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High-Precision Tests of Stochastic Thermodynamics in a Feedback Trap[1] MOMČILO GAVRILOV, YONGGUN JUN, JOHN BECHHOEFER, Dept. of Physics, Simon Fraser University, Burnaby, BC, Canada — Feedback traps can trap and manipulate small particles and molecules in solution. They have been applied to the measurement of physical and chemical properties of particles and to explore fundamental questions in the non-equilibrium statistical mechanics of small systems. Feedback traps allow one to choose an arbitrary virtual potential, do any time-dependent transformation of the potential, and measure various thermodynamic quantities such as stochastic work, heat, or entropy. In feedback-trap experiments, the dynamics of a trapped object is determined by the imposed potential but is also affected by drifts due to electrochemical reactions and by temperature variations in the electronic amplifier. Although such drifts are small for measurements on the order of seconds, they dominate on time scales of minutes or slower. In this talk, we present a recursive algorithm that allows real-time estimations of drifts and other particle properties. These estimates let us do a real-time calibration of the feedback trap. Having eliminated systematic errors, we were able to show that erasing a one-bit memory requires at least kT ln 2 of work, in accordance with Landauer's principle.

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