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Size effects in microstructured superconductors and quantum materials

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Propositions

accompanying the thesis

SIZE EFFECTS IN MICROSTRUCTURED SUPERCONDUCTORS AND QUANTUM MATERIALS

1. The periodicity of the magnetic interference pattern of a planar Josephson junction between thin films has two universal geometry-independent limits, determined by the surface area of its electrodes. (*Chapter 3 of this thesis*)
2. Besides magnetic non-colinearity and spin-orbit coupling, a vortex magnetization pattern can serve as the generator of superconducting long-range triplet correlations. (*Chapter 4 of this thesis*)
3. The bistability of magnetic textures can be employed to construct energy efficient non-volatile superconducting memory elements. (*Chapter 5 of this thesis*)
4. The reduction of the resistivity in current driven experiments on Ca_2RuO_4 cannot be explained by heating effects only. (*Chapter 6 of this thesis*)
5. Indisputable evidence of hydrodynamic charge flow in the strange metal state of the cuprate superconductors from transport experiments requires single micrometer-sized devices at best, which is experimentally near impossible. (*Jan Zaenen, SciPost Phys 6, 061 (2019)*)
6. The gradual increase of infrared response across the metal-insulator phase boundary, as measured by scanning near field optical microscopy, highlights the non-uniform current density distribution in current-driven experiments on Ca_2RuO_4 . (*Zhang et al., Phys. Rev. X 9, 011032 (2019)*)
7. There are many inconsistencies between the different experimental works that try to determine the pairing symmetry of Sr_2RuO_4 , therefore one or more are incorrect or ill-interpreted. (*Grinenko et al., Nat. Commun. 12, 3920 (2021)*)
8. When performed correctly, the focused ion beam structuring technique does not induce damages that limit transport experiments. (*Philip J.W. Moll, Annu. Rev. Condens. Matter Phys. 9, 147-162 (2018)*)
9. All scientific equipment that cannot be interfaced with a computer is impractical in modern physics research, and therefore should be discarded.
10. The Leiden PhD thesis should be restructured: the propositions should be abolished, the summaries should be incorporated in the introductory chapter, and an abstract should become obligatory.