

Abstract Submitted
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Majorana Zero Modes in Graphene PABLO SAN-JOSE, CSIC

- Madrid, JOSE L. LADO, International Iberian Nanotechnology Laboratory (INL), RAMN AGUADO, CSIC - Madrid, FRANCISCO GUINEA, Instituto Madrileo de Estudios Avanzados en Nanociencia (IMDEA-Nanociencia), JOAQUIN FERNNDEZ-ROSSIER, Departamento de Fisica Aplicada, Universidad de Alicante — A clear demonstration of topological superconductivity (TS) and Majorana zero modes remains one of the major pending goal in the field of topological materials. One common strategy to generate TS is through the coupling of an s-wave superconductor to a helical half-metallic system. Numerous proposals for the latter have been put forward in the literature, most of them based on semiconductors or topological insulators with strong spin-orbit coupling. Here we demonstrate an alternative approach for the creation of TS in graphene/superconductor junctions without the need of spin-orbit coupling. Our prediction stems from the helicity of graphene's zero Landau level edge states in the presence of interactions, and on the possibility, experimentally demonstrated, to tune their magnetic properties with in-plane magnetic fields. We show how canted antiferromagnetic ordering in the graphene bulk close to neutrality induces TS along the junction, and gives rise to isolated, topologically protected Majorana bound states at either end. We also discuss possible strategies to detect their presence. Remarkable progress has recently been reported in the fabrication of the proposed type of junctions, which offers a promising outlook for Majorana physics in graphene systems.

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