Carl von Ossietzky
Universität
Oldenburg
Institut für PHYSIK

PHYSICAL COLLOQUIUM

INVITATION

Monday, 07.11.2022, 4.15 p.m., Room W02 1-148 and per
video conference: https://meeting.uol.de/b/anj-2vc-j6s-fwe

speaks

Dr. Christoph Kastl,
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about

"Spin-orbit control in graphene-based van der Waals interfaces"

Experimental control of local spin-charge interconversion is of primary interest for spintronics. Van der Waals (vdW) heterostructures enable such functionality by design when combining graphene with a spin-orbit coupled material. Such heterostructures promise high electron mobilities, non-trivial spin texture, and gate-tunability of electronic properties rendering them candidates for all-electrical control of (proximity-induced) spin phenomena.

I will discuss exemplarily interfaces between graphene and Bi2Te2Se featuring a lattice-matched, commensurate stacking, where proximity effects have been predicted to impart an anisotropic and electronically tunable spin texture. By polarization-resolved photocurrent measurements, we find a circular photogalvanic effect which is drastically enhanced at the Dirac point of the proximitized graphene. We attribute the gate-tunability to the proximity-induced interfacial spin structure, which could be exploited for, e.g., spin filters [1].

Typically, electric spin valve experiments are employed to read-out such devices in non-local geometries, while leaving the local interplay between the interface symmetry and local charge flow across the heterointerface unexplored. Taking graphene/WTe2 heterointerfaces as model system, we utilize magneto-optical Kerr microscopy to probe the local, current-induced spin polarisation. Even for a nominal in-plane transport, substantial out-of-plane spin accumulation is induced by a corresponding out-of-plane current flow. We present a theoretical model which fully explains the electric switching and spatial distribution of the Kerr signal as a result of a gate-tunable, non-linear anomalous Hall effect in the heterostructure. Our results highlight the potential of optoelectronic methods for the local read-out of spin-charge interconversion and spin-orbit coupling [2].

References

[1] J. Kiemle, L. Powalla, K. Polyudov, L. Gulati, M. Singh, A. Holleitner, M. Burghard, C. Kastl, Gate-Tunabl Helical Currents in Commensurate Topological Insulator/Graphene Heterostructures, ACS Nano 16, 12338 (2022).
[2] L. Powalla, J. Kiemle, E. König, A. Schnyder, J. Knolle, K. Kern, A. Holleitner, C. Kastl, M. Burghard, Nat. Commun. 13, 3152, (2022).

All interested persons are cordially invited.

Prof. Dr. Christian Schneider