Moiré minibands in graphene heterojunctions with hexagonal 2D crystals.

V. Falko[1] J. Wallbank[1] A. Patel[1] M. Mucha-Kruczynski[1] A. Geim[2]
[1]Physics Department, Lancaster University, Lancaster, LA1 4YB, UK
[2]School of Physics and Astronomy, Manchester University, Oxford Road, Manchester, UK

The transformation of the linear Dirac spectrum of electrons in monolayer graphene and parabolic spectrum in bilayer graphene due to the influence of a tightly bound insulating or semiconducting layer is studied. We present a symmetry-based classification and quantitative analysis of generic miniband structures for electrons in graphene heterojunction with a 2D crystal with the hexagonal Bravais symmetry, such as boron nitride. In particular, we identify conditions at which the first moire miniband is separated from the rest of the spectrum by either one or a group of three isolated mini Dirac points and is not obscured by dispersion surfaces coming from other minibands. In such cases the Hall coefficient exhibits two distinct alternations of its sign as a function of charge carrier density. Then, we study the Hofstadter spectrum of electrons in a magnetic field.