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N. Santos: A little hair can make a big difference: local thermodynamic stability of hairy black holes

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The local thermodynamic stability of a black hole (BH) in the canonical ensemble is defined by the positivity of the specific heat at constant global charges. Schwarzschild BHs in thermal equilibrium with the environment are always unstable against small fluctuations of energy, whereas Reissner-Nordström/Kerr BHs with sufficiently large specific electric charge/angular momentum are stable. One could expect that asymptotically-flat hairy BHs branching off from such stable phases would also be, by continuity, locally thermodynamically stable for vanishingly little hair. In this talk, we show the situation changes when the hair grows from the addition of ultralight bosonic matter to Einstein-Maxwell theory. Specifically, we find quasi-bald BHs are locally unstable in this statistical ensemble, regardless of their specific global charges.

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