

**EMERGENCE OF ORDER AND DISORDER FAR-FROM-EQUILIBRIUM: A FUNDAMENTAL
FRONTIER IN THERMODYNAMICS AND CONDENSED MATTER PHYSICS**

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ABSTRACT

Equilibrium Thermodynamics and Statistical Mechanics that underpins it, is a triumph of 19th century physics. The framework explains equations of state, phases and phase transitions, critical phenomena, and universality classes just to name a few of its successes. However, despite this profound advance in our understanding of the universe around us, it cannot address behavior of systems far-from-equilibrium and yet, such systems display a myriad of organizations and order that emerge spontaneously. Such order (and the complimentary disorder) are seen systems from hard to soft condensed matter and extend into the biological world. This talk will review some representative systems that cover this breath of emergent behavior and will attempt to define some of the more outstanding questions to be answered for the next revolution in thermodynamics.

Keywords: equations of state, organization, order, emergence, statistical mechanics, thermodynamics