Special Issue

Complexity in High-Energy Physics: A Nonadditive Entropic Perspective

Message from the Guest Editors

Complexity typically arises in systems that occupy the intermediate regime between perfect order and complete stochasticity. Signatures of complex behaviour are now being investigated across high-energy physics by studying various observables following power-law distributions. These observables reveal the existence of features that conventional Boltzmann–Gibbs statistics cannot adequately accommodate.

Over the past decade, nonadditive statistical frameworks based on Tsallis entropy have been successfully used to model this behaviour. Power–law distributions derived from non-additive entropy describe a wide array of observables in high-energy collisions like transverse-momentum spectra.

This Special Issue focuses on the interface between complex-systems science and high-energy physics through the lens of nonadditive statistical mechanics. It brings together theoretical analyses and phenomenological investigations that trace the origins of nonadditive statistics, clarify its physical interpretation, and demonstrate its utility in explaining the emergent complexity characteristic of high-energy phenomena.

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The concept of entropy is traditionally a quantity in physics that has to do with temperature. However, it is now clear that entropy is deeply related to information theory and the process of inference. As such, entropic techniques have found broad application in the sciences.

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