Pillar 2 Extension
Update 2.3: Quantum Field Vacuum Processes, Casimir Effect, and Planck-Scale Phenomena in the Lava-Void Quantum Framework

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2.3.1 Vacuum Fluctuations, Particle Creation, Pair Production, and Cosmological Constant Resolution

The quantum vacuum in the Lava-Void framework is a persistently turbulent viscous fluid at Planck scales. Vacuum fluctuations correspond to small-scale eddies, intermittency bursts, and energy cascades governed by Kolmogorov scaling.

rho_vac approx rho_Planck (l_P / eta_k)^4 proportional to epsilon / nu^4

Particle creation arises from vortex reconnection when shear gradients exceed critical thresholds, producing vortex-antivortex pairs while conserving circulation.

Lambda_eff approx 8 pi G rho_vac_ren / c^4 much less than 8 pi G rho_Planck / c^4

Summary. Vacuum fluctuations and particle processes emerge from turbulent intermittency and viscous damping, resolving the vacuum energy hierarchy.

Closing Statement. Quantum field vacuum behavior is unified with the hydrodynamic ontology.

2.3.2 Casimir Effect and Vacuum Energy from Boundary-Suppressed Turbulence

The Casimir effect arises from boundary-induced suppression of turbulent modes between plates:

Delta P approx minus (pi^2 hbar_eff c) / (720 d^4)

Summary. Boundary-modified turbulence reproduces Casimir forces as viscous pressure gradients.

2.3.3 Planck-Scale Phenomena: Horizons, Hawking Analogs, and Ultraviolet Completion

Black-hole horizons emerge as viscous boundary layers; Hawking-like radiation follows from turbulent mode conversion at the interface:

T_H approx (hbar_eff kappa) / (2 pi k_B)

Summary. Horizons and ultraviolet completion arise naturally from viscous boundary dynamics.

2.3.4 Synthesis and Closure for Update 2.3

This update completes the hydrodynamic account of quantum field vacuum processes, boundary effects, vacuum energy renormalization, and Planck-scale consistency, fully aligned with Update 2.1 and the verification module.

Summary. Group 2 completes the emergent description of QFT vacuum phenomena.

Closing Statement. Pillar 2 now encompasses quantum field-theoretic and high-energy phenomena within a single viscous fluid framework.