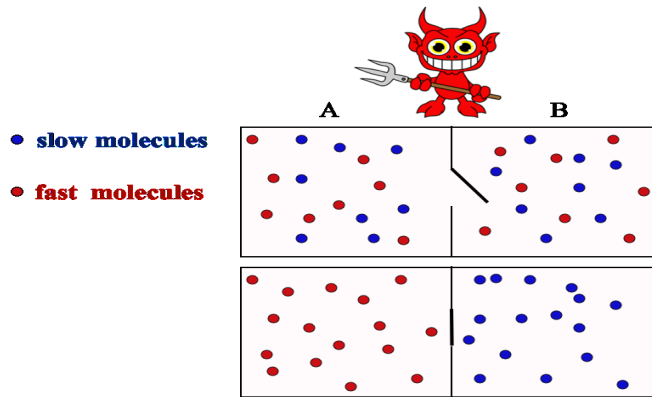


The Maxwell demon and Landauer's principle: from gedanken to real experiments



S. Ciliberto

Laboratoire de Physique de l'ENS de Lyon, CNRS UMR5672
46 Allée d'Italie- 69364 Lyon- France

During this talk we will recall the connections between information and thermodynamics. We will then discuss a specific example of the measure of the Landauer's bound.

Rolf Landauer argued that the erasure of information is a dissipative process. A minimal quantity of heat, proportional to the thermal energy, is necessarily produced when a classical bit of information is deleted. A direct consequence of this logically irreversible transformation is that the entropy of the environment increases unavoidably by a finite amount. We experimentally show the existence of the Landauer bound in a generic model of a one-bit memory. Using a system of a single colloidal particle trapped in a modulated double-well potential, we establish that the mean dissipated heat saturates at the Landauer bound in the limit of long erasure cycles. This result demonstrates the intimate link between information theory and thermodynamics. For a memory erasure procedure, which is a logically irreversible operation, a detailed Jarzynski Equality is verified, retrieving the Landauer limit independently of the work done on the system.

References :

Experimental verification of Landauer's principle linking information and thermodynamics, A. Bérut, A. Arakelyan, A. Petrosyan, S. Ciliberto, R. Dillenschneider, E. Lutz, Nature , 483, 187–189 (08 March 2012).

Detailed Jarzynski Equality applied to a Logically Irreversible Procedure, A. Bérut, A. Petrosyan, S. Ciliberto, EPL, 103 (2013) 60002

Information: From Maxwell's demon to Landauer's eraser, Eric Lutz, Sergio Ciliberto, Physics Today 68 (9), 30 (2015)

