Design of a Majorana trijunction

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Abstract
Braiding of Majorana states demonstrates their non-Abelian exchange statistics. Braiding requires control of the pairwise couplings between all Majorana states in a trijunction device [1]. In order to have adiabaticity, a trijunction device requires the desired pair coupling to be sufficiently large and the undesired couplings to vanish. In this work, we design and simulate of a trijunction device in a two-dimensional electron gas focusing on the normal region that connects three Majorana states. We use an optimization approach to find the operational regime of the device in a multi-dimensional voltage space. We then compare the performance of devices with different shapes and disorder strengths to determine the feasibility criteria for a braiding experiment.

References

[1] B. van Heck, A. R. Akhmerov, F. Hassler, M. Burrello, C.W.J. Beenakker , New Journal of Physics,14 (2012).

Figures

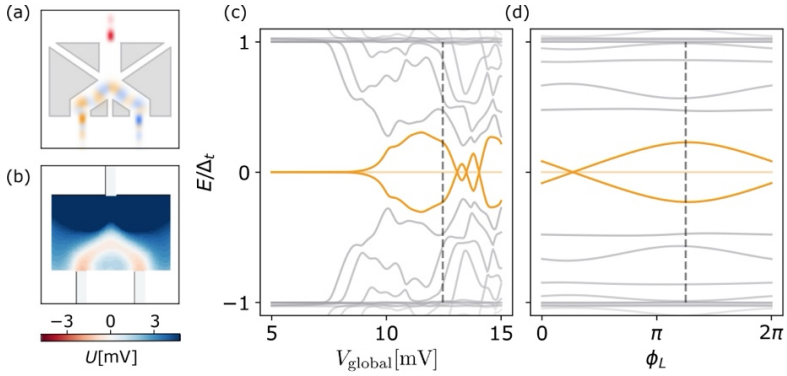

Figure 1: Coupling procedure of two Majorana states in a trijunction device. (a) Majorana wavefunctions. (b) Electrostatic potential. Spectra w.r.t. gate voltage (c) and phase difference (d).

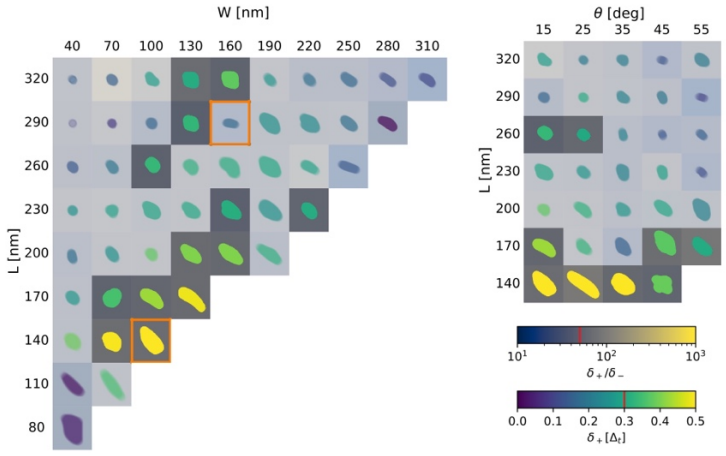

Figure 2: Device geometry dependence of the braiding quality metrics. Shapes correspond to operation voltage space. Geometries suitable for braiding are highlighted.