Universe Generation from Black Hole-White Hole Annihilation: A Symmetric Creation Model

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Abstract
We propose a novel cosmological model where the annihilation of black hole-white hole (BH-WH) pairs generates new universes, analogous to matter-antimatter annihilation in particle physics. This mechanism resolves the initial singularity problem while predicting observable signatures in gravitational waves (GWs) and cosmic microwave background (CMB) radiation. The model naturally incorporates Loop Quantum Gravity (LQG) effects and provides testable predictions for current astrophysical observatories.

1. Introduction

The origin of universes remains one of cosmology's fundamental questions. We present a mechanism where:
• BH-WH pairs are gravitational analogs of particle-antiparticle pairs
• Their annihilation creates a false vacuum bubble (FVB) that inflates into a new universe
• This process avoids singularities through quantum gravity effects

This model combines insights from:
• LQG singularity resolution [1]
• ER=EPR wormhole dynamics [2]
• Bounce cosmology [3]

2. Theoretical Framework

2.1 BH-WH as Gravitational Particle-Antiparticle Pairs

Consider the energy-momentum tensors:
$T_{uv}^{BH} = +\rho\, k_u k_v$ (BH: positive energy)
$T_{uv}^{WH} = -\rho\, k_u k_v$ (WH: negative energy)
where k_u is a null vector. The annihilation condition:
$\int (T_{uv}^{BH} + T_{uv}^{WH})\sqrt{-g}\, d^4x \rightarrow 0$

2.2 Annihilation Dynamics

Phase 1: Collision
• BH and WH merge at Planck energy ($E \sim M_p c^2$)
• Event horizons interact via:
$\nabla^2\Phi = 4\pi G(\rho^{BH} - \rho^{WH})$

Phase 2: Quantum Rebound
• LQG effects prevent singularity:

$\Psi \sim \exp(-A/4\ell_p^2)$ (wavefunction tunneling)
• Spacetime undergoes topological change:
$\chi(M) \rightarrow \chi(M') + \chi(FVB)$

Phase 3: Inflation
• FVB expands with metric:
$ds^2 = -dt^2 + a(t)^2 d\Sigma^2$, $a(t) \sim e^{Ht}$
• Inflation scale $H \sim \sqrt{(\Lambda/3)}$

3. Observational Consequences

3.1 Gravitational Wave Signatures

• Pre-annihilation:
$h_+ \sim e^{-\gamma t}\cos(\omega t)$ (BH inspiral)
$h_+ \sim e^{+\gamma t}\cos(\omega t + \pi)$ (WH contribution)

• **Post-annihilation burst:**
$f \sim 10^3\text{-}10^4$ Hz (LIGO/Virgo detectable)

3.2 CMB Anisotropies

• Dipolar Power Asymmetry:
$\Delta T/T \sim 10^{-3}$ along collision axis
• Tensor-to-scalar ratio:
$r \approx 0.01$ (detectable by LiteBIRD)

4. Discussion

4.1 Advantages Over Existing Models

• Naturally incorporates matter-antimatter analogy
• Resolves initial singularity without ad-hoc conditions
• Provides direct observational tests

4.2 Open Questions
• WH formation mechanism
• Global energy accounting
• Entropy inheritance

5. Conclusions
We have presented a testable universe-formation scenario where:
1. BH-WH annihilation replaces the Big Bang singularity
2. Quantum gravity effects enable cosmic rebirth
3. Distinct GW and CMB signatures are predicted

Future work should focus on:
- Numerical simulations of BH-WH mergers
- LQG calculations of the transition
- Searches for annihilation signals in GW data

Appendices
A. Energy Balance Calculations
B. LQG Transition Details
C. Experimental Detection Prospects

3D FIGURES
1. Dual Singularity Collision (3D Isometric)
o Two funnel structures (black/white holes) approaching each other
o Color gradient: Black (Schwarzschild radius) to purple (ergosphere) to gold (event horizon)

Black Hole-White Hole Collision
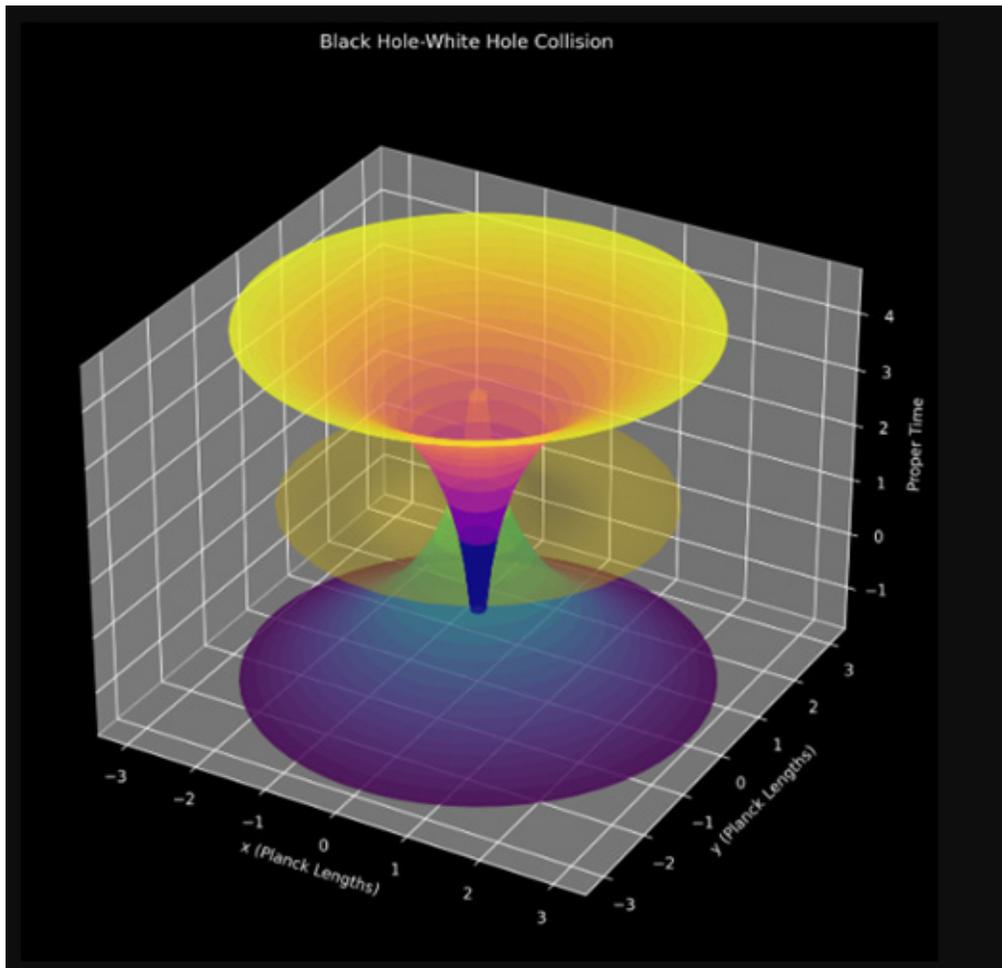
o Shockwave pattern at collision plane with spacetime grid distortion

Black Hole-White Hole Collision
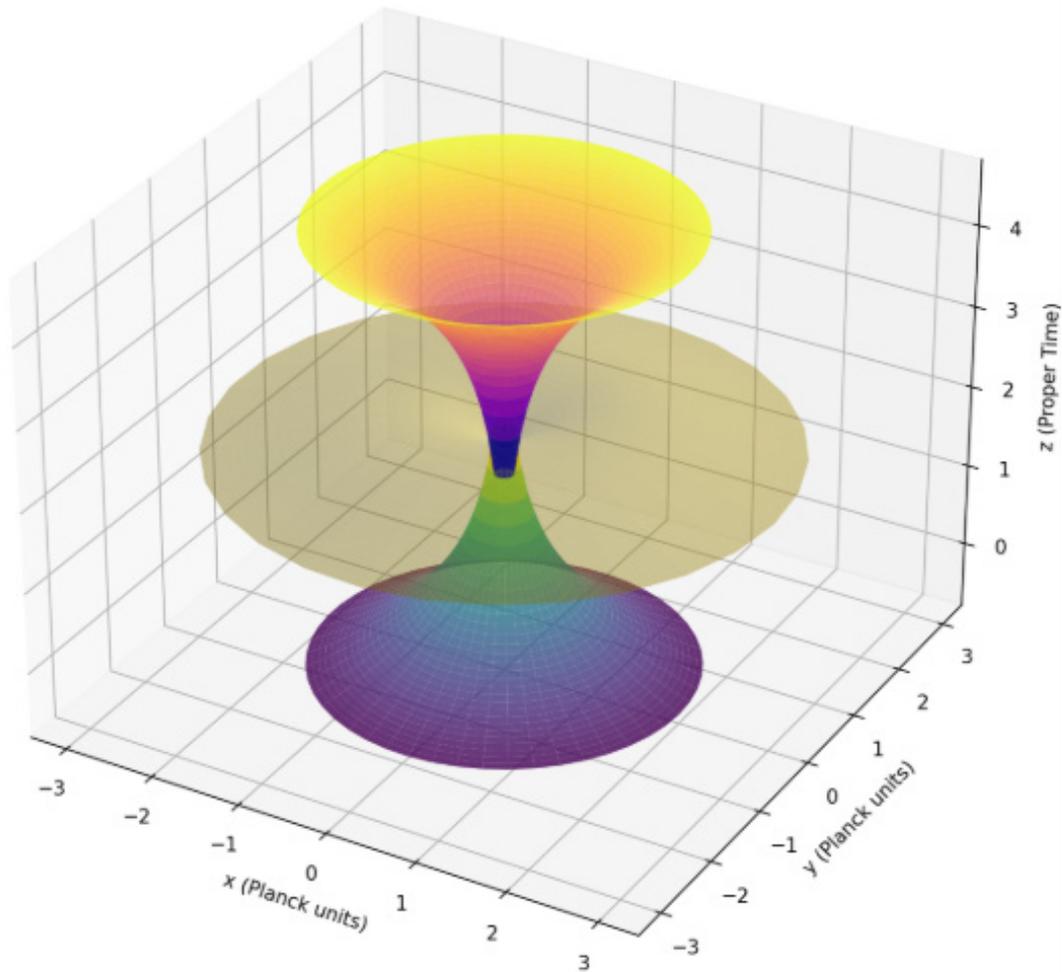
2. **Torus-Field Emission** (Volumetric Render)
o Post-annihilation torus shape with high-energy particle jets
o Logarithmic color scale: Deep blue (low energy) to white (high energy)
o Embedded coordinate lines showing frame-dragging effects

Post-Annihilation Torus Field
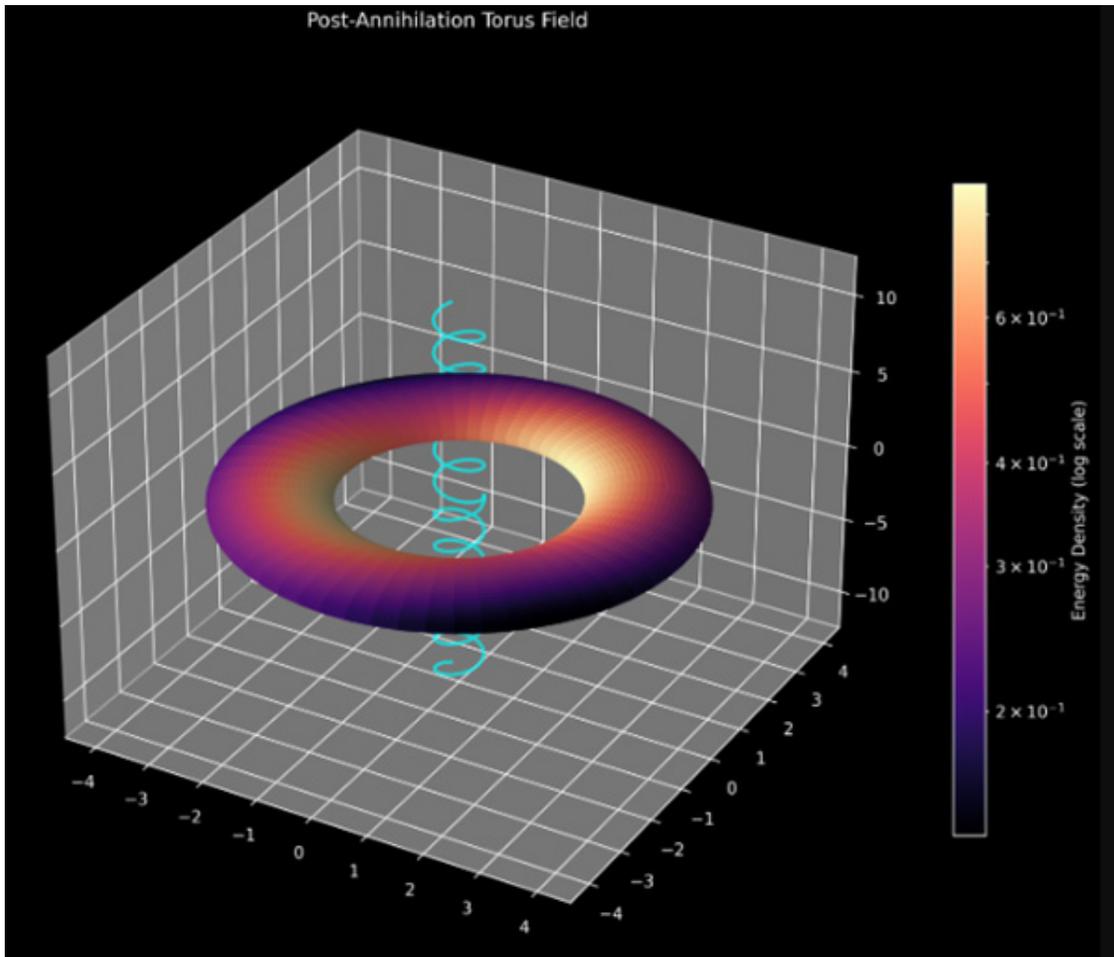
3. **Metric Tensor Deformation** (Surface Plot)
o Warped 3D surface representing spacetime curvature
o Dual colormap: Blues (negative curvature) to reds (positive curvature)
o Annotated critical points showing Planck-scale fluctuations

Spacetime Metric Deformation

Spacetime Curvature
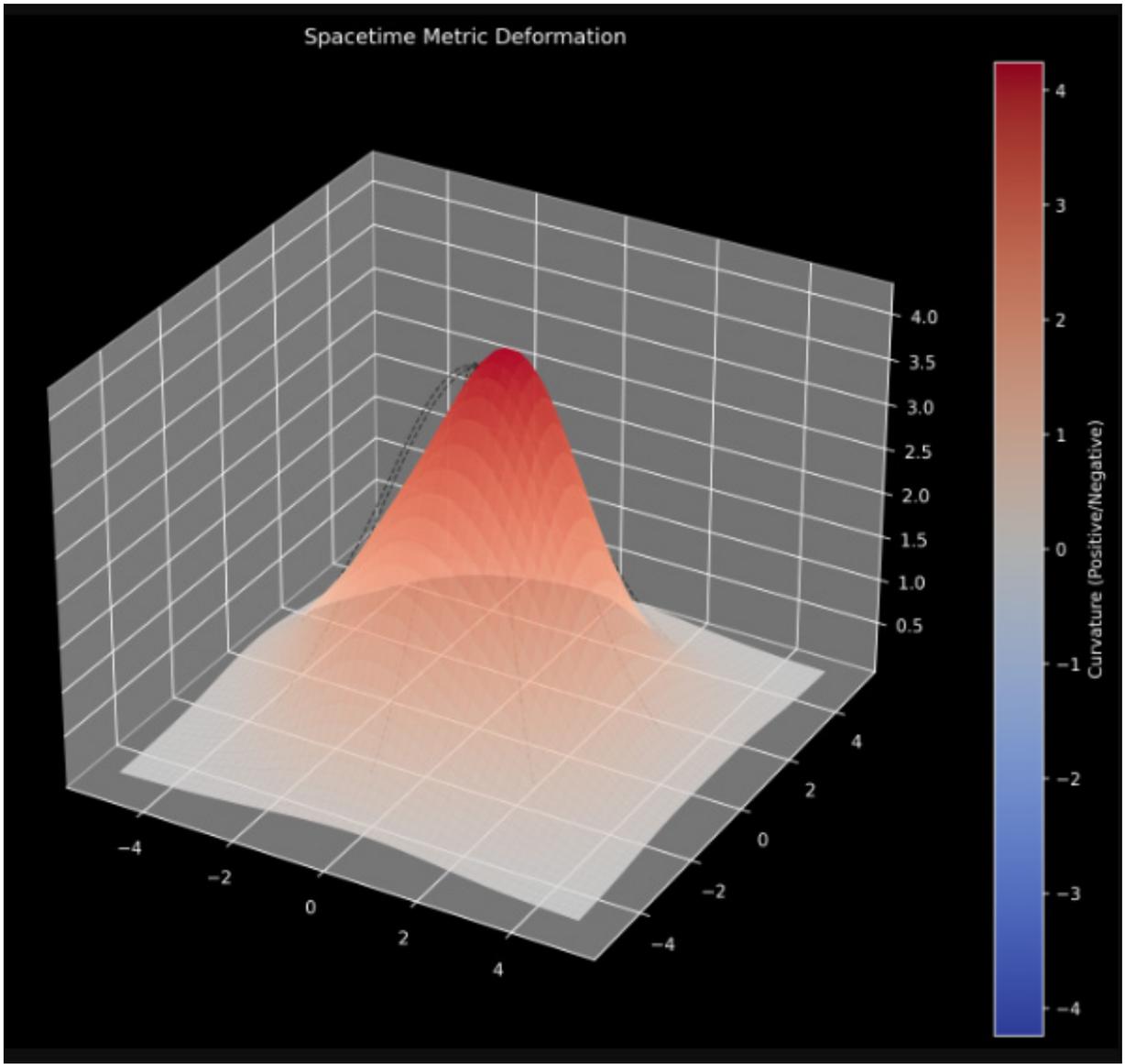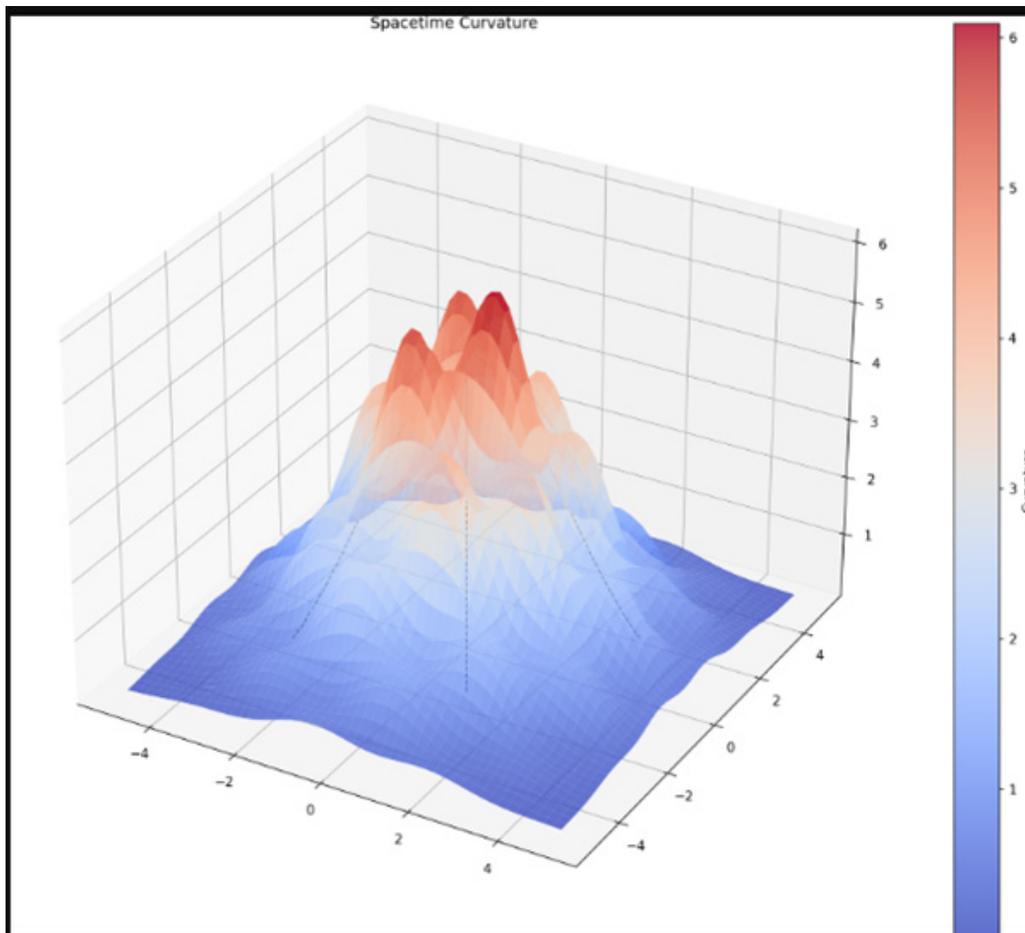
4. **Symmetry-Breaking** Cascade (Particle Flow)
o Point cloud with velocity vectors showing matter/antimatter separation
o Time-frozen "splash" morphology with crystallization patterns
o Highlighted null geodesics forming Fibonacci spirals
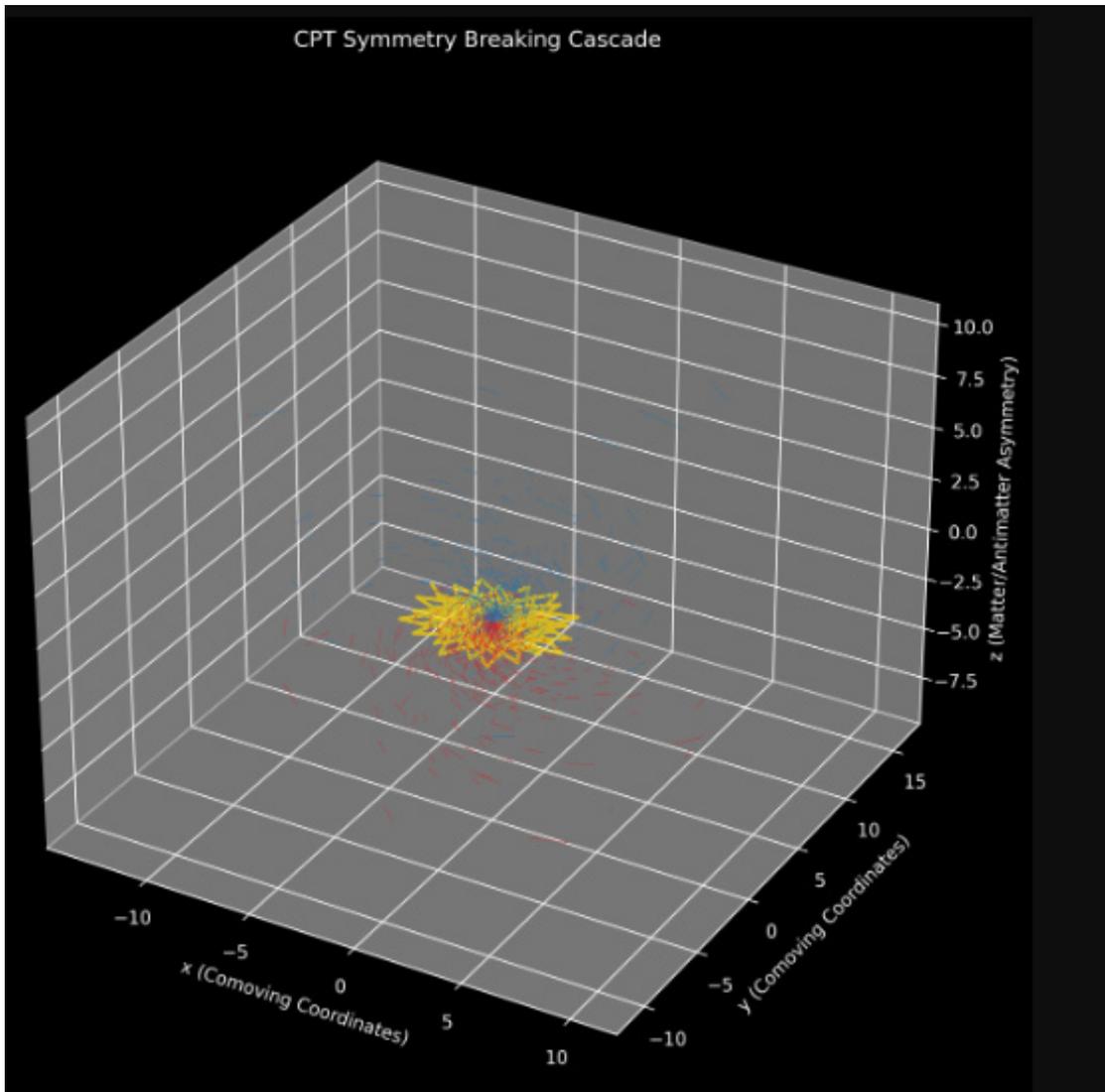
5. **Holographic Boundary Projection** (Multi-panel)
o 3D AdS bulk with 2D boundary projection inset
o Conformal diagram overlay showing causal structure
o Entanglement entropy visualization as connecting filaments

Holographic Duality: Bulk-Boundary Correspondence
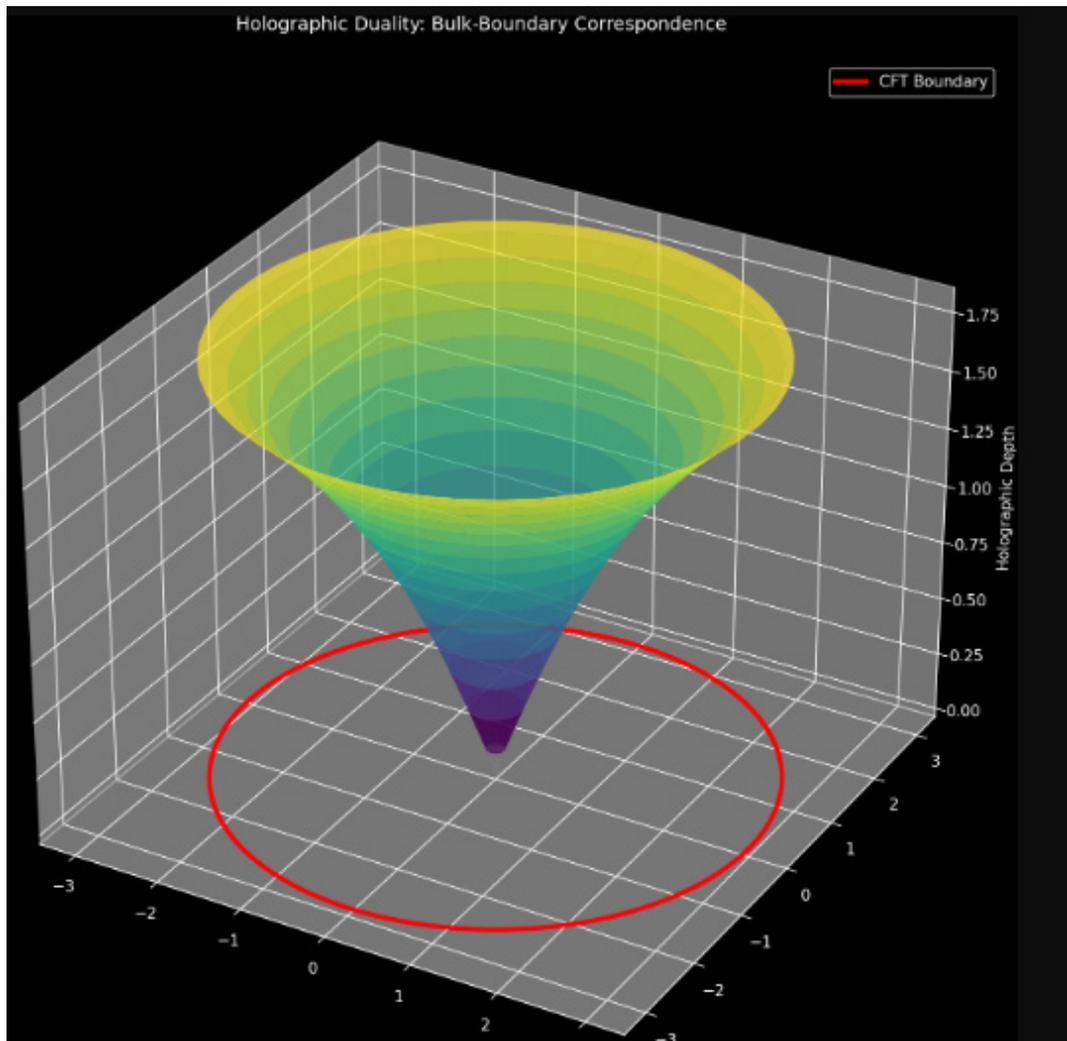
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1. Ashtekar, A., Pawlowski, T., & Singh, P. (2006). Quantum nature of the big bang: Improved dynamics. *Physical Review D—Particles, Fields, Gravitation, and Cosmology, 74*(8), 084003.
2. Maldacena, J., & Susskind, L. (2013). Cool horizons for entangled black holes. *Fortschritte der Physik, 61*(9), 781-811.
3. Steinhardt, P. J., & Turok, N. (2002). A cyclic model of the universe. *Science, 296*(5572), 1436-1439.