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Light-induced dc currents in materials with $C_{4n}\mathcal{K}$ symmetry

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Berry curvature manifests as current responses to applied electric fields. When time reversal is broken, a Berry curvature ''monopole" gives rise to a Hall current that is proportional to the applied field. When time reversal is preserved, a Berry curvature ''dipole" may result in a Hall current that is second order in the applied field. In this work, we examine a current response arising from a Berry curvature ''quadrupole". This arises at third order in the applied field. However, it is the leading response when the following symmetry conditions are met. The material must not be symmetric under time-reversal ($\mathcal{K}$) and four-fold rotations (C_{4n}); however, it must be invariant under the combination of these two operations ($C_{4n}\mathcal{K}$). This condition is realized in altermagnets and in certain magnetically ordered materials. We argue that shining light is a particularly suitable approach to see this effect. In the presence of a static electric field, light gives rise to a dc electric current that can be easily measured.

Keyword-1

Anomalous Hall effect

Keyword-2

Altermagnets

Keyword-3

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