

EMERGENT OR FUNDAMENTAL? ABOUT THE ORIGIN OF THERMODYNAMIC UNIVERSALITY

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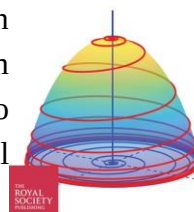
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ABSTRACT

Temperature is a universal thermodynamic concept because it is independent of the structure and constituents of the material. Apparently, the whole conceptual framework of classical equilibrium thermodynamics shares this kind universality. Thermodynamics is working far beyond ideal gases with well abstracted microscopic properties. Non-equilibrium thermodynamics is a framework dealing with dissipative systems, and in several aspects, it is also universal. For example, the Fourier law of heat conduction is our number one technological model dealing with heat conduction for fluids and solids equivalently.

The various modern branches of non-equilibrium thermodynamics developed ideas that are capable of generalizing the constitutive functions like the Fourier law of heat conduction. Moreover, one can derive the evolution equations of dissipative systems. The abstraction of the metaphysical principles makes transparent the core ideas, the origin of the apparent universal properties and also the tools and means of validation. The ultimate challenge is whether we can interpret physics without mechanics, in particular, whether we can understand mechanics through thermodynamic concepts.

In the presentation, I summarize the common aspects of the various branches of non-equilibrium thermodynamics and the related efforts to contribute to the clarification of some fundamental problems of physics like the origin of gravity.



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