Gibbs Paradox and the Higher Similarity - Higher Entropy Relationship

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Abstract

There are three kinds of correlation of the entropy of mixing with similarity. The Gibbs paradox statement, which has been regarded as a very fundamental assumption in statistical mechanics, says that the entropy of mixing or assembling to form solid assemblages, liquid and gas mixtures or any other analogous assemblages such as quantum states, decreases discontinuously with the increase in the property similarity of the composing individuals. Most authors accept this relastionship (e.g. [1]). Some authors revised the Gibbs paradox statement and argued that the entropy of mixing decreases continuously with the increase in the property similarity of the individual components [2]. A higher similarity - higher entropy relationship and a new theory has been constructed: entropy of mixing or assembling increases continuously with the increase in the similarity. Similarity Z can be easily understood when two items A and B are compared: if A and B are distinguishable (minimal similarity), Z=0. If they are indistinguishable (maximal similarity), Z=1.

References:

[1] E. T. Jaynes, The Gibbs Paradox, In Maximum Entropy and Bayesian Methods; C. R. Smith, G. J. Erickson, P. O. Neudorfer, Eds.; Kluwer Academic: Dordrecht, 1992, p.1-22.

[2] J. von. Neumann, Mathematical Foundations of Quantum Mechanics. Princeton, NJ: Princeton University Press, 1955.

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