

Electronic noise due to temperature differences across nanoscale conductors: Beyond standard thermal and shot noises

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Since the discovery of electronic thermal (Johnson–Nyquist) noise and shot noise about a century ago, these two forms of fundamental electronic noise have had an enormous impact on science and technology. Here, we report on a new version of electronic noise that is generated by temperature differences across nanoscale conductors, which we term “delta-T noise” [1,2]. We experimentally demonstrate this noise in atomic and molecular junctions, and analyze it theoretically using the Landauer formalism. The delta-T noise reveals a peculiar combination of characteristics that makes it different from the known thermal noise and voltage-activated shot noise. This noise can be used to detect temperature differences across nanoscale conductors without the need for fabricating sophisticated local probes. Furthermore, delta-T noise should be considered when designing modern nanoscale electronics, since temperature gradients are often generated unintentionally across electronic components.

[1] O. Shein-Lumbroso, L. Simine, A. Nitzan, D. Segal and O. Tal, *Nature*, 562 (2018) 240.

[2] E. Scheer and W. Belzig, *Nature (News & Views)*, 562 (2018) 200.