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Topological superconductivity with antiferromagnetic insulators

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Place: Room 525, Science Bldg. 5 (Physics), Kyoto University

Abstract:

Two dimensional topological superconductivity has attracted great interest due to the emergence of Majorana modes bound to vortexes and propagating Majorana modes at the edges.[1] However, due to its rare appearance in natural compounds, its experimental replication relies on delicate artificial engineering by combination of helical states, magnetic fields and conventional superconductors.[2]

Here we introduce a platform alternative to those mechanisms, by showing that a class of three dimensional antiferromagnets can be used to engineer a two dimensional topological superconductor. Our proposal [3] relies on the appearance of solitonic states at the interface between an antiferromagnet and a superconductor that become topologically gapped by intrinsic spin-orbit coupling. We show that those interfacial states do not require fine tuning between the superconducting and the antiferromagnetic exchange fields, as its existence is protected by asymptotic boundary conditions. Our findings open the venue of using three dimensional antiferromagnetic insulators as a solid state platform to engineer topological superconductivity.

[1] S.R. Elliott and M. Franz, Rev. Mod. Phys. **87**, 137 (2015).
[2] C.W.J. Beenakker, Ann. Rev. Condens. Matter Phys. **4**, 113-136 (2013).
[3] J. L. Lado and M. Sigrist, in preparation (2018).

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