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An exactly solvable model of Maxwell's demon DIBYENDU MANDAL, Department of Physics, University of Maryland, College Park, CHRISTOPHER JARZYNSKI, Department of Chemistry and Biochemistry, and Institute for Physical Science and Technology, University of Maryland, College Park — The paradox of Maxwell's demon has stimulated numerous thought experiments, leading to discussions about the thermodynamic implications of information processing. However, the field has lacked a tangible example or model of an autonomous, mechanical system that reproduces the actions of the demon. To address this issue, we introduce an explicit model of a device that can deliver work to lift a mass against gravity by rectifying thermal fluctuations, while writing information to a memory register. We solve for the steady-state behavior of the model and construct its nonequilibrium phase diagram. In addition to the engine-like action described above, we identify a "Landauer eraser" region in the phase diagram where the model uses externally supplied work to remove information from the memory register. Our model offers a simple paradigm for investigating the thermodynamics of information processing by exposing a transparent mechanism of operation.

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