Dynamic spin conductivity of Heisenberg antiferromagnets

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Abstract

We study the dynamic spin conductivity of insulating antiferromagnets described by the XXZ Heisenberg model with an anisotropy parameter Δ. Spin currents flow in response to a magnetic-field gradient or, in systems with spin-orbit coupling, perpendicular to a time-dependent electric field. The dynamic spin conductivity at zero temperature is calculated within interacting spin-wave theory in two and three dimensions. At the isotropic point ($\Delta = 1$), which separates the Ising regime ($\Delta > 1$) from the XY regime ($\Delta < 1$), we find that the dimensionality of the system plays a crucial role: In $d = 3$ the regular part of the spin conductivity vanishes linearly in the zero frequency limit, whereas in $d = 2$ it approaches a finite zero frequency value.

[1] M. Sentef, M. Kollar, and A. P. Kampf, cond-mat/0612215 (2006).

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