



Department of
Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

An entropy current in higher derivative theories of gravity

(Zoom Seminar)

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Zoom link shall be shared separately

We construct a proof of the second law of thermodynamics in an arbitrary diffeomorphism invariant theory of gravity working within the approximation of linearized dynamical fluctuations around stationary black holes. We achieve this by establishing the existence of an entropy current defined on the horizon of the dynamically perturbed black hole in such theories. By construction, this entropy current has non-negative divergence, suggestive of a mechanism for the dynamical black hole to approach a final equilibrium configuration via entropy production as well as the spatial flow of it on the null horizon. This enables us to argue for the second law in its strongest possible form, which has a manifest locality at each space-time point. We explicitly check that the form of the entropy current that we construct in this paper exactly matches with previously reported expressions computed considering specific four derivative theories of higher curvature gravity. Using the same set up we also provide an alternative proof of the physical process version of the first law applicable to arbitrary higher derivative theories of gravity.

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