Spin-Charge Conversion in Twisted van der Waals Heterostructures

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Spin-charge conversion processes in graphene-based van der Waals (vdW) heterostrucutres have been the subject of many theoretical and experimental studies over the past decade [1,2]. The field of spintronics prides itself on uncovering the novelty of these processes, with the perspectives of technology and fundamental physics in mind [3]. In recent years, research has turned towards studying the role played by misalignment between the layers of vdW heterostructures [4], i.e. twisting, leading to the birth of a new field known as twistronics.

In this talk, we look at the unification of spintronics with twistronics: we study the rich transport effects generated by proximity-induced spin-orbit coupling (SOC) in graphene on transition metal dichalcogenide (TMD) bilayers. Previous works [5-7] have found that the introduction of a twist between the graphene and TMD layers allows for the tuning of the SOC strength. Introducing a twist liberates the spin-texture of the Rashba-split graphene bands, such that it is no longer confined to be perpendicular to the momentum. Specifically, we study the generation of spin accumulation upon the application of an electrical current. We further demonstrate the robustness of our observations against twist-angle disorder.

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