

**Garbaczewski, Piotr**

**Differential entropy and time.** (English) Zbl 1135.82312  
*Entropy* 7, No. 4, 253-299 (2005).

**Summary:** We give a detailed analysis of the Gibbs-type entropy notion and its dynamical behavior in case of time-dependent continuous probability distributions of varied origins: related to classical and quantum systems. The purpose-dependent usage of conditional Kullback-Leibler and Gibbs (Shannon) entropies is explained in case of non-equilibrium Smoluchowski processes. A very different temporal behavior of Gibbs and Kullback entropies is confronted. A specific conceptual niche is addressed, where quantum von Neumann, classical Kullback-Leibler and Gibbs entropies can be consistently introduced as information measures for the same physical system. If the dynamics of probability densities is driven by the Schrödinger picture wave-packet evolution, Gibbs-type and related Fisher information functionals appear to quantify nontrivial power transfer processes in the mean. This observation is found to extend to classical dissipative processes and supports the view that the Shannon entropy dynamics provides an insight into physically relevant non-equilibrium phenomena, which are inaccessible in terms of the Kullback-Leibler entropy and typically ignored in the literature.

**MSC:**

**82C03** Foundations of time-dependent statistical mechanics  
**94A17** Measures of information, entropy

Cited in 4 Documents

**Keywords:**

differential entropy; von Neumann entropy; Shannon entropy; Kullback-Leibler entropy; Gibbs entropy; entropy methods; entropy functionals; Fisher information; Ornstein-Uhlenbeck process; Schrödinger picture evolution; dynamics of probability densities; invariant density

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