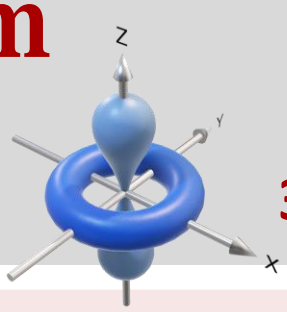
Department of Physics Colloquium

March 13, 2023 **3:00 PM**



Zentropy

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Entropy drives changes in all systems from quantum to black holes. While the total entropy of a system can be accurately obtained from experimentally measured heat capacity, its theoretical prediction remains elusive. Entropy of a system is counted theoretically by either statistical mechanics in terms of top-down Gibbs distribution or bottom-up quantum mechanics in terms of Fermi-Dirac and Bose Einstein distributions. Our newly termed zentropy theory integrates them into a nested formula to account for disorder and fluctuations from the electronic scale to the macroscopic scale of the system.

In this presentation, the zentropy theory is introduced through the combined law of thermodynamics containing entropy production due to internal processes, and its capability is demonstrated through prediction of emergent behaviors in magnetic and ferroelectric materials including singularity at critical points, effects previously thought to be explainable exclusively via strong correlated physics. Furthermore, the entropy production in the combined law enables us to derive flux equations and coefficients of cross-phenomena from fundamental thermodynamics.

(https://doi.org/10.1080/21663831.2022.2054668).

This colloquium will be held in-person, at SERC 116 unless announced otherwise.