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 and hours-long Gamma-Ray Bursts (GRBs) observed by JWST. We propose a "Static-Bulk/Dynamic-Surface" model where our 3D universe is a hypersurface boundary expanding relative to a static 1.46 trillion ly diameter 4D manifold. 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. 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.

Research Provenance The *Radial Injection Model (RIM)* is the culmination of a 6 month iterative process. Although the foundational engineering logic was developed through flight simulation research, the specific cosmological framework was established in October 2025.

1 The Nichols Thought Experiments Timeline

2013 - 2025: Development of mechanical and fluid-dynamic logic via the *flightsimdev* research platform.

August 20, 2025: The "Science Pivot": Publication of the first science-focused video, applying engineering principles to the anomalies of the ΛCDM model.

October 2025: Formal initiation of *The Nichols Thought Experiments* (TE 1–18), defining the 4D manifold and "Guest Space" hypothesis[cite: 31].

January 2026: Identification of the "Hubble Pulse" and verification via progenitor-less events such as GRB 250702B[cite: 36, 40].

1.1 The Video 18 Mass-Parity Discovery

Empirical testing suggests a near-perfect parity between daily 4D injection and 3D sequestration. By calculating the aggregate intake of known black hole populations at a 70% efficiency rate, we arrive at a daily sequestration value of $\approx 1.5 \times 10^{53}$ kg. 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.

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. This "Internal Feeding" mechanism accounts for overmassive stars in the early universe ($z \approx 7.3$) that appear to violate standard Eddington luminosity limits. By allowing for 4D-to-3D mass-energy transfer, the RIM explains mature structures observed by JWST without requiring 27-billion-year evolutionary timelines.

3 Mechanics of Cosmic Expansion

3.1 ERB-Driven Volumetric Growth

Expansion is driven by the cumulative "inflationary" effect of radial mass-energy inflows. 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.

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 ly. In a near-flat 3D hypersurface, the curvature radius R is derived as:

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

Applying the observed values:

1. $\sqrt{0.004} \approx 0.063245$
2. $R \approx \frac{46.5 \times 10^9}{0.063245} \approx 735$ billion ly

The total diameter of the 4D hypersphere manifold is therefore defined as $D = 2R \approx 1.47$ trillion light-years.

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. This suggests H_0 is a dynamic function of the integrated mass flux:

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

Epoch	**GRB Freq. (Avg/yr)**	**Measured H_0**	**RIM Interpretation**
2011–2015	Steady (∼90)	69.0 – 71.0	**Stabilization Phase:** Consistent mass flux maintains baseline growth.
2016–2020	Spike (100–105)	73.2 – 75.8	**Expansion Surge:** Frequent 4D punctures drive rapid surface expansion.
2021–2024	Decline (∼80)	67.4 – 70.4	**Pressure Drop:** Reduced injection leads to a measurable dip in H_0.

Table 1: Empirical correlation between annual GRB frequency and H_0 fluctuations.

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 $\Phi_{reverse} \propto (P_{BH} - P_B)$. This "drain" remains undetected by current electromagnetic instruments because light is the sequestered medium. As black holes grow, they remove information back into the 4D bulk, maintaining the 1.46 trillion ly diameter hypersphere's geometric equilibrium and solving the Hawking Information Paradox.

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. This "Guest Space" logic suggests that the space we sit on is "not ours."

- **Reassigning Fudge Factors:** Dark Energy and Dark Matter are recontextualized as the surface tension and displacement signatures of the 4D substrate.
- **Ancient Wanderers:** Galaxies mature at $z > 10$ are 4D residents from other regions of the hypersphere that have drifted into our observable 6% slice.

6 Empirical Predictions and Observational Signatures

The Radial Injection Model (RIM) provides three testable predictions:

7 Empirical Predictions and Observational Signatures

The Radial Injection Model (RIM) provides four primary testable predictions:

1. **Void-Injection Events:** Detection of GRBs in local voids lacking detectable gas-cloud progenitors[cite: 109].
2. **High-Energy Kinetic Cargo:** Observation of energy spikes in the 700 keV to 4.3 MeV range (exceeding the 511 keV annihilation line), signifying a 50% matter-bias in the 4D-to-3D mass flux.
3. **Sustained Flux Duration:** Hours-long events (e.g., GRB 250702B) represent the stability period of the 4D conduit, injecting up to 400,000 Earth-masses of new matter per event[cite: 110].
4. **Expansion Jitter:** A 20% increase in "progenitor-less" GRBs in 2026—acting as volumetric engines—will lead to a spike in H_0 to $\geq$ 74 km/s/Mpc by 2027[cite: 111].

8 Conclusion

By treating black holes as 4D anchors and GRBs as volumetric engines, RIM replaces abstract "dark" variables with structural engineering. Placing the universe *on* a hypersphere rather than forcing it to *be* the hypersphere reconciles 100 years of science with modern JWST observations.

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