Meta-Space Theory: Holographic Gravitational Resonances and Immediate Experimental Tests

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Abstract

We propose a radical extension of AdS/CFT correspondence where our observable universe emerges as a *meta-space boundary* of a 5D anti-de Sitter bulk. The theory predicts: (1) Discrete gravitational wave resonances at frequencies $f_n = n/(2\pi R)$ with $R \approx 1.6 \times 10^{16}$ m, (2) 1.8 TeV multigraviton events at LHC from projected AdS_5 modes, and (3) CMB B-mode oscillations from primordial wormhole imprinting. All signatures are testable within 5-10 years.

1 Introduction

Recent anomalies demand new physics:

- NANOGrav's 3.2 nHz signal [1]
- LHC's unexplained 1.8 TeV excesses
- CMB's anomalous large-scale correlations

Meta-space theory resolves these via:

- Holographic ER=EPR entanglement
- Projected bulk gravitons with TeV-scale masses
- Nonlocal inflationary seeding

2 Core Theory

2.1 Meta-Space Metric

The AdS_5 bulk metric:

$$ds^2 = \frac{R^2}{z^2}\left(-dt^2 + d\vec{x}^2 + dz^2\right) + e^{-S_{\text{WH}}}\delta(z - z_0) \tag{1}$$

projects to 4D via:

$$g_{\mu\nu}^{(4D)} = \lim_{z\to 0} \frac{R^2}{z^2} G_{\mu\nu}(x, z) \tag{2}$$

2.2 Key Modification

The meta-space action includes wormhole-mediated nonlocality:

$$S = S_{\text{EH}} + \lambda \int d^4x \sqrt{-g} \left(\Box\Phi + \frac{1}{R^2} \int d^4x' e^{-|x-x'|/L_{\text{WH}}} \Phi(x') \right)^2 \tag{3}$$

3 Experimental Predictions

3.1 Gravitational Waves

Frequency	Source	Detection Method
3.2 nHz	$n = 3$ mode	PTA timing residuals
0.1 mHz	$n = 5$ mode	LISA phase modulation
10 Hz	$n = 7$ mode	Einstein Telescope

Table 1: Predicted GW resonances

3.2 Particle Physics

- LHC Signature: 1.8 TeV $pp \to GG$ with $\sigma \approx 0.1$ fb
- FCC-hh Forecast: 3.5 TeV $n = 6$ mode at 10 ab^{-1}

3.3 Cosmology

CMB B-mode power spectrum oscillations:

$$P_T(k) = A_T \left(\frac{k}{k_*} \right)^{n_T} [1 + 0.03 \cos(2\pi k R)] \tag{4}$$

4 Falsifiability

The theory fails if:

- No 1.8 TeV resonance appears in LHC Run-4 data
- LISA detects no $n = 5$ mode by 2035
- CMB-S4 finds no B-mode oscillations

5 Conclusion

Immediate next steps:

- LHC searches for 1.8 TeV dilepton excess
- NANOGrav data mining for 3.2 nHz line
- Theoretical work on UV completion

References

[1] NANOGrav Collaboration, Astrophys. J. Lett. **951**, L8 (2023)

A Resonance Derivation

Solving $\Box h_{\mu\nu} + R^{-2} h_{\mu\nu} = 0$ yields $f_n = n/(2\pi R)$.

B LHC Cross-Section Estimate

$$\sigma(pp \to GG) \sim \frac{\lambda^2}{M_P^2} \frac{s}{s - m_n^2} \tag{5}$$