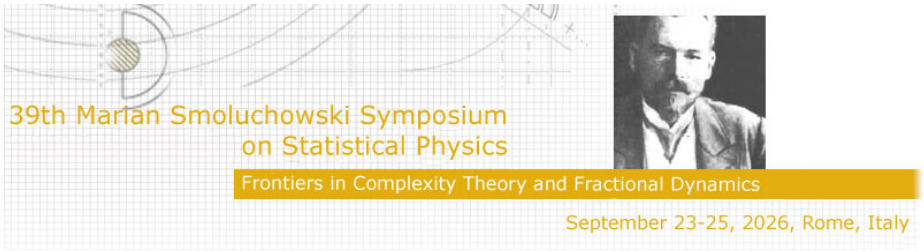

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Reset-controlled thermodynamic transition in an inhomogeneous Brownian information engine

Thursday, 24 September 2026 15:30 (1h 30m)

We investigate a Brownian information engine driven by space-dependent diffusivity. The working protocol is described by overdamped Langevin dynamics within a harmonic confinement and is controlled via resetting. The geometry of the space-dependent diffusivity has a significant impact on the information processing. If the fluctuation increases, while moving away from the potential's center $D(x)\ (1+x^2)$, a higher information-energy exchangeability is observed. This colossal information processing is hindered by a lower resetting cycle time. Interestingly, for a case of space-dependent fluctuations whose strength disappears going away from the potential center, $D(x)\ (1-x^2)$ enables a reset-controlled thermodynamic phase behavior. In the slow-resetting limit $(r\to 0)$, the system exhibits an athermal engine-refrigerator transition governed by the ratio between the frequency of the confining potential and the strength of the space-dependent fluctuation $= \frac{k}{2D0}$. The engine can convert the acquired information into a positive output work only if > 1, revealing a noise-induced thermodynamic transition. Moreover, a finite cycle time acts as a nonequilibrium control field, redistributing the probability by shifting the engine-refrigerator phase boundary. Our analytical predictions are supported by Langevin simulations and contrasted with the homogeneous diffusivity, highlighting the distinct role of multiplicative noise in enabling reset-controlled information use.

References

1. M. R. Evans and S. N. Majumdar, *Phys. Rev. Lett.* **106**, 160601 (2011).
2. A. Pal and S. Reuveni, *Phys. Rev. Lett.* **118**, 030603 (2017).
3. U. Seifert, Rep. *Prog. Phys.* **75**, 126001 (2012).
4. T. Sagawa and M. Ueda, *Phys. Rev. Lett.* **104**, 090602 (2010).
5. P. Bauri, R. Rafeek, and D. Mondal (under preparation, 2026)

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