Letter

Hidden Zeeman-type spin polarization in bulk crystals

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Exploring hidden effects that have been overlooked given the nominal global crystal symmetry but are indeed visible in solid-state materials has been a fascinating subject of research recently. Here, we introduce a hidden Zeeman-type spin polarization (HZSP) in nonmagnetic bulk crystals with sublattice structures. In the momentum space of these crystals, the doubly degenerate bands formed in a certain plane can exhibit a uniform spin configuration with opposite spin orientations perpendicular to this plane, whereas such degenerate states are spatially separated in a pair of real-space sectors. Interestingly, we find that HZSP can manifest itself in both centrosymmetric and noncentrosymmetric materials. We further demonstrate the important role of nonsymmorphic twofold screw-rotational symmetry played in the formation of HZSP. Moreover, two representative material examples, i.e., centrosymmetric WSe_2 and noncentrosymmetric $BaBi_4O_7$, are identified to show HZSP via first-principles calculations. Our finding thus not only opens different perspectives for hidden spin polarization research but also significantly broadens the range of materials towards spintronics applications.

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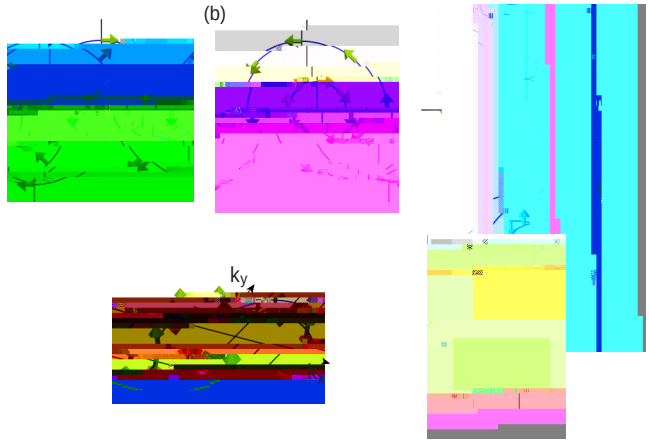
I . Since the discovery of hidden spin polarization in centrosymmetric crystals [N may also provide new design principles for building novel


(b)
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