Anomalous transport effects in altermagnets

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Altermagnets represent a recently established class of compensated collinear magnets, complementing the conventional categories of ferro- and antiferromagnets [1,2]. Unlike antiferromagnets, where opposite sublattices are related by lattice translation or inversion, altermagnetic sublattices are connected through rotational symmetries (symmorphic or nonsymmorphic, proper or improper) [1,2]. This symmetry relation breaks time-reversal symmetry in the electronic band structure and, in contrast to ferromagnets, produces a momentum-dependent spin splitting that alternates in sign across the Brillouin zone—hence the term altermagnetism. Importantly, the net magnetization integrates to zero over the full Brillouin zone.

Here, we present experimental verification of this alternating spin splitting using angle-resolved photoemission spectroscopy (ARPES) on MnTe [3]. The characteristic spin splitting further enables linear-response phenomena such as the anomalous Hall effect [4–6] and X-ray magnetic circular dichroism [7,8]. We will discuss the symmetry requirements underlying these anomalous transport responses, their dependence on the orientation of the Néel vector (Figure 1), and their experimental fingerprints.

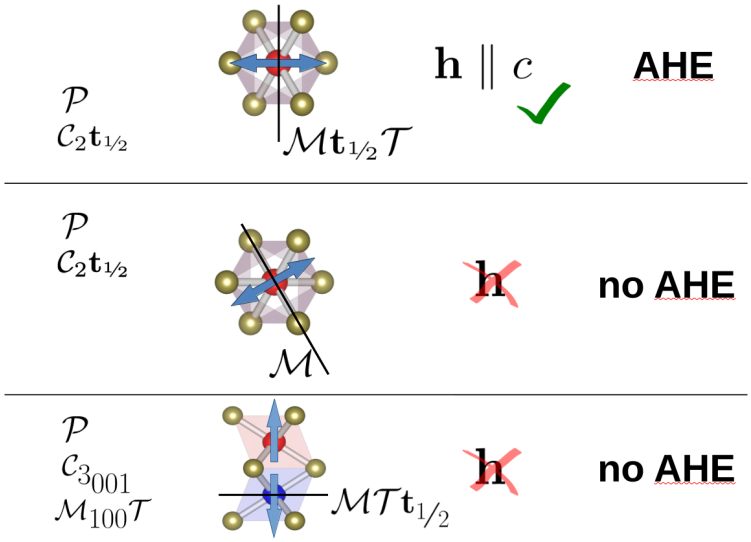

Figure 1. Magnetic symmetries of three Néel vector orientations in a NiAs structured (e.g. MnTe) system together with the Hall pseudovector which indicates the presence of an anomalous Hall effect.

References

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