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Majorana Bound States Induced by Antiferromagnetic Skyrmion Textures

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Majorana bound states are zero-energy states predicted to emerge in topological superconductors and intense efforts seeking a definitive proof of their observation are still ongoing. A standard route to realize them involves antagonistic orders: a superconductor in proximity to a ferromagnet. Here, we show that this issue can be resolved using antiferromagnetic rather than ferromagnetic order. We propose to use a chain of antiferromagnetic skyrmions, in an otherwise collinear antiferromagnet, coupled to a bulk conventional superconductor as a novel platform capable of supporting Majorana bound states that are robust against disorder. Crucially, the collinear antiferromagnetic region neither suppresses superconductivity nor induces topological superconductivity, thus allowing for Majorana bound states localized at the ends of the chain. Our model introduces a new class of systems where topological superconductivity can be induced by editing antiferromagnetic textures rather than locally tuning material parameters, opening avenues for the conclusive observation of Majorana bound states.

\[1\] S. A. Díaz, J. Klinovaja, D. Loss, and S. Hoffman, arXiv:2102.03423.

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