Lattice models for Josephson junctions and graphene superlattices

Ostroukh, V.

Author: Ostroukh, V.
Title: Lattice models for Josephson junctions and graphene superlattices
Issue Date: 2018-06-27

Stellingen

behorende bij het proefschrift

Lattice models for Josephson junctions and graphene superlattices

1. The doubled Fraunhofer periodicity observed in an edge-channel Josephson junction can be explained by the appearance of a conducting channel along the interface with the superconductor.

   Chapter 2

2. The SQUID-like Fraunhofer diffraction pattern observed in InAs quantum wells is not conclusive evidence for topologically protected edge channels.

   Chapter 3

3. A non-circular Fermi surface may induce a two-dimensional vortex lattice in the normal region of a ballistic Josephson junction.

   Chapter 4

4. An index theorem protects the valley degeneracy of the lowest Landau level in the presence of valley-momentum locking.

   Chapter 5

5. Contrary to the claim by Gutiérrez *et al.*, the Kekulé bond texture in a graphene-on-copper superlattice does not produce a gapped spectrum.

   C. Gutiérrez *et al.*, Nature Phys. **12**, 950 (2016).

6. The topologically protected valley switch in a graphene superlattice, reported by Beenakker *et al.* for electron reflection, exists also in transmission.

   C. W. J. Beenakker *et al.*, Phys. Rev. B **97**, 241403(R) (2018).

7. The Dynes-Fulton relationship, used to reconstruct the current density from the magnetic-field dependence of the Josephson effect, can be relied upon only in tunnel junctions.

   R. C. Dynes and T. A. Fulton, Phys. Rev. B **3**, 3015 (1971).

8. The dispersion relation of a spin-1 Weyl semimetal can be understood as the effect of a non-Abelian gauge field, by application of the theory of de Juan.

   F. de Juan, Phys. Rev. B **87**, 125419 (2013).

Viacheslav Ostroukh

27 June 2018