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Black hole metamorphosis: what happens after half evaporation?

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Hawking's calculation of particle production by a black hole is based on the semi-classical approximation, in which back-reaction on the metric is not taken into account. This leaves open the question of how the black hole evolves as a result of evaporation. In an attempt to answer it, we construct a simple analogue system, which shares the information storage properties of a black hole such as its Bekenstein-Hawking entropy. We find indications that at the latest after losing half of the mass, a black hole undergoes a metamorphosis leading to a drastic deviation from Hawking evaporation. As two likely possibilities for the subsequent evolution, it can either become extremely long lived or decay via a new classical instability. The first option would open up a new window for small primordial black holes as viable dark matter candidates.

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