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Semiclassical aspects of two-dimensional black holes: singularity resolution via a negative central charge

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We analyze the semiclassical geometry of two-dimensional (CGHS) black holes in the Boulware vacuum. In this state, the expectation value of the stress-energy tensor is singular at the classical horizon. However, when backreaction effects are taken into account, the resulting geometry becomes horizonless and takes the form of a non-symmetric wormhole, featuring a curvature singularity beyond the throat. Remarkably, reversing the sign of the central charge of the conformal matter eliminates this singularity, yielding a backreacted geometry that is both horizonless and asymptotically flat. We argue that this behavior is largely universal, independent of the specific local counterterm added to the non-local Polyakov action. This result aligns with recent findings obtained in the semiclassical analysis of Schwarzschild geometry within the framework of two-dimensional dilaton gravity. We also discuss the physical significance of negative central charges in conformal anomalies from a four-dimensional perspective.

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