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Do We Need a Fifth Law of Thermodynamics?

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Abstract – In future, thermodynamics is expected to exert a significant influence in various disciplines, resulting in emergence of new laws of thermodynamics. Four established laws of thermodynamics are the zeroth law (temperature conceptualization), the first law (input-heat channelization *viz.* internal-energy increase and useful-work performance), the second law (entropy and heat-sink conceptualization) and the third law (absolute zero cannot be achieved). Various versions of the fourth law have been presented by Beretta; Chernomorskii; Cobos-Murcia; Jackimowicz; Martínez-Kahn & Martínez-Castilla; Morel & Fleck; Tangle, Bhalekar & Andresen as well as the author. In author’s version “it is not possible to design a *Carnot Engine* or any other physical heat engine, whose source has a positive-absolute temperature and sink has a negative-absolute temperature”. It is to be noted that author’s version of the fourth law is closely related and is, in fact, derivable from the third law. The author believes that a new law, to be given due weightage, must be linked to the previous one. In the wake of the 2025 Nobel Prize in Physics “for the discovery of macroscopic-quantum-mechanical tunneling and energy quantization in an electric circuit”, a fifth law of thermodynamics is proposed. Temperature is considered as thermodynamic potential, setting the direction of heat flow from one reservoir to the other. Considering a quantum-potential-barrier model, on a macroscopic scale, heat may flow from positive- to negative-absolute temperature (passing through zero-absolute temperature) through tunneling process. However, no heat engine could operate with a heat sink at absolute zero or below absolute zero.

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Keywords – Attainability of absolute zero, Carnot engine, Entropy, Heat sink, Heat source

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