Field-dependent heat transport SmB6: phonons scattered by magnetic impurities

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The striking observation of quantum oscillations in the Kondo insulator SmB_6 suggests that there may be chargeless fermionic excitations at low temperature in the bulk of this material [1]. One way to detect such putative excitations is through their ability to carry entropy, which a measurement of thermal transport should in principle detect as a non-zero residual linear term in the T = 0 limit, i.e. $\kappa_0 / T > 0$. Here we report low-temperature measurements of the thermal conductivity κ in SmB_6, down to 70 mK, performed on various single crystals in magnetic fields up to 15 T [2]. By extrapolating at low temperature, we observe that the residual linear term $\kappa_0 / T = 0$ at each field in every single crystal, in agreement with a previous study [3]. However, we also observe a large enhancement of $\kappa(T)$ with increasing field, unlike in the prior study [3]. Furthermore, the effect of field is anisotropic, depending on the relative orientation (parallel or perpendicular) of field and heat current. The temperature dependence is complex and non-monotonic, suggesting that heat is carried predominantly by phonons which are scattered by magnetic impurities. We compare our results to a recently published study [4] and discuss how to reconcile current discrepancies in experimental observations on SmB_6.

[1] B. S. Tan et al., Science 349,287 (2015).
[2] M-E. Boulanger et al., arXiv : 1709.10456
[3] Y. Xu et al., Physical Review Letters 116, 246,403 (2016).
[4] M.Hartstein et al., Nat. Phys. (2017)