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Propositions

accompanying the dissertation

COHERENT MANIPULATION OF NORMAL AND ANDREEV FERMIONS

by

Kostas VILKELIS

1. Aharonov-Bohm magnetoconductance oscillations in Science 368, 1234 (2020) are not a signature of coherent interference phenomenon. *(This proposition pertains to this dissertation)*
2. The observations reported in Nat. Phys. 17, 43 (2021) are only consistent with the presence of Majorana zero modes if the exchange interaction is induced within both the superconductor and semiconductor. *(This proposition pertains to this dissertation)*
3. Open components of the Fermi surface generate magnetisation in small samples. *(This proposition pertains to this dissertation)*
4. Cooper pair splitters with variable capacitors enable gate-controlled universal manipulation of fermions. *(This proposition pertains to this dissertation)*
5. Ruling out possible semiclassical explanations using explicit modelling should become a standard check of mesoscopic transport experiments.
6. Greater technological advancements would result from prioritizing research efforts to discover and utilize high critical field superconductors at liquid nitrogen temperatures rather than pursuing room temperature superconductors.
7. In the next 5 years, gate-defined encapsulated bilayer graphene will become the leading platform to study mesoscopic physics.
8. Future advances in nanoscale devices will be achieved through the use of the magnetic proximity effect.
9. Proprietary closed-source scientific software (e.g. Matlab, Mathematica) are incompatible with scientific ethos.
10. The negative public image of aspartame-containing products (e.g. "Coke Zero") contributes to the decline of public health by discouraging the consumption of sugar-free alternatives.

These propositions are regarded as opposable and defendable, and have been approved as such by the promotor Dr. A. R. Akhmerov and copromotor Dr. M. T. Wimmer.