

Thermodynamic anomaly in overdamped systems with time-dependent temperature

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It is generally believed that for systems in which the temperature changes with time, the overdamped description breaks down. This feature is attributed to the fact that the velocity degree of freedom does not equilibrate within the overdamped time scales. In this talk, I am going to discuss about the discrepancies in the energetics of a thermodynamic system with temporally varying temperature when an overdamped approximation is used. In our recent work, we found that the overdamped approximation fails to capture the complete heat exchanged between the system and its surrounding bath. We also find that within this approximation the entropy production too deviates from its true value. This “thermodynamic anomaly” has far-reaching implications. In particular, the efficiency of heat engines needs to be suitably modified when studied with the overdamped description. Moreover, we also find a method of calculating kinetic energy changes for Langevin systems with large viscosity which outperforms the traditionally used experimental methods.

[1] Thermodynamic anomaly in overdamped systems with time-dependent temperature. *Shakul Awasthi, Hyunggyu Park, Jae Sung Lee* [Manuscript in preparation]