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Incomparability, Entropy, and Mixing Dynamics

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Abstract

Boltzmann states are considered in a fundamentally new way, specifically their mixing character. The mixing character of these states is known to be partially ordered by majorization and thus contains information regarding their incomparability. Previously we showed that Boltzmann entropy states had a huge range in the number of incomparable states. Here we phase average incomparability across Boltzmann states. We propose the consequent function as a new state variable, complimentary to entropy, that provides new insights to Boltzmann systems. This function can be related to a traditional complexity viewpoint and so we call it average Boltzmann complexity (ABC). The evolution of Boltzmann complexity is explored via a Monte Carlo lattice dynamics approach and is shown to be consistent with the view of entropy as the arrow of time. Our report concludes with a discussion of the information contained in Boltzmann complexity and offers suggestions for further studies.

Keywords: entropy; incomparability; majorization; complexity; mixing; time's arrow

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