

Abstract Submitted
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Reconstructing Fourier's law from disorder in quantum wires¹

MASSIMILIANO DI VENTRA, YONATAN DUBI, University of California - San Diego — The validity of Fourier's law in nano-scale wires poses a fundamental theoretical challenge, with both scientific and technological implications. In this work, a novel theory of open quantum systems is used to study the local temperature and heat currents in metallic nanowires connected to leads at different temperatures. We show that for ballistic wires the local temperature is almost uniform along the wire and Fourier's law is invalid. By gradually increasing disorder, a uniform temperature gradient ensues inside the wire and the thermal current linearly relates to this local temperature gradient, in agreement with Fourier's law. Finally, we show that while disorder is responsible for the onset of Fourier's law, the non-equilibrium energy distribution function is determined solely by the heat baths.

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