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Evaporation of four-dimensional dynamical black holes sourced by the quantum trace anomaly

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A first approximation to describe the interplay between quantum matter and gravity can be obtained in the quantum field theory on curved spacetimes by studying the back-reaction of a quantum field on the spacetime geometry, using the so-called semiclassical Einstein equation. In this framework, the evaporation of four-dimensional spherically symmetric dynamical black holes can be explained by the appearance of a **negative ingoing energy flux** at the apparent horizon, which induces a negative variation of the black hole mass. This negative flux can be sourced by the **trace anomaly** of the quantum stress-energy tensor in case of a free massless conformally-coupled scalar field, once a certain averaged energy condition is valid outside the horizon. This condition holds assuming that the semiclassical Einstein equation is fulfilled outside the horizon by the background geometry which is sourced by classical collapsing matter. As an example, both the negative flux and the rate of evaporation can be explicitly evaluated in the Vaidya spacetime, which describes the exterior geometry of a null radiating star. The talk is based on a joint work with N. Pinamonti, S. Roncallo and N. Zanghì (*arXiv:2103.02057 [gr-qc]*).

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