Abstract Submitted
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Thermodynamic equivalence of Jordan and Einstein frame in scalar-tensor theory[1] KRISHNAKANTA BHATTACHARYA, California State University Fresno and IIT Guwahati, BIBHAS MAJHI, ASHMITA DAS, IIT Guwahati — Scalar-tensor theory is a modified theory of gravity which can be described in the two frames. The original frame is known as the Jordan frame, where a scalar field ϕ is non-minimally coupled with the Ricci scalar R. This non-minimal coupling of ϕ and R can be removed by a conformal transformation of the metric tensor and a rescaling in ϕ. This conformal frame is known as the Einstein frame. There are two major questions in scalar-tensor theory: (1) Whether the conformal equivalence of the action in the two frames is merely a mathematical equivalence or whether these two frames are indeed equivalent. (2) What are the explicit covariant expressions of the physical quantities (energy, entropy, temperature) and how they are connected in the two frames. In Phys.Rev.D **95**, 064026 (2017) and Phys.Rev.D **97**, 124013 (2018) we have explored these issues. We show that by properly defining the Lagrangians in the two frames, one can obtain the first law and the covariant expressions of the thermodynamic parameters (including energy) following the Iyer-Wald formalism. We also show that all the thermodynamic parameters are conformally invariant.

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