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Title: Understanding the conductance spectroscopy of Majorana zero modes

Abstract:
Semiconductor nanowire-superconductor hybrid systems provide a promising platform for hosting Majorana zero modes. In this talk, I will describe how Majorana zero modes in these systems can be detected using conductance measurements and the current experimental status on their detection. Starting from the basics of quantum transport theory, I will demonstrate how to adapt the Keldysh non-equilibrium Green's function (NEGF) technique to model experimentally relevant and current device structures [1-3]. I will then describe various "false positives" associated with conductance spectroscopy on realistic device structures, and how we could capture these effects via quantum transport theory. Moving on, I will describe the non-locality of true Majorana modes can be described via the concept of topological entanglement entropy [4], which connects directly with the bulk-boundary correspondence of a topological phase [4]. While recent experiments have indeed shown several false positives in the conductance spectra, we demonstrate that the entanglement entropy can indeed signal a genuine transition, regardless of the constituent non-idealities in an experimental situation.

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