

Phonon Thermal Hall Effect in Mott Insulators via Skew Scattering by the Scalar Spin Chirality

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Thermal transport is a crucial probe for studying excitations in insulators. In Mott insulators, the primary candidates for heat carriers are spins and phonons; which of these candidates dominates the thermal conductivity is a persistent issue. Typically, phonons dominate the longitudinal thermal conductivity while the thermal Hall effect (THE) is primarily associated with spins, requiring time-reversal symmetry breaking. The coupling between phonons and spins usually depends on spin-orbit interactions and is relatively weak. Here, we propose a new mechanism for this coupling and the associated THE: the skew scattering of phonons via spin fluctuations by the scalar spin chirality. This coupling does not require spinorbit interactions and is ubiquitous in Mott insulators, leading to a thermal Hall angle on the order of 10^{-3} to 10^{-2} . Based on this mechanism, we investigate the THE in YMnO_3 with a trimerized triangular lattice where the THE beyond spins was recognized, and we predict the THE in the kagome and square lattices.