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On Thermal Stability of Hairy Black Holes

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We discuss thermodynamical stability of black hole spacetimes, with the latter viewed as defects in the thermodynamical parameter space. We derive, in a model independent way, the conditions for a hairy black hole with a secondary hair to reach a stable thermal equilibrium with the heat bath, which the black hole is embedded to. As a specific example, we consider black holes with scalar hair in higher-curvature modified gravity theories. If the scalar hair, induced by interactions of matter fields with quadratic-curvature corrections, produces an inner horizon in the deformed geometry, a thermodynamically stable configuration will be reached with the black hole becoming extremal in its final stage. We also speculate that such stable black-hole remnant might induce a minimum length in the quantum spacetime.

Reference:

N. Chatzifotis, P. Dorlis, N.E. Mavromatos and E. Papantonopoulos [arXiv:2302.03980 [gr-qc]].

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