Nichols Radial Injection Model (RIM) and Radial ERB Inflows:
A Mechanism for Progenitor-less Astrophysical Events,
the Hubble Pulse, and 4D Substrate Interactions

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Abstract

Current ΛCDM models struggle to account for the rapid formation of massive galaxies [cite: 5] and hours-long Gamma-Ray Bursts (GRBs) observed by JWST[cite: 5]. We propose a "Static-Bulk / Dynamic-Surface" model where our 3D universe is a hypersurface boundary expanding relative to a static 1.46 trillion light-year diameter 4D manifold[cite: 6]. We posit that the Big Bang was a primary mass-injection event, followed by transient Einstein–Rosen Bridge (ERB) punctures triggered by 4D matter–antimatter interactions[cite: 7]. This framework suggests that "dark" variables are structural interactions with the 4D substrate, eliminating the need for arbitrary age revisions and providing a mechanical origin for the Hubble Pulse[cite: 8].

Research Provenance

The Radial Injection Model (RIM) is the culmination of a six-month iterative process[cite: 10]. Although the foundational engineering logic was developed through flight simulation research [cite: 13], the specific cosmological framework was established in October 2025[cite: 11].

1 The Nichols Thought Experiments Timeline

- **2013–2025**: Development of mechanical and fluid-dynamic logic via the *flightsimdev* research platform[cite: 13].

- **August 20, 2025**: The "Science Pivot"—publication of the first science-focused video applying engineering principles to anomalies in the ΛCDM model[cite: 14].

- **October 2025**: Formal initiation of *The Nichols Thought Experiments* (TE 1–18), defining the 4D manifold and "Guest Space" hypothesis[cite: 15].

- **January 2026**: Identification of the "Hubble Pulse" and verification via progenitor-less events such as GRB 250702B[cite: 16].

1.1 The Video 18 Mass-Parity Discovery

Empirical testing suggests a near-perfect parity between daily 4D injection and 3D sequestration[cite: 18]. By calculating the aggregate intake of known black hole populations at a 70% efficiency rate, we arrive at a daily sequestration value of approximately 1.5×10^{53} kg[cite: 19]. This mirrors the total estimated mass of the observable universe, suggesting that our "Guest Space" exists in a state of continuous, high-velocity renewal rather than static expansion[cite: 20].

2 In-Situ Stellar Augmentation

We propose that ERB events may occur within existing stellar cores, where radial mass flux Φ_m acts as a secondary fuel source[cite: 23]. This "internal feeding" mechanism accounts for over massive stars in the early universe ($z \approx 7.3$) that appear to violate standard Eddington luminosity limits[cite: 24]. By allowing for 4D-to-3D mass–energy transfer, RIM explains mature structures observed by JWST without requiring 27-billion-year evolutionary timelines[cite: 25].

3 Mechanics of Cosmic Expansion

3.1 ERB-Driven Volumetric Growth

Expansion is driven by the cumulative inflationary effect of radial mass–energy inflows[cite: 28]. Each ERB event acts as a localized pressure source, increasing

total energy density and necessitating an increase in 3D surface area to maintain geometric equilibrium[cite: 29].

3.2 Calculation of the Hypersphere Curvature Radius

To define the scale of the 4D substrate, we utilize the curvature parameter $\Omega_k \approx 0.004$ and the observable radius $r = 46.5$ billion light-years[cite: 31]. In a near-flat 3D hypersurface, the curvature radius R is derived as:

$$R = \frac{r}{\sqrt{\Omega_k}} \tag{1}$$

Applying observed values[cite: 33, 34]:

$$\sqrt{0.004} \approx 0.063245, \qquad R \approx \frac{46.5 \times 10^9}{0.063245} \approx 7.35 \times 10^{11} \text{ ly}.$$

The total diameter of the 4D hypersphere manifold is therefore $D = 2R \approx 1.47$ trillion light-years[cite: 35, 36].

3.3 The Hubble Pulse: Correlation with Φ_m

Analysis of the 2005–2025 epoch reveals a "Hubble Pulse" where the measured expansion rate H_0 correlates with the annual frequency of GRB injection events[cite: 39]. This suggests that H_0 is a dynamic function of the integrated mass flux[cite: 40]:

$$H_0(t) \propto \sum \int \Phi_m(t) dt \tag{2}$$

3.4 GRB-Weighted Hubble Pulse and 0.1333 Scaling

To quantify the contribution of progenitor-less GRBs to the observed expansion rate, we introduce a GRB-weighted scaling factor[cite: 44]. Let the normalized GRB factor for year t be $F_{GRB}(t)$[cite: 45]. Following the RIM correlation, the GRB contribution to H_0 is[cite: 49]:

$$H_{GRB}(t) = 59 \text{ km/s/Mpc} \times F_{GRB}(t) \times 0.1333 \tag{3}$$

Epoch	GRB Freq (yr^{-1})	Meas. H_0	GRB-W. H_0	RIM Interpretation
2011–2015	90	69.0–71.0	7.87	Stabilization phase: consistent mass flux[cite: 59].
2016–2020	100–105	73.2–75.8	8.97	Expansion surge via frequent 4D punctures[cite: 59].
2021–2024	80	67.4–70.4	6.99	Pressure drop from reduced injection*[cite: 59].

* **SMBH Mass Volatility:** During the 2021–2024 pressure drop, high-redshift anchors such as TON 618 exhibited apparent mass decreases (shifting from original ∼66B $M_\odot$ toward modern ∼40B $M_\odot$ estimates). This is consistent with RIM Section 4 predictions regarding episodic 3D-to-4D sequestration.

Table 1: Empirical correlation between GRB frequency and Hubble constant variations.

4 The Pressure-Gradient Mechanism: Return Valves

Inside a black hole, gravitational pressure P_{BH} exceeds bulk pressure P_B, forcing a reverse-flow state[cite: 61]:

$$\Phi_{reverse} \propto (P_{BH} - P_B) \qquad (4)$$

This drain remains undetected because light is the sequestered medium[cite: 63]. As black holes grow, they remove information back into the 4D bulk, maintaining the 1.46 trillion light-year hypersphere's equilibrium and resolving the Hawking information paradox[cite: 64].

5 The Substrate Hypothesis: Space as a Guest Structure

We propose that the space we inhabit is a secondary 3D structure displacing a pre-existing 4D manifold[cite: 66, 67].

- **Reassigning fudge factors**: Dark Energy and Dark Matter are re-contextualized as surface tension and displacement signatures of the 4D substrate[cite: 68].

- **Ancient wanderers**: Galaxies mature at $z > 10$ are 4D residents that have

drifted into our observable 6% slice[cite: 69].

6   Empirical Predictions and Observational Signatures

1. **Void-injection events**: Detection of GRBs in local voids lacking progenitors[cite: 72].

2. **High-energy kinetic cargo**: Energy spikes in the 700 keV to 4.3 MeV range[cite: 73].

3. **Sustained flux duration**: Hours-long events (e.g. GRB 250702B) injecting up to 400,000 Earth-masses[cite: 74].

4. **Expansion jitter**: A 20% increase in GRBs in 2026 leading to $H_0 \geq 74$ by 2027[cite: 75].

7   Conclusion

By treating black holes as 4D anchors and GRBs as volumetric engines, RIM replaces abstract variables with structural engineering. Placing the universe on a hypersphere, rather than forcing it to be the hypersphere, reconciles a century of cosmology with modern JWST observations.

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