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Hot qubits on the horizon

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Perturbation theory for gravitating quantum systems tends to fail at very late times (a type of perturbative breakdown known as secular growth). We argue that gravity is best treated as a medium/environment in such situations, where reliable late-time predictions can be made using tools borrowed from quantum optics. To show how this works, we study the explicit example of a qubit hovering just outside the event horizon of a Schwarzschild black hole (coupled to a real scalar field) and reliably extract the late-time behaviour for the qubit state. At very late times, the so-called Unruh-DeWitt detector is shown to asymptote to a thermal state at the Hawking temperature.

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