SUPPLEMENTAL MATERIAL

Landauer's erasure principle in a squeezed thermal memory

Jan Klaers[1*]

[1] *Complex Photonic Systems (COPS), MESA+ Institute for Nanotechnology, Universiteit Twente, 7500 AE Enschede, The Netherlands*

In this supplemental material, we provide a further analysis of the data presented in Fig. 3 of the main text. This allows a comparison with the investigated analytical model. Figure 3a of the main text shows the required work W to compress the single-particle gas to half of its initial volume as a function of the timing parameter t_0, which defines the points in time, namely t_0, $\nu^{-1} + t_0$, $2\nu^{-1} + t_0$, $\ldots$, at which the compression steps are executed. The given values W_r (for different squeezing parameters r) are normalized to the work at vanishing squeezing $W_{r=0}$ (corresponding to the Landauer limit). For critical damping and in the over-damped regime, the ratio $W_r/W_{r=0}$ (at a fixed timing t_0) is observed to closely follow a simple exponential scaling with the squeezing parameter r:

$$W_r/W_{r=0} \simeq \mathrm{e}^{-\lambda r} \; . \tag{S1}$$

By means of linear regression, we determine the numerical values of the work cost exponent λ occuring in our simulations, see Fig. S1. In general, λ is found to be somewhat below the value

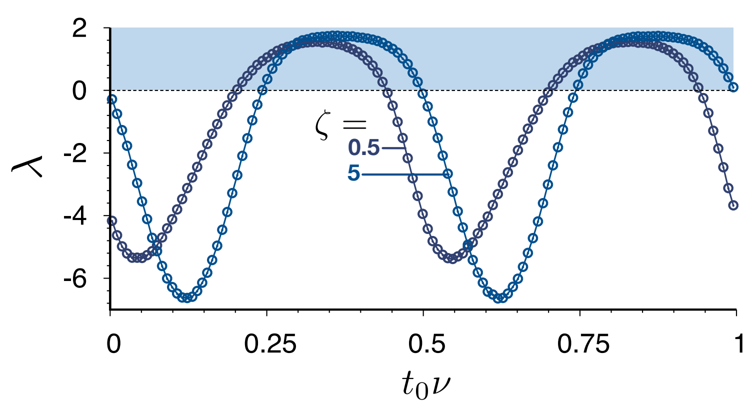

Figure S1. Work cost exponent λ as a function of the timing parameter t_0 for critical damping ($\zeta = 0.5$) and in the over-damped regime ($\zeta = 5$). Positive values of λ (blue-shaded region) correspond to a reduction of the work costs with increasing squeezing factor r.

* j.klaers@utwente.nl

of $\lambda = 2$ derived from the analytical model in the main text, see eq. (6). The largest exponents obtained, corresponding to the strongest work cost reduction with increasing squeezing factor, are close to $\lambda = 1.8$. The observed quantitative discrepancy has its origin in the assumed phase space density of a spatially compressed squeezed thermal state, as given in eq. (4) of the main text. The latter does not properly take into account the particle trajectories right after the collision with the piston (compare with the numerically obtained phase space densities in Fig. 2).