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Unusual behaviour of thermal conductivity in vanadium dioxide across the metal-insulator transition[1] KEDAR HIPPALGAONKAR, Institute of Materials Research and Engineering, SANGWOOK LEE, CHANGHYUN KO, University of California, Berkeley, FAN YANG, Lawrence Berkeley National Lab, JOONKI SUH, KAI LIU, KEVIN WANG, XIANG ZHANG, CHRIS DAMES, JUNQIAO WU, University of California, Berkeley — In an electrically conductive solid, the Wiedemann-Franz (WF) law requires the electronic contribution to thermal conductivity to be proportional to the product of electrical conductivity and absolute temperature , where the ratio is the Lorenz number, typically not much different from the Sommerfeld value $L_0 = 2.44\text{x}10^{-8}$ W-ohm-K^{-2} at room temperature. The WF law reflects a basic property of metals where charge and heat are both carried by the same quasiparticles that both experience elastic scattering. At temperatures below the Debye temperature, the WF law has been experimentally shown to be robust in conventional conductors, with violations theoretically predicted or experimentally observed in strongly correlated electron systems or Luttinger liquids. However, the experimentally observed violations are at very low temperatures. Here we report breakdown of the WF law in a strongly correlated metal, in which the electronic thermal conductivity and L nearly vanish at temperatures above room temperature, where the electronic thermal conductivity amounts to only <˜5% of the value expected from the WF law.

[1]Unusual behaviour of thermal conductivity in vanadium dioxide across the metal-insulator transition

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