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Topological superconductivity in quasicrystals

Majorana fermions – charge-neutral spin-1/2 particles that are their own antiparticles – have been detected in one- and two-dimensional topological superconductors. Due to the non-Abelian exchange statistics that they obey, Majorana fermions open the door to new and powerful methods of quantum information processing. Motivated by the recent experimental discovery of superconductivity in a quasicrystal, we study the possible occurrence of non-Abelian topological superconductivity (TSC) in two-dimensional quasicrystals by the same mechanism as in crystalline counterparts. We show that the TSC phase can be realised in Penrose and Ammann-Beenker quasicrystals, where the Bott index is unity. Furthermore, we confirm the existence of Majorana zero modes along the surfaces and in a vortex at the centre of the system, consistently with the bulk-boundary correspondence.