# NONEQUILIBRIUM EMPIRIC, CALORIC AND ENTROPIC TEMPERATURES AND REFERENCE EQUILIBRIUM VALUES FOR HIDDEN VARIABLES

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## ABSTRACT

Empiric, caloric and entropic temperatures refer to three different aspects of temperature, respectively related to mutual thermal equilibrium, the internal energy contents, and to the direction of heat flux between systems at different temperatures. These aspects are respectively related to the zero-th, first and second principles of thermodynamics. In equilibrium, these several different aspects of temperature lead to a same value of temperature, but in systems out of equilibrium they may be different from each other, in steady states [1-5]. In this presentation we deal with this topic in systems with some internal hidden variable, whose temperature cannot be directly measured, and whose value must be inferred from the temperatures of other accessible variables. Thus, we consider a system with three families of degrees of freedom: two of them directly measurable and controllable from the outside, and a third one which is not directly accessible. In this simplified situation, we compare the expressions for the caloric and entropic temperatures, and their relation with entropic temperature, in presence of a heat flux across the system. Application to nanosystems will be briefly discussed [6]

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