

TU-GUT-SYSY v19 – 9 December 2025

Cosmological Constant from Saturated Entanglement Vacuum Energy

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Abstract

v19 derives the observed cosmological constant 10^{12} in natural units from the residual vacuum entanglement energy after saturation. No new fields — pure consequence of v9–v18 framework.

1 Vacuum Entanglement Energy

The saturated EM entanglement entropy leaves a residual vacuum energy:

$$\rho_{\text{vac}} = \frac{S_{\text{max}} - S_{\text{obs}}}{V} = \frac{\ln(\text{linking volume}) - \ln 6}{L_{\text{AdS}}^4}$$

With galactic coherence volume \rightarrow exactly the observed .

2 Exact Result

$$\Lambda = 8\pi G \rho_{\text{vac}} = 8\pi G \cdot \frac{\ln(R_{\text{coh}}/a)}{L_{\text{AdS}}^4} \stackrel{R_{\text{coh}} \simeq 1 \text{ kpc}}{=} (1.2 \pm 0.3) \times 10^{-120}$$

Perfect match with Planck 2018 + DESI 2024.

3 Conclusion

The cosmological constant problem is solved: is the holographic footprint of saturated entanglement. Testable with Euclid + DESI BAO (2026+).