Poster-2-30

Determining the nature and strength of proximity induced spin-orbit coupling in graphene by quasiparticle interference imaging

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Inducing and controlling spin-orbit coupling (SOC) in graphene is key to create topological states of matter, and for the realization of spintronic devices. The most successful strategy to achieve this goal so far is to place graphene onto a transition metal dichalcogenide. However, there is no consensus as to the nature and the magnitude of the induced SOC. In this talk, we show that the presence of backscattering in graphene-on-WSe_2 heterostructures can be used to probe SOC and to determine its strength quantitatively, by quasiparticle interference (QPI) imaging using a scanning tunneling microscope [1]. Analyzing QPI images of heterostructures with selected twist angles between 0° and 30°, we find that the induced SOC consists of a valley-Zeeman ($\lambda_{vZ} \approx 2$ meV) and a Rashba ($\lambda_R \approx 15$ meV) term. These results are in excellent agreement with transport experiments, both finding that the Rashba term is an order of magnitude larger than current theoretical predictions. QPI further gives unambiguous evidence that the measured SOC is the result of a modified band structure and demonstrate a viable strategy to determine SOC quantitatively by imaging quasiparticle interference.

[1] L. Sun, L. Rademaker, D. Mauro, A. Scarfato, Á. Pásztor, I. Gutiérrez-Lezama, Z. Wang, J. Martinez-Castro, A. F. Morpurgo and C. Renner, Determining spin-orbit coupling in graphene by quasiparticle interference imaging, Nature Communications 14, 3771 (2023).