THE CRM APPLIED MATHEMATICAL AND PHYSICS (CAMP) SEMINARS

CENTRE DE RECERCA MATEMÀTICA

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Thermodynamics of symmetry breaking

Abstract:

A symmetry breaking (SB) involves an abrupt change in the set of microstates that a system can explore. This change has unavoidable thermodynamic implications.
According to Boltzmann's microscopic interpretation of entropy, a shrinkage of the set of compatible states implies a decrease of entropy, which eventually needs to be compensated by dissipation of heat and consequently requires work.

Examples are the compression of a gas and the erasure of information. On the other hand, in a spontaneous SB, the available phase space volume changes without the need for work, yielding an apparent decrease of entropy. Here we show that this decrease of entropy is a key ingredient in the Szilard engine and Landauer's principle and report on a direct measurement of the entropy change along SB transitions in a Brownian particle. The SB is induced by a bistable potential created with two optical traps.

The experiment confirms theoretical results based on fluctuation theorems, allows us to reproduce the Szilard engine extracting energy from a single thermal bath, and shows that the signature of a SB in the energetics is measurable, providing new methods to detect, for example, the coexistence of metastable states in macromolecules.

Date:	**March 13, 2014**
Place:	**Room C1/028**
Time:	**12:00**