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Short Review

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The Role of Thermodynamics and Quantum Mechanics in Limiting Electronic Computation

Fayez Fok Al Adeh

The Syrian Cosmological Society, Damascus, SYRIA

Corresponding author: Fayez Fok Al Adeh, President of The Syrian Cosmological Society, Damascus, Syria.

Tel: 00963112776729; E-mail: hayfa@scs-net.org; mefayezfokaladeh@gmail.com

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The second law of thermodynamics is a universal law. The galactic spiral structures, for example, arise in response to the interaction of that law and the law of gravitation [1, 9]. The second law of thermodynamic states that some forms of transformation of one kind of energy to another do not occur in natural processes [13] another profound principle of nature is worth mentioning here. The Heisenberg's uncertainty principle asserts that nature forbids knowledge beyond a certain limit. The equivalence of entropy and information means that new information is obtained at the price of increased entropy (in a different part of the system). More accuracy means an increase of local information content and a corresponding decrease in local entropy. This is balanced by a parallel increase in global entropy. I introduce new concepts like the degree of assignment, the mass specific degree of assignment, or the mass specific number of distinguishable messages and a dynamic computer. Using these and other concepts, I deduce a relation between the entropic properties of the computer memory (i.e. its macroscopic disorder properties). The result formulated asserts that electronic computations are not out of the grasp of the second law of thermodynamics. A computer is only a limited ordering machine [8]. Increasing its ordering tasks without bounds is impossible, for such an increase will end sooner or later in macroscopic disorder and chaos.

Using Heisenberg's uncertainty principle [2,10] I arrive at the conclusion that the total mass equivalent of the energy that is invested in signals communicating different elements of the computer cannot exceed the total mass of the system.

No closed computer system, however constructed, can run programs of infinite lengths (practically very long programs) [7].

In discussing quantum mechanical description [12] I make use of the main properties of algorithms[4,5] and floating point numbers [3] and hence provide a reasonable argument in favor of the wave interpretation of quantum mechanics as compared with other interpretations of quantum mechanics [6,11&14].

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