

THERMODYNAMICS OF UNIVERSAL PATTERNS

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ABSTRACT

Nature is not random but regular. Irrespective of scale and scope, distributions are skewed, thus cumulating sigmoidally. Although lognormal, logistic, and power-law functions follow data closely, mathematical models do not explain why the patterns are universal. A true explanation calls for substance and cause.

The ubiquitous patterns imply a unity of nature. Yet, the basis of the universal laws of thermodynamics has remained only implicit. Like Newton and Galileo, also Boltzmann revered ancient atomism but did not recognize the quantum of light, the carrier of energy, as the founding postulate of statistical mechanics, the many-body theory underlying thermodynamics. Having atomism in mind, Lewis renamed the light quantum to the photon but did not revise statistical mechanics to include photon influxes and effluxes. Thus, while accounting for flows of energy, thermodynamics has remained tacit about the carrier of energy and time, the photon being the fundamental constituent of nature.

Assuming everything comprises photons, I show how to mathematize a general energy level diagram to the equation of state, which, in turn, can be differentiated with respect to time into the equation of change, the 2nd law of thermodynamics. Straightforward analysis reveals the universal patterns emerging from the least-time evolution of any system toward thermodynamic balance, the free energy minimum, the entropy maximum. The holistic worldview offers humankind unprecedented understanding from elementary particles to cosmic expanses, from a gene to the biosphere, and from purchase to world trade, accompanied by unrelenting responsibility.

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