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Quantum Black Hole Physics from the Event Horizon

Quantum gravity theories predict deformations of black hole solutions relative to their classical counterparts. A model-independent approach was advocated in our work that uses metric deformations parametrised in terms of physical quantities, such as the proper distance. While such a description manifestly preserves the invariance of the space-time under coordinate transformations, concrete computations are hard to tackle since the distance is defined in terms of the deformed metric itself. In this work, for spherically symmetric and static metrics, we provide a self-consistent framework allowing us to compute the distance function in close vicinity to the event horizon of a black hole. By assuming a minimal degree of regularity at the horizon, we provide explicit (series) expansions of the metric. This allows us to compute important thermodynamical quantities of the black hole, such as the Hawking temperature and entropy, for which we provide model-independent expressions, beyond a large mass expansion. Moreover, imposing for example the absence of curvature singularities at the event horizon leads to non-trivial consistency conditions for the metric deformations themselves, which we find to be violated by some models in the literature.

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