

Spin-induced nonlinear current in magnetic Weyl semimetals and its topological/geometrical properties

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Magnets hosting strong exchange interactions can exhibit nontrivial cross-correlated responses, such as the generation of an electric current driven by magnetization dynamics. The emergence of such cross-correlated phenomena requires a low-symmetry environment, specifically the simultaneous breaking of spatial inversion and time-reversal symmetries [1].

We therefore focus on the magnetic Weyl semimetal (MWSM) lacking both symmetries and consider the spin precession in a MWSM coupled to a heat bath (Fig.1-(a, b)). Treating the spin dynamics as an axial gauge field (Fig.1-(b)), we analyze the rapid spin-induced current by using Floquet theory (Fig.1-(c)) and the Keldysh Green's function method [2].

We further evaluate the nonlinear response via topological or geometric quantities, such as the Berry curvature, the quantum metric, and the shift vector, to identify their origins. In this presentation, we will discuss these coefficients and compare their properties with nonlinear electric current induced by AC electric field [3].

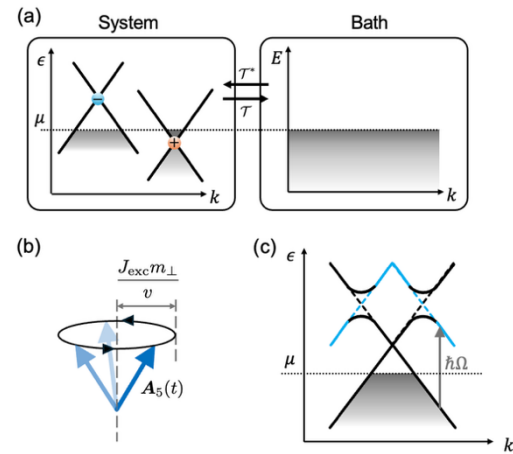


Figure 1. (a) The system of magnetic Weyl semimetal is coupled to a heat bath. (b) The local spin in the MWSM can be regarded as the effective gauge field, which is called the axial gauge field. (c) We focus on a Floquet band which has a photon-dressed valence band and bare conduction band.

References

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