

Phenomena of Majorana Wavefunctions in arbitrarily shaped Topological Superconductors.

Johanna Zijderveld

A. Mert Bozkurt, İnanç Adagideli, Michael Wimmer
TU Delft, Lorentzweg 1, Delft, Netherlands
Johanna@zijderveld.de

Majorana billiards are finitely sized and arbitrarily shaped topological superconductors which feature fermion parity switches. We investigate the properties of the Majorana wavefunction in these system through the lens of quantum chaos. For a certain parameter range, we map the problem of finding Majorana wavefunctions to finding the eigenfunctions of a normal state Hamiltonian. Within this regime, we find that Majorana wavefunctions are scarred along the same trajectory of their normal state counterpart. Furthermore, we observe that, before becoming a fully localized chiral edge state, the Majorana wavefunction displays signatures similar to caustics. Finally, we establish a connection between chiral Majorana modes and eigenfunctions of a normal state Hamiltonian under a magnetic field. Overall, our findings offer valuable insights into the properties of the Majorana wavefunctions and their relation to semiclassical physics and quantum chaos.

Figures

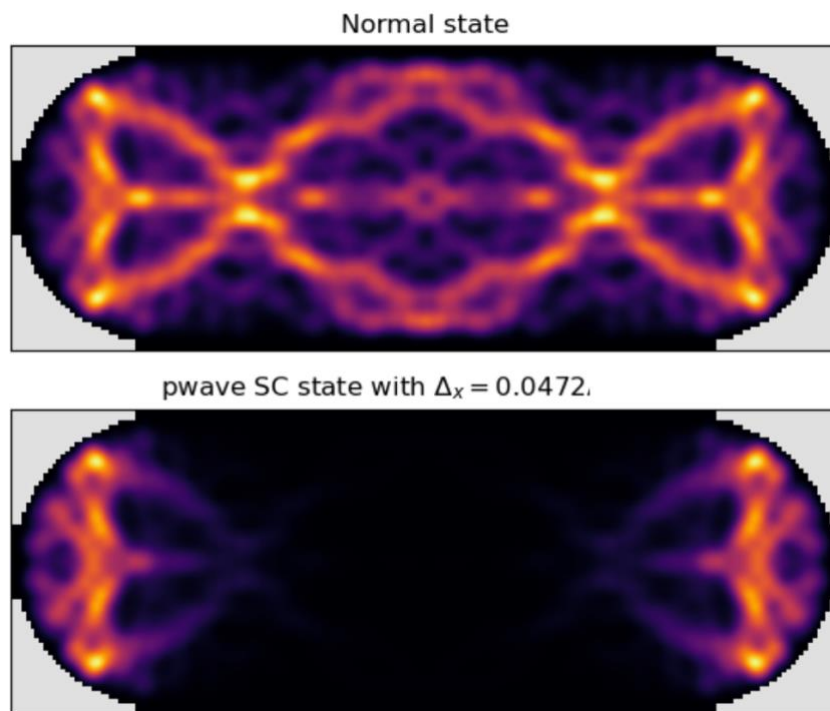


Figure 1: Top figure shows a scar in a stadium billiard shape governed by a regular Hamiltonian. Bottom figure shows the Majorana wavefunction localized at the ends of the same scar, where the Hamiltonian is a p-wave Hamiltonian with a superconducting gap in one direction.