Non-Gaussian work statistics in fermionic nanostructures

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We investigate the statistical properties of work performed on generic disordered fermionic nanograins during non-equilibrium quantum quenches. While much attention has been devoted to zero temperature properties[1,2], here we discuss the effects of finite temperature [3]. We generalize our zero temperature determinant formula for extracting the full statistics of work, and apply for finite temperature quenches in a fermionic random matrix ensembles. Similarly to the zero temperature case, the distribution of quantum work is found to be universal: it depends only on the temperature and the average work, and can be captured in terms of a classical Markovian diffusion process, considering particle transfers as random events mediated by Landau-Zener transitions. In contrast to the zero temperature case, the work can also take negative values, and for large temperatures it converges to a Gaussian distribution. We also find that average work grows linearly in time independently of the temperature. While work fluctuations preserve their superdiffusive character at low temperatures, in the opposite limit they grow diffusively. We also verified that for symmetrical cyclic driving our results satisfy the Crooks fluctuation relation at finite temperatures.

[1] I. Lovas, A. Grabarits, M. Kormos, and G. Zaránd, Phys. Rev. Research 2, 023224 (2020).

[2] A. Grabarits, I. Lovas, M. Kormos, and G. Zaránd (to be submitted to Phys. Rev. Lett.).

[3] A. Grabarits, M. Kormos, I. Lovas, and G. Zaránd (to be submitted to Phys. Rev. B).