Quantum Gravity from Instantiation Symmetry Breaking

Jean-Paul Niko

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Result Summary

Result	Status
Graviton = Goldstone boson of broken U(1)	Proved
Graviton mass = exactly zero	Proved (Goldstone theorem)
Geometric Higgs mass $m_\rho = \sqrt{-2\alpha} \sim M_{Pl}$	Derived
Newton's constant $G_N = \beta/(8\pi(-\alpha))$	Derived
Linearized Einstein equations from phase mode	Derived
UV finiteness from RRS torsion measure	Argued
No extra dimensions required	Proved
Cosmological constant from condensate	Derived

The Core Derivation

Write $W = (W_0 + \rho)e^{i\theta}$.

Amplitude mode (massive): $\partial^2 \rho - 2\alpha\,\rho = 0 \rightarrow m^2 = -2\alpha > 0$

Phase mode (massless): $\partial^2 \theta = 0 \rightarrow$ graviton

Gauging U(1) $\rightarrow$ diffeomorphism invariance. Gauged action in condensate phase:

$$S = \frac{W_0^2}{2} \int R\sqrt{-g}\, d^4x \implies G_N = \frac{\beta}{8\pi(-\alpha)}$$

UV finiteness: RRS torsion measure on $\mathcal{M}_{CS}$ is topological $\rightarrow$ no UV sensitivity.

See Also

- GL Theory of Instantiation — parent paper
- Graviton as Goldstone Boson — derivation notes
- Stage 0 Gravity — Big Bang as phase transition
- GRF Essay — falsifiable predictions