# Highlights

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## Signatures of topological phase transitions in Josephson current-phase discontinuities

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Topological superconductors differ from topologically trivial ones due to the presence of topologically protected zero-energy modes. To date, experimental evidence of topological superconductivity in nanostructures has been mainly obtained by measuring the zero-bias conductance peak via tunneling spectroscopy. Here, we propose an alternative and complementary experimental recipe to detect topological phase transitions in these systems. We show in fact that, for a finite-sized system with broken time-reversal symmetry, discontinuities in the Josephson current-phase relation correspond to the presence of zero-energy modes and to a change in the fermion parity of the ground state. Such discontinuities can be experimentally revealed by a characteristic temperature dependence of the current, and can be related to a finite anomalous current at zero phase in systems with broken phase-inversion symmetry.

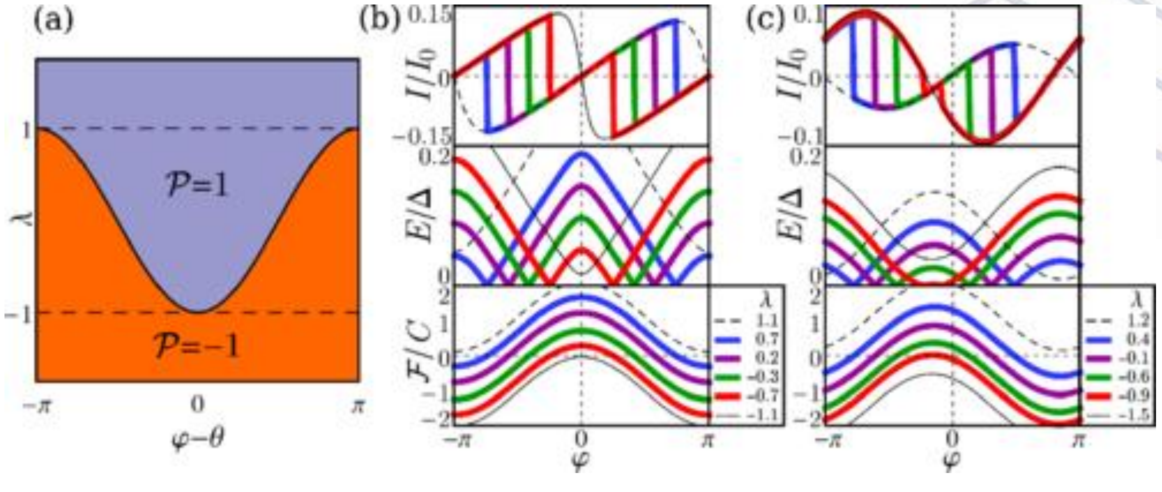


Figure: Topological phase space (a) of a finite-sized topological superconductor. Topological transitions between states with different fermion parities occur as a function of the phase difference between the edges of the system. Current phase relation, lowest-energy Andreev level, and Pfaffian for a quantum wire (b) and a planar well (c). Current discontinuities correspond to zero-energy modes and to variations of the fermion parity between the trivial and nontrivial branch (dashed and dotted lines respectively).