Friedel oscillations at the surfaces of rhombohedral N-layer graphene[1]

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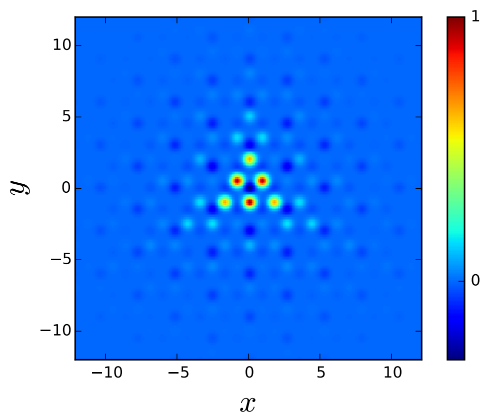

Localised-impurity-induced Friedel oscillations at the surface of ABC trilayer graphene. This interference pattern encodes the topological Berry phase that characterizes the semimetallic band structure.

The low-energy physics of rhombohedral *N*-layer graphene mainly arises on the external layers, where most of the π electrons are located. Their Bloch band structure defines a two-band semimetal; the dispersion relation scales as $\pm q^N$ with the momentum norm q in the vicinity of two non-equivalent valleys. Through this poster, we address the problem of elastic scattering through a localized impurity located either on the surface of the material or within the bulk, and focus on the quantum interferences it induces on the two external layers. It is apprehended in the framework of a *T*-matrix approach, which enables the description of realistic scatters. In rhombohedral multilayer graphene, the impurity induces Friedel oscillations that always decay as $1/r$. As a result, monolayer graphene is the only material of the rhombohedral class that exhibits $1/r^2$-decaying Friedel oscillations. The interference patterns are subsequently analyzed in momentum space. This analysis enables a clear distinction between monolayer graphene and multilayer graphene. It also shows that the interference pattern reveals the whole Bloch band structure, and highlights the number of layers stacked in the material, as well as the π-quantized Berry phases that characterize the existence of nodal points in the semimetallic spectrum. Experimentally, these features may be probed from scanning tunneling microscopy, when imaging the local density of states at the surfaces of suspended rhombohedral N-layer graphene.

1. Dutreix C., Katsnelson M. I., Phys. Rev. B 93, 035413 (2016)