphene-WS_2 heterostructures at room temperature

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Graphene constitutes a unique material for spintronics owing to its exceptional and tunable electrical properties [1]. It enables the propagation of spin information over long distances, which demonstrates its potential as a spin channel material [2]. Additionally, spin transport in graphene can be manipulated by means of proximity effects when it is interfaced with a transition metal dichalcogenide, leading to a strong anisotropic spin dynamics [3]. These key features provide the building blocks for electric-field generation and manipulation of spin currents by using the spin-orbit phenomena in graphene-based devices.

In this talk, I will show you the strong and controllable spin-to-charge (StC) conversion that can be obtained in engineered graphene-WS_2 heterostructures at room temperature. By using spin precession experiments I will show you that StC driven by the spin galvanic and the spin Hall effects can be unambiguously detected and quantified [4]. Remarkably, the corresponding conversion efficiencies can be tailored by electrostatic gating in magnitude and sign, with a magnitude that is comparable to the largest efficiencies reported to date. Such unprecedented electric-field tunability provides a novel route for spin generation free from magnetic materials and paves the way for the development of ultra-compact and low power consumption magnetic memory devices.

References

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Figures

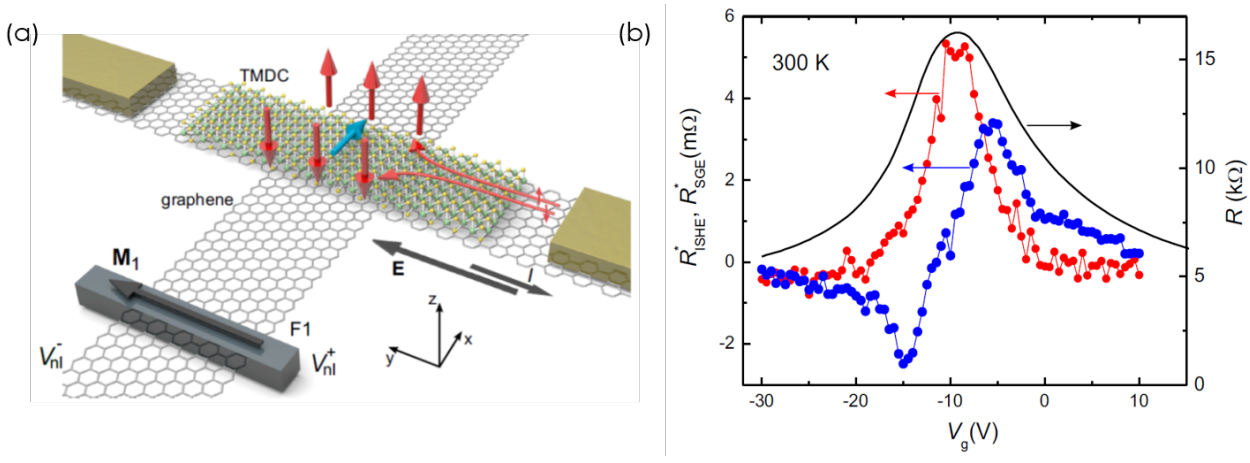

Figure 1: (a)Sketch of the graphene-based spin device used in this study and induced spin texture due to the spin galvanic (blue arrows) and the spin Hall effects (red arrows). (b) Electric-field modulation of both signals at room temperature.