Information shift dynamics described by Tsallis q=3 entropy on a compact phase space---a microscopic model of the cosmological constant

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Recent mathematical investigations have shown that under very general conditions exponential mixing implies the Bernoulli property. As a concrete example of a statistical mechanics which is exponentially mixing we consider a Bernoulli shift dynamics by Chebyshev maps of arbitrary order N≥2, which maximizes Tsallis q=3 entropy rather than the ordinary q=1 Boltzmann-Gibbs entropy. Such an information shift dynamics may be relevant in a pre-universe before ordinary space-time is created [1]. We discuss symmetry properties of the coupled Chebyshev systems, which are different for even and odd N. We provide numerical evidence that the low-energy value of the fine structure constant alpha=1/137 is distinguished as a coupling constant in this context, leading to uncorrelated behaviour in the spatial direction of the corresponding coupled map lattice for N=3.

This is a kind of exotic generalized statistical mechanics model, but where could it be physically embedded? One possibility is to regard this as an underlying microscopic model of a small cosmological constant in the universe---the existence of dark energy is evidenced in the form of the observed accelerated expansion of the universe, and constant dark energy is just represented by a small cosmological constant. The type of model considered above has been previously shown to serve as a possible model of dark energy in the universe [2]. The time evolution of the information shift dynamics is not in physical time but in the fictitious time coordinate of the Parisi-Wu approach of stochastic quantization [3]. The underlying model can be used to fix and stabilize the observed numerical values of standard model parameters such as coupling constants, masses, and mixing angles. They are distinguished as states corresponding to strongest possible random properties of the underlying chaotic microscopic dynamics [4].

References

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