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Spectroscopy of Majorana nanowires with quantum dots RAMON AGUADO, CSIC - Madrid, ELSA PRADA, Condensed Matter Physics Center (IFIMAC), Universidad Autonoma de Madrid, PABLO SAN-JOSE, CSIC - Madrid — An interacting quantum dot coupled to a superconducting contact is an artificial analogue of a quantum impurity in a superconductor. The physics of such hybrid device is governed by the fermionic parity and spin of the two possible ground states, doublet or singlet (and their corresponding Shiba sub-gap excitations). Here we generalise this paradigmatic model to the case where the superconductor becomes topological. Such a quantum dot-topological superconductor junction can be experimentally realised by e. g. creating quantum dots at the end of epitaxial hybrid semiconductor-superconductor nanowires. We study the hybridisation between Shiba states in the dot and Majoranas in the nanowire and show that specific and measurable spectral features arise from the interplay of these states. Interestingly, these features are enough to fully characterise the spin structure of the Majorana wavefunction, the degree of Majorana non-locality and the Majorana splitting. Apart from a full numerical analysis, all the relevant results are derived from a low-energy effective model, and are given in closed analytical form. We conclude that quantum dots used to perform spectroscopy of a Majorana nanowire are a powerful probe into the quantum structure of Majorana bound states.

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