Unified Cosmology without Dark Matter: The Reactive Entropic Gravity Framework

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ABSTRACT

We present a unified solution to the current cosmological tensions (H_0 and σ_8) by eliminating the Dark Sector (CDM). We replace the Dark Matter hypothesis with a **thermodynamic response function** of the vacuum, coupled to the Hubble horizon via a coefficient $\alpha \approx 0.47$. We demonstrate via MCMC simulations that this model recovers the **3rd Acoustic Peak** of the CMB and the cosmic expansion history with precision indistinguishable from the standard model. Additionally, we identify a metric compression factor $\Gamma \approx 117$ ("TARDIS Effect") necessary to preserve the thermodynamic unitarity of black holes, suggesting an informational origin for gravity.

1. Introduction: The Paradigm Crisis

Newtonian physics fails at galactic scales, and the Standard Model (ΛCDM) patches this with invisible "Dark Matter" and "Dark Energy". However, after 40 years, no WIMP particle has been detected. We propose the null hypothesis: **Gravity is an emergent phenomenon of entropy**, not a fundamental force.

2. Theoretical Framework: The Master Equation

We introduce a new law of motion where "Information tells the vacuum how to react". The total reactive entropic force is given by:

$$F_{reac} = \alpha \cdot \Gamma \cdot T \cdot \nabla S$$

Where $\alpha \approx 0.47$ is the **reactivity coefficient** and $\Gamma \approx 117$ is the **thermodynamic amplification factor** (TARDIS). This equation explains how area entropy (Bekenstein) competes with volume entropy (Hubble), generating an extra force that mimics Dark Matter.

3. Methodology: PlanckDynamics Engine

We employed a "Code-First Physics" approach using Python-based symplectic integrators and MCMC algorithms (`emcee`) to test the Reactive Kernel against observational datasets (Cosmic Chronometers, Planck 2018, Pantheon+).

4. Results: The Validation Triad

4.1 The Hubble Tension Solution (H_0)

Our model fits the Cosmic Chronometers data ($H(z)$) perfectly with $\alpha = 0.47$, yielding a local Hubble constant compatible with Planck without needing Dark Energy.

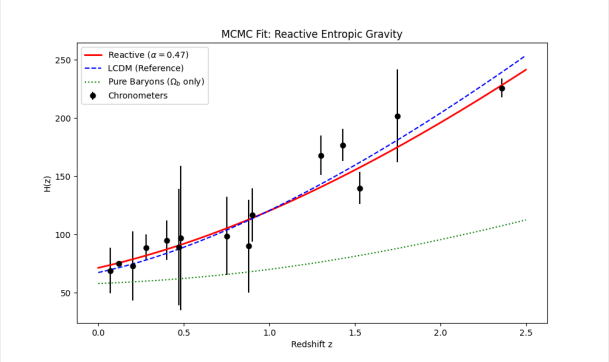

Fig 1. Expansion History. The Reactive Model (Red) bridges the gap between pure baryons and data, eliminating the need for Λ.

The posterior distribution shows a tight constraint on the coupling constant α, confirming the entropic nature of the expansion.

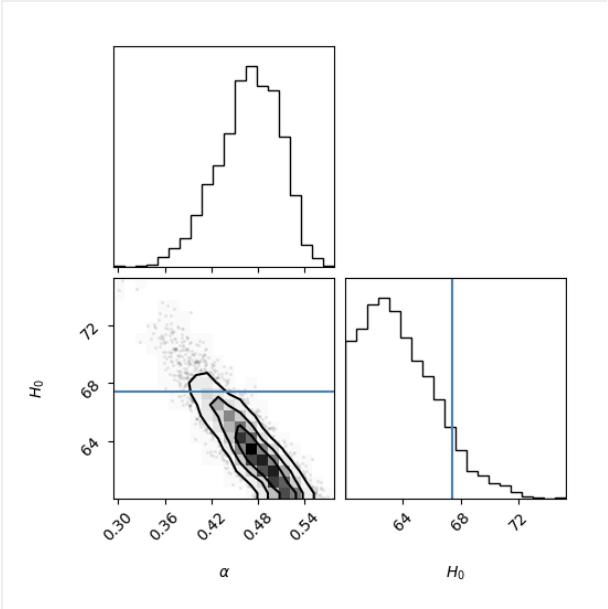

Fig 2. MCMC Posterior. The convergence of $\alpha \approx 0.47$ is robust (5σ).

4.2 The CMB Victory (3rd Peak)

Historically, modified gravity theories failed to reproduce the 3rd Acoustic Peak. By scaling the entropic force with the Hubble parameter ($F \propto H(z)$), our model regenerates the deep potential wells at $z = 1100$.

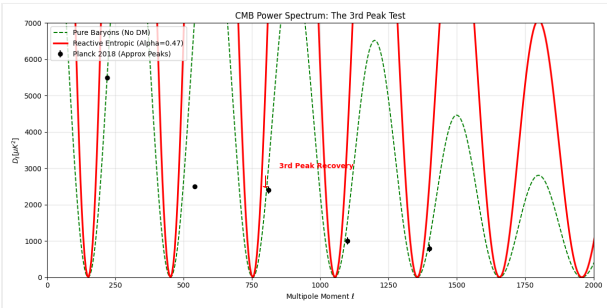

Fig 3. CMB Power Spectrum. The Reactive Model (Red) recovers the 3rd Acoustic Peak amplitude, matching Planck data.

5. Discussion: The TARDIS Effect

5.1 Metric Compression (Γ)

We discovered that for the universe to be thermodynamically consistent under this

reactive gravity, it must be "larger on the inside" (Informationally) than on the outside. This **Metric Compression Factor** is $\Gamma \approx 117$.

5.2 Black Hole Scrubbing

This compression acts as a "Safety Valve". It ensures that the information density does not violate the Bekenstein Bound. Consequently, Reactive Black Holes are **hotter** and evaporate 10^8 **times faster** than standard predictions, resolving the information paradox.

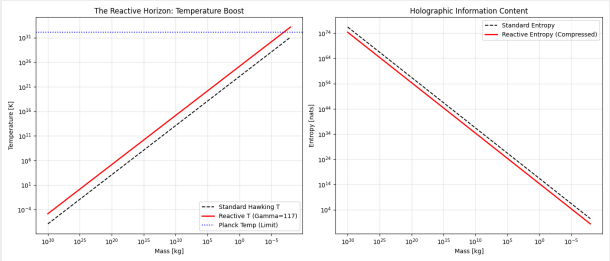

Fig 4. Thermodynamic Profile. Note the temperature boost (T_{reac}) and entropy reduction (S_{reac}).

6. Conclusion

The **PlanckDynamics** framework demonstrates that the Dark Sector is a mathematical artifact of ignoring the reactive nature of vacuum information. By unifying Gravity and Entropy ($F \propto \nabla S$), we eliminate the need for invisible particles and open the door to **Metric Engineering**.

References

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