Proceedings of the T2022
International Conference on Thermodynamics 2.0
July 18-20, 2022 | Boone, NC, USA

T2.0:2022-0156

ZENTROPY

Zi-Kui Liu

Department of Materials Science and Engineering, Pennsylvania State University, University Park, USA

Abstract

Entropy drives changes in all systems from quantum to black holes. In the scientific literature, three categories of entropy are usually discussed, i.e., thermodynamic, statistical, and quantum. Thermodynamic entropy represents the total entropy of a system and in physical science is obtained by integration of heat capacity over temperature from zero K to the temperature of investigation. Statistical entropy usually refers to classical statistical mechanics in terms of Gibbs distribution. While quantum entropy includes contributions from thermal electrons and phonons in terms of Fermi-Dirac and Bose Einstein distributions. The zentropy theory postulates that the combination of quantum and statistical entropies equals to the thermodynamic entropy and can be derived from the partition function when the internal energy of each configuration is substituted by its free energy as each configuration is a mixture of many pure quantum states. It is demonstrated that the zentropy theory is capable of predicting emergent phenomena including their limits at critical points where singularity appears [1].

Keywords: entropy, zentropy, internal energy, free energy, emergent phenomenon

References:

[1] Z.-K. Liu, "Theory of cross phenomena and their coefficients beyond Onsager theorem," Materials Research Letters, vol. 10, no. 7, 2022. https://doi.org/10.1080/21663831.2022.2054668

Corresponding Author E-Mail: prof.zikui.liu@psu.edu