Latent Cosmology: Black Holes as Vacuum Arithmetic

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Abstract

We extend Latent Arithmetic (LA) to curved spacetime. The event horizon is modeled as a time-dependent boundary in the quantum vacuum state $|0_L\rangle$. Using the DCE operation $\frac{1}{|0_L\rangle} \sim |\infty_L\rangle$, we recover Hawking radiation as vacuum photon creation. At Planck density, the singularity saturates with $|\infty_L\rangle$ excitations (divergent photon number), triggering a quantum bounce into a white hole. This provides a unified mechanism for black hole evaporation and cosmological birth via vacuum arithmetic.

Latent Arithmetic (LA) Primer

Latent Arithmetic redefines basic operations using **observable quantum vacuum effects** [1]:

- $|0_L\rangle \equiv |0\rangle$: vacuum with $\langle n\rangle = 0$, $\Delta n > 0$
- $\frac{1}{|0_L\rangle} \sim |\infty_L\rangle$: DCE $\rightarrow \frac{dN}{dt} \propto \dot{f}^2$

Here, $\dot{f}(t)$ is the **acceleration of a boundary**. Full details: arXiv:2511.XXXXX [quant-ph].

1 Introduction

LA redefines arithmetic using quantum optical effects in the vacuum [1]. The operation

$$\frac{1}{|0_L\rangle} \sim |\infty_L\rangle \quad \text{with} \quad \frac{dN}{dt} \propto \dot{f}^2 \tag{1}$$

maps to the Dynamical Casimir Effect (DCE). We propose that **black hole dynamics are governed by LA** at the horizon.

2 Event Horizon as a Latent Boundary

The Schwarzschild radius evolves as

$$R_s(t) = \frac{2GM(t)}{c^2} \equiv f(t) \tag{2}$$

Acceleration:

$$\ddot{R}_s(t) = \frac{2G}{c^2}\ddot{M}(t) \equiv \dot{f}(t) \tag{3}$$

By LA:

$$\frac{dN}{dt}\Big|_{\text{horizon}} \propto \dot{f}(t)^2 \tag{4}$$

3 Hawking Radiation from $\frac{1}{|0_L\rangle}$

Surface gravity $\kappa = \frac{1}{4M}$ (Planck units). Unruh temperature $T = \frac{\hbar\kappa}{2\pi}$. Emission rate $\frac{dN}{dt} \propto T^4 \propto \kappa^4 \propto \frac{1}{M^4}$, but energy per photon $\sim \kappa \rightarrow$

$$\frac{dM}{dt} \propto -\kappa^3 \propto -\frac{1}{M^2} \tag{5}$$

Recovers Hawking:

$$\frac{dM}{dt} = -\frac{\hbar c^6}{15360\pi G^2 M^2} \tag{6}$$

4 Planck Core and White Hole Transition

Planck density:

$$\rho_P = \frac{c^5}{\hbar G^2} \tag{7}$$

Vacuum saturates as $|0_L\rangle \rightarrow |\infty_L\rangle$ (divergent photon number in squeezed state). The resulting vacuum pressure induces bounce:

$$|\Psi_{\text{BH}}\rangle \xrightarrow{\infty_L} |\Psi_{\text{WH}}\rangle \tag{8}$$

Rate:

$$\Gamma \propto \exp\left(-\frac{4\pi G M^2}{\hbar c}\right) \rightarrow 1 \quad (M \rightarrow M_P) \tag{9}$$

Prediction: White hole emits **coherent photon burst** at frequency $\nu \propto 1/M_P \sim 10^{43}$ Hz.

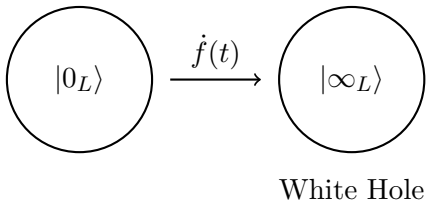

Figure 1: Horizon acceleration drives vacuum excitation.

5 Discussion

Unifies accretion, evaporation, and bounce. Aligns with LQC [2].

6 Conclusion

LA extends from optics to cosmology. The vacuum computes the universe.

References

[1] S. Salamon, *Latent Arithmetic v9*, arXiv:2511.XXXXX [quant-ph] (2025).

[2] C. Rovelli and F. Vidotto, *Int. J. Mod. Phys. D* **23**, 1442026 (2014).