

# Review of: "On the statistical arrow of time"

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This paper is flawed even in its motivations. The author confuses the notion of thermodynamic entropy, responsible for the so-called arrow of time, with the conceptually different notion of information entropy.

Information entropy measures the amount of uncertainty in a random process, according to the knowledge that an observer has about it. As E.T. Jaynes notices in his notes "Information theory and statistical mechanics", Phys. Rev. 106 (1957) 620, also cited by the author, the notion of information entropy " .... has really nothing to do with the laws of physics ....", and, in particular, neither with the arrow of time.

Thermodynamic entropy, on the other hand, is a physical measurable property of macroscopic systems, which can be uniquely defined as a function of any two other thermodynamic properties. For example, the entropy of a monoatomic ideal gas is given by the Sackur-Tetrode equation in terms of its pressure and density.

Thermodynamic entropy measures the volume in phase space consistent with the macroscopic state of the system and, therefore, it somehow estimates the allowed "diversity" in the states of individual degrees of freedom, without any knowledgeable agent involved!

Thermodynamic entropy is responsible - through the second law of thermodynamics - for many aspects of the dynamics of macroscopic physical systems, also in the cosmological scenario. For example, energy conservation considerations allow both for the decay of massive particles into pairs of photons (or other gauge bosons), as well as for the reverse process. Nonetheless, at cosmological temperatures well below the mass of the particle, the volume in phase space occupied by the massless bosons is much larger than the volume occupied by the massive particle, and the reaction occurs mainly in only one direction. Obviously, at these very early stages in the history of the Universe, there was not any knowledgeable agent to keep account.

In summary, the starting assumption upon which the author builds his arguments is absolutely flawed, which makes this paper less interesting.

