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On quantum transport in flat-band materials

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Citation

Oriekhov, D. (2023, October 4). *On quantum transport in flat-band materials. Casimir PhD Series*. Retrieved from <https://hdl.handle.net/1887/3642874>

Version: Publisher's Version

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Stellingen

behorende bij het proefschrift

On quantum transport in flat-band materials

1. The diverging spin-spin exchange interaction at low temperatures in a doped pseudospin-1 system indicates a ground-state instability. [Chapter 2]
2. The quasiparticle spectrum of a bilayer dice lattice depends qualitatively on the way the two monolayers are stacked. [Chapter 5]
3. An unpaired edge vortex in a topological superconductor produces a divergent charge noise in a metal contact. [Chapter 7]
4. The “*Majorana-induced DC Shapiro steps in topological Josephson junctions*” reported in Phys. Rev. B **102**,140501(R) (2020) appear also in non-topological Josephson junctions. [Chapter 8]
5. Edge vortex injection by a 2π phase shift across a Josephson junction requires a junction that is sufficiently short to avoid trapping of quasiparticle excitations when the phase difference crosses π and the gap in the junction closes.
6. Tachyon ghost modes, such as studied in Phys. Rev. B **101**, 245136 (2020), can be converted into real plasmons by applying an external modulation to a heterostructure.
7. A Josephson junction containing an altermagnet can have a bistable free energy profile, with a minimum at two distinct values of the phase difference.
8. We have not found a room temperature superconductor yet because the available flat-band materials become disordered at room temperature.
9. The Leiden science museum has removed the exhibit honoring Dutch Nobel prize winners, because “Great achievements come from collaboration, not the brilliant insight of an individual”. This is not historically accurate.

Dmytro Oriekhov
Leiden, 4 October 2023