WSe_2/metal heterostructures investigated by Quasi-Particle Interference mapping, STM/STS, and ARPES

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WSe_2 is one of the semiconducting TMDs that has great potential in both spintronics and valleytronics. Interfacing it with various metallic substrates however can affect its electronic structure through a variety of effects, one of them being the rotation angle of the WSe_2 layer relative to the underlying substrate, which creates a scattering potential for its quasiparticles. Here we studied the electronic structure of WSe_2/metal heterostructures as a function of the thickness of the WSe_2 overlayer (i.e. monolayer and thicker), and rotation angle relative to the atomically flat metallic substrate, using a combination of Scanning Tunnelling Microscopy and Spectroscopy (STM/STS), quasi-particle interference (QPI), and ARPES. From these complementary techniques we could observe: (i) evidence of zone folding due to the Moire potential of the heterostructure, (ii) gap states due to hybridisation, and (iii) intervalley scattering forbidden in isolated (i.e. no t metal supported) WSe_2. Our analysis tries to formulate a unified understanding of these various experimental facts.