UNIVERSITÉ DE GENÈVE

DQMP Department of Quantum Matter Physics

DQMP FORUM

Tuesday, February 14th, 2023 – 13h00
Auditoire Stückelberg

Coffee and tea will be available from 12h50 at the entrance of the Auditoire
Reduce waste and bring your own coffee cup!

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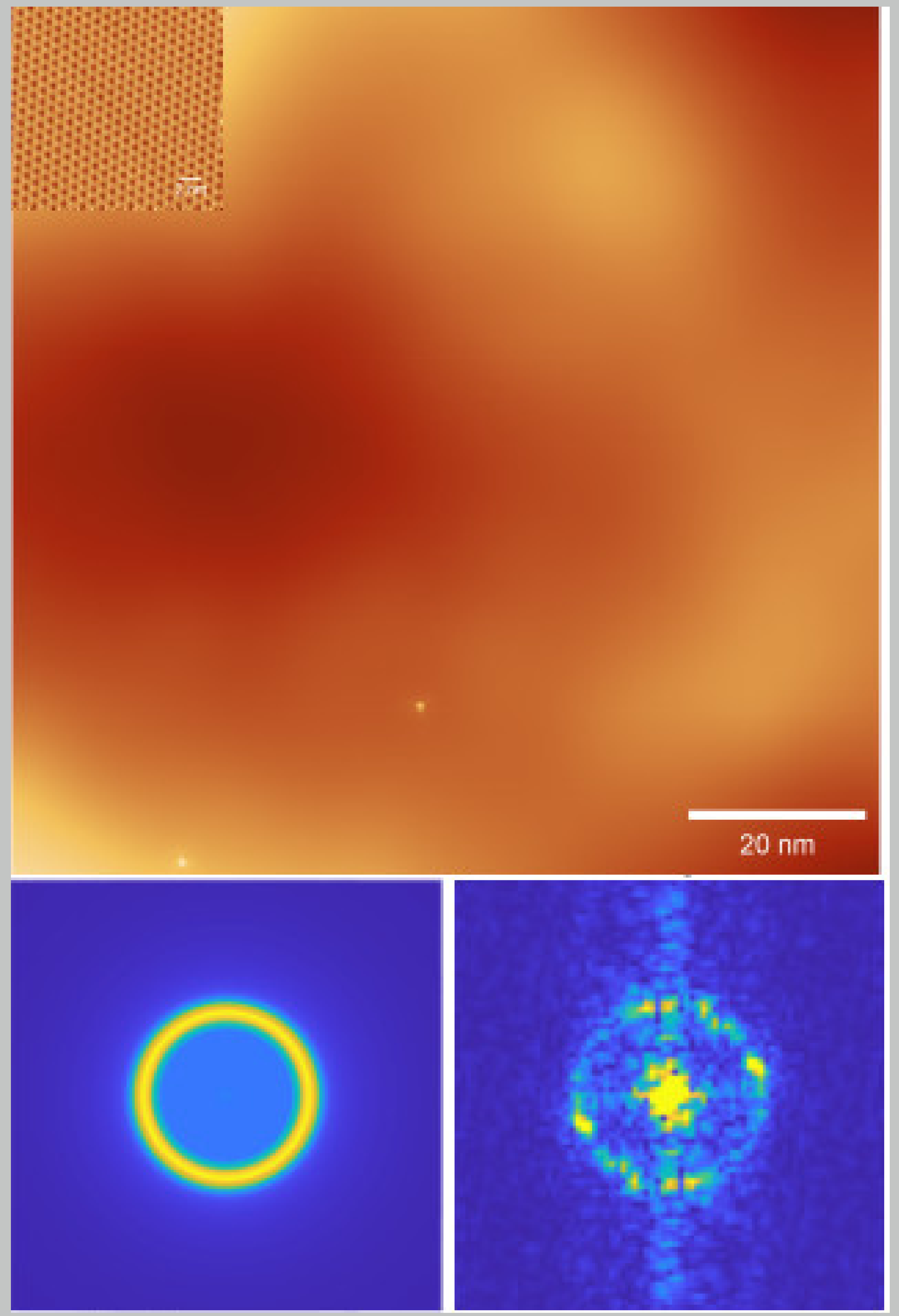
DQMP Department of Quantum Matter Physics

Determining Proximity Induced Spin-orbit Coupling in Graphene by Quasiparticle Interference Imaging

Lihuan Sun
(group of prof. Renner)

Inducing and controlling spin-orbit coupling (SOC) in graphene is key to create topological states of matter, and for the realization of spintronic devices. Placing graphene onto a transition metal dichalcogenide is currently the most successful strategy to achieve this goal, but there is no consensus as to the nature and the magnitude of the induced SOC. Here, 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 imaging quasiparticle interference with a scanning tunneling microscope. A detailed theoretical analysis of the Fourier transform of quasiparticle interference images reveals that the induced SOC consists of a valley-Zeeman ($\lambda_{vZ} \simeq 2$ meV) and a Rashba ($\lambda_R \simeq 15$ meV) term, one order of magnitude larger than what theory predicts, but in excellent agreement with earlier transport experiments. The validity of our analysis is confirmed by measurements on a 30 degree twist angle heterostructure that exhibits no backscattering, as expected from symmetry considerations. Our results demonstrate a viable strategy to determine SOC quantitatively by imaging quasiparticle interference.



Vertical Electronic Transport in the van der Waals Antiferromagnetic Semiconductor CrSBr

Xiaohanwen Lin
(group of prof. Morpurgo)

Transport mechanisms in disordered conventional semiconductors are well established. In contrast, very little is known about the intrinsic transport mechanism in *van der Waals* magnetic semiconductors. Here, we measure the vertical transport response in antiferromagnetic semiconductor CrSBr, where conventional semiconductor transport mechanisms can be applied. By analyzing the temperature dependence of the resistance in the linear current-voltage ($I-V$) transport regime we find that transport is governed by thermal activation at high temperatures and by variable range hopping below 40 K, where the hopping distance is determined by the antiferromagnetic (AFM) and field-induced ferromagnetic (FM) state of the material. In the nonlinear $I-V$ regime, we observe a bias-dependent very large negative magnetoresistance that reaches 90000 %.