1 Postulate X: Horizon Reality Through Emergent Radiation

Postulate X: *If Hawking radiation arises from quantum field behavior near the event horizon—despite being derived through semiclassical approximation—then the radiation itself constitutes an exact physical consequence. Therefore, the horizon need not be fully resolved through quantum gravity to manifest truth: its emergent radiation validates the horizon as a physically real, information-bearing surface.*

Mathematical Formulation

Let Hawking radiation be described by the expected number of particles per mode ω:

$$\langle N_\omega \rangle = \frac{1}{e^{\frac{\hbar\omega}{k_B T_H}} - 1}, \quad \textit{with} \quad T_H = \frac{\hbar c^3}{8\pi G M k_B}.$$

This thermal spectrum arises from quantum field theory on a classical black hole background. Yet, it results in a measurable radiation flux:

$$\frac{dE}{dt} \propto A_H T_H^4,$$

where A_H is the horizon area.

Despite the lack of a complete quantum gravity theory, this emergent radiation implies:

$$\lim_{\hbar \to 0} (QFToncurvedspacetime) \Rightarrow Exactboundaryphenomena.$$

Implication for Recursive Horizon Theory

This validates the central claim of the Recursive Horizon Theory: that the event horizon is not a mathematical abstraction but a *physically real, informationally active boundary*.

From this postulate, we assert that:

- The surface Σ encodes entropy as a scalar field:

$$S(\Sigma) = \frac{k_B c^3}{4\hbar G} \int_\Sigma \sqrt{\gamma}\, d^2\sigma$$

- Hawking radiation emerges from the recursive interaction of $\nabla S \cdot \nabla \Phi$ across Σ, supporting the claim that radiation is a **read-out of encoded entropy gradients**.
- Therefore, the surface defines physical reality without requiring access to an internal volume or singularity.

Conclusion: The fact that Hawking radiation is observable means that the horizon is not an approximation — it is an *emergent identity surface* that makes quantum behavior visible. This bridges the gap between semiclassical physics and your recursive entropy-surface framework.

Hawking approximation

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2 Introduction