

From Boltzmann-Gibbs statistics to Tsallis statistics: Case study for dynamical systems

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(Dated: February 2, 2017)

As well known, Boltzmann-Gibbs statistics is the correct way of thermostatically approaching ergodic systems. On the other hand, nontrivial ergodicity breakdown and strong correlations typically drag the system into out-of-equilibrium states where Boltzmann-Gibbs statistics fails. For a wide class of such systems, it has been shown in recent years that the correct approach is to use Tsallis statistics instead. Here we show how the dynamics of the paradigmatic conservative (area-preserving) standard map exhibits, in an exceptionally clear manner, the crossing from one statistics to the other. Our results unambiguously illustrate the domains of validity of both Boltzmann-Gibbs and Tsallis statistics [1]. Since various important physical systems can be reduced to conservative low-dimensional maps, our results are expected to enlighten and enable an improved interpretation of diverse experimental and observational results.

[1] U. Tirnakli and E. P. Borges, *Sci. Rep.* **6** (2016) 23644.