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Spinphänomene in reduzierten Dimensionen

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Seminarankündigung

Sprecher: **Dr. Ahmet Avsar**  
EPFL, Switzerland

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**Thema:** Electric field control of spin transport in 2D materials

Abstract

For spin-based electronics, it is essential to have materials with large spin signals and long spin relaxation times at room temperature (RT). With respect to the material selection, spin functionality in semiconductors in particular offers new opportunities that are feasible in metal-based spintronics devices. However, the carrier concentrations in these bulk semiconductors are determined extrinsically with the addition of foreign atoms by ion implantation. This causes additional scattering, and masks their intrinsic properties.

In this respect 2D materials hold great promise due to the ability of tuning the carrier concentration by the electric field effect without modifying their intrinsic properties. In this talk, I will discuss the electric field control of spin transport in 2D materials. First, I will introduce ultra-thin, semiconducting black phosphorus (BP) as a promising material for possible spintronics applications requiring rectification and amplification actions. Based on measurements in the non-local spin valves geometry with pure spin currents, spin relaxation times in BP can be as high as ~ 4 ns with spin relaxation lengths exceeding 6 μm. These values are at least an order of magnitude higher than what has been measured in typical graphene and other metals based spin valves. Our in-situ device preparation method enables us probing the intrinsic spin transport properties of BP. We obtain record non-local spin signals up to 320 Ω. After discussing the dominant spin relaxation mechanism in BP crystal, I will demonstrate that its spin transport properties can be manipulated in a transistor-like manner by just controlling the electric field even at RT. I will also present a similar electric field control effect in high mobility single and bilayer graphene spin devices2-3. If the time permits, I will discuss graphene optospintronics. Motivated by a recent proposal4, we realize optical spin injection into graphene by bringing monolayer WSe2 in a close proximity with graphene5.

References

Ansprechpartner: J. Fabian