

Along the Boltzmann-Gibbs-von Neumann-Shannon legacy – Nonadditive entropies

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Boltzmann-Gibbs (BG) statistical mechanics is, together with Newton, Einstein and quantum mechanics as well as Maxwell electromagnetism, one of the pillars of contemporary theoretical physics. As well known, this magnificent theory, grounded on the BG additive entropic functional, satisfactorily handles, along more than 150 years, a plethora of physical phenomena. It fails, however, when relevant space-time correlations are strictly long-ranged, meaning typically that correlation momenta are not finite at all orders. To overcome such limitations, a generalized statistical mechanics is possible grounded on nonadditive entropic functionals. This enlarged theory, first proposed in 1988, has been successfully applied to diverse natural, technological and social complex systems. Moreover, it implies that the BG entropy is sufficient but not necessary for preserving the Legendre structure of classical thermodynamics. We will briefly present the foundations of this generalized theory, as well as applications in low- and high-energy physics, cosmology, nonlinear dynamical systems, economics, engineering, medical and computational sciences, among others.

Bibliography at <https://tsallis.cbpf.br/biblio.htm>