Title:	Thermal transport of the frustrated spin-chain mineral linarite: Magnetic heat transport and strong spin-phonon scattering
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Abstract:	The mineral linarite [PbCuSO4(OH)2] forms a monoclinic structure where a sequence of Cu(OH)2 units forms a spin- 1 2 chain. Competing ferromagnetic nearest-neighbor (J1) and antiferromagnetic next-nearest-neighbor interactions (J2) in this quasi-one-dimensional spin structure imply magnetic frustration and lead to magnetic ordering below TN = 2.8 K in a multiferroic elliptical spin-spiral ground state. Upon the application of a magnetic field along the spin-chain direction, distinct magnetically ordered phases can be induced. We studied the thermal conductivity κ in this material across the magnetic phase diagram as well as in the paramagnetic regime in the temperature ranges 0.07–1 K and 9–300 K. We found that in linarite the heat is carried mainly by phonons but shows a peculiar nonmonotonic behavior in field. In particular, κ is highly suppressed at the magnetic phase boundaries, indicative of strong scattering of the phonons off critical magnetic fluctuations. Even at temperatures far above the magnetically ordered phases, the phononic thermal conductivity is reduced due to scattering off magnetic fluctuations. The mean free path due to spin-phonon scattering (lspin-phonon) was determined as a function of temperature. A power law behavior was observed mainly above 500 mK indicating the thermal activation of spin fluctuations. In the critical regime close to the saturation field, lspin-phonon shows a 1/T dependence. Furthermore, a magnon thermal transport channel was verified in the helical magnetic phase. We estimate a magnon mean free path which corresponds to about 1000 lattice spacings.
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