Scanning tunneling microscopic investigations into electron transport through graphene

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Graphene exhibits advantageous electronic properties that render it a promising candidate for carbon-based microelectronic applications and spinelectronic devices. To make use of these properties in devices, the graphene layer has to be contacted via macroscopic electrodes. It is therefore of utmost importance to (a) study the interaction of graphene with different electrode materials and to (b) determine the influence of graphene-electrode combinations on the electron transport through the graphene layer.
So far extended metal contacts to graphene have been studied [1-3]. Here, we use the tip of a cryogenic scanning tunneling microscope to contact graphene layers on Ru(0001) and Ir(111). Both surfaces exhibit a moiré lattice, which introduces a periodic variation of graphene-surface interactions. In these experiments the electrical conductance of graphene junctions is characterized with atomic precision. We find that the resulting contact conductances vary systematically with the strength of the graphene-substrate interaction due to the moiré lattice and substrate material. The results are analyzed by means of model calculations, utilizing density functional theory and nonequilibrium Green's functions techniques.

References

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