Dislocations in stripes and lattice Dirac fermions

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accompanying the PhD thesis
Dislocations in Stripes and Lattice Dirac Fermions

1. The continuum description of electrons in the graphene lattice with topological defects takes the form of Dirac particles in a space with curvature and torsion.

   Chapter 2

2. For a certain type of lattice dislocations, the graphene honeycomb lattice topology is destroyed locally, so that the connection to a continuum Dirac theory for electrons is questionable. However, the characteristic zero energy states are shared by both descriptions.

   Chapter 4

3. Lattice dislocations piercing a two-dimensional topological insulator sample induce a persistent spin-current on the edge of the sample.

   Chapter 5

4. The real space map of the phase of stripes confirms that stripes are incommensurate with the underlying lattice, but it is non-trivial that their disordering is dominated by topological defects.

   Chapter 7

5. Stripe melting via defects leads to an isotropic nematic, which is elusive because it respects the rotational symmetries of the lattice.

   Chapter 7
   *F.A. Bais, and C.J.M Mathy, Phys. Rev. B **73**, 224120 (2006)*

6. Realistic external lattice strains can cause an analog of the quantum Hall effect by generating pseudo-magnetic fields for the graphene Dirac electrons.

   *F. Guinea, M. I. Katsnelson, and A. K. Geim, Nat. Phys. **6**, 30 (2010)*

7. The correct way to describe the superfluid to Bose-Mott insulator transition in 3+1 and higher dimensions is by focusing on the non-conservation of the superflow at the vortices in the superfluid.

   A.J. Beekman, D. Sadri, and J. Zaanen, arXiv:1006.2267 (2010)

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8. Spintronics acquires robust, purely quantum and topological manipulation, thanks to the topological insulators.

J. Maciejko, E.-A. Kim, and X.-L. Qi, arXiv:0908.2267 (2009)

9. Contrary to intuition, operations of rotation and translation become the same when performed locally. In crystals, this leads to equivalences between dislocations and disclinations, while in curved spaces to equivalence of Einstein's theory and teleparallelism.

H. Kleinert, arXiv:1005.1460 (2010)

10. Research has proven that the primates and their societies are capable (to a lesser degree) of anything that humans are, except the conscious, deliberate and irrational self-sacrifice, which is void of any benefit, but done in the name of faith.

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