

Measuring and Controlling Out of Equilibrium Fluctuations

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Relation between information and thermodynamics has been a long standing subject for debate. Debate surrounding a Gedanken experiment. Maxwell's demon, brought us rich scientific discussions on information-energy relations. We demonstrated a Szilard-type Maxwell's demon, or information-energy conversion, using sub-micron sized particles subjected to thermal fluctuations. By using real-time based on information about a particle's location, the particle climbs up a spiral-stairs-like potential, with gaining free energy larger than the amount of work performed on it beyond the conventional limit of the second law of thermodynamics. Moreover, a new nonequilibrium equality concerning the feedback control has been shown to hold; this verifies a new principle for information thermodynamics for the nonequilibrium systems with feedback control.