

Entropy and statistical mechanics: An historical perspective

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The basic properties of the standard form for the entropy S_{BG} in statistical mechanics, which was developed on solid physical and mathematical foundations by Boltzmann, Gibbs and Einstein, will be reviewed. A solvable model, based on Einstein's 1916 quantum theory of radiation, which illustrates these properties will be presented [1]. Recently, a new form of the entropy called S_q has been proposed by C. Tsallis, that depends on a variable q , and has been applied extensively. It will be demonstrated, however, that claims that "this entropy preserves the same basic properties of the BG one"¹ is *false* except for $q = 1$, but in this case $S_1 = S_{BG}$ [2],[3].

References

- [1] M. Nauenberg, "The evolution of radiation toward thermal equilibrium: A soluble model that illustrates the foundations of statistical mechanics Am. J. Phys **72**, 313-323 (2004)

- [2] M. Nauenberg, " Critique of q-entropy for thermal statistics" Phys. Rev. E **67**, 036114 (2003);
" Reply to Comment on Critique of q-entropy for thermal statistics" Phys. Rev. E **69**, 038102 (2004);
<http://physics.ucsc.edu/~michael>

- [3] R. Balian and M. Nauenberg, " Letter to the Editors" Europhysics news, n.2 v.37 (2006).

¹See, for example, the abstract of C.Tsallis at this summer school.