

Thermodynamic Bounds on Precision in Ballistic Multi-Terminal Transport

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Is there a fundamental minimum to the thermodynamic cost of precision in non-equilibrium processes? Here, we investigate this question, which has recently triggered notable research efforts [1,2], for ballistic transport in a multi-terminal geometry. For classical systems, we derive a universal trade-off relation between total dissipation and the precision, at which particles are extracted from individual reservoirs [3]. Remarkably, this bound becomes significantly weaker in presence of a magnetic field breaking time-reversal symmetry. By working out an explicit model for chiral transport enforced by a strong magnetic field, we show that our bounds are tight. Beyond the classical regime, we find that, in quantum systems far from equilibrium, correlated exchange of particles makes it possible to exponentially reduce the thermodynamic cost of precision [3]. Uniting aspects from statistical and mesoscopic physics, our work paves the way for the design of precise and efficient transport devices.

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- [2] T. R. Gingrich, J. M. Horowitz, N. Perunov, J. L. England; *Phys. Rev. Lett.* **116**, 120601 (2016).
- [3] K. Brandner, T. Hanazato, K. Saito; *Phys. Rev. Lett.*, **120**, 090601 (2018).