

Signatures of edge states in NbSe₂/NiPS₃/NbSe₂ antiferromagnetic Josephson junctions

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The interplay between superconductivity and magnetic textures can give rise to unconventional superconducting phenomena [1-3]. Van der Waals (vdW) materials provide a versatile platform for investigating the competition between these orders. Here, we report on individual NbSe₂/NiPS₃/NbSe₂ Josephson junctions that exhibit behavior characteristic of superconducting quantum interference devices (SQUIDs) [4]. This response is attributed to the coupling between superconductivity in NbSe₂ and the spin texture of the vdW antiferromagnetic

insulator NiPS₃. The SQUID-like behavior persists under in-plane magnetic fields of at least 6 T. Microscopic modeling of the antiferromagnetic

insulator/superconductor (AFI/S) interface points to the emergence of localized states at the junction edges, which can form channels that dominate transport. These results highlight AFI/S heterostructures as a promising system for exploring engineered superconducting behavior and unconventional transport phenomena.

References

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