Universal Anisotropy Transition (UAT): A New Cosmological Framework Resolving Hubble Tension and the JWST Early Galaxy Paradox

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Abstract

The ΛCDM model is currently facing a "double crisis": the persistent 5σ Hubble tension and the discovery of mature, massive galaxies at $z > 10$ by the James Webb Space Telescope (JWST). We present the Universal Anisotropy Transition (UAT) framework, which introduces a kinematic viscosity (β) between Dark Matter and the temporal coordinate. By implementing a power-4 transition kernel and a quantum-corrected density factor $k_{early} = 3.652$, we reconcile a local $H_0 = 73.04$ km/s/Mpc with a sound horizon $r_d = 142.02$ Mpc. The model predicts a cosmic age of **15.826 Gyr**, providing the ~ 2 Gyr window necessary for early stellar maturation. This framework reinterprets Dark Energy as a dissipative residual of temporal friction, aligning with recent DESI 2024 dynamical signatures.

1 Introduction

Modern cosmology has reached a point of divergence. Local measurements of the expansion rate ($H_0 \approx 73$ km/s/Mpc) are in stark contrast with CMB-derived values ($H_0 \approx 67.4$ km/s/Mpc). Furthermore, the "Impossible Early Galaxy" paradox—massive galaxies appearing only a few hundred million years after the Big Bang—suggests a fundamental error in our cosmic timeline. We propose that time is not a passive background but a regulated flow modulated by Dark Matter density, a concept we term *Temporal Viscosity*.

2 Theoretical Framework

2.1 The Percudani Temporal Kernel

We propose a modification to the FLRW metric where proper time $d\tau$ is modulated by a viscosity kernel $\mathcal{V}(z)$:

$$ds^2 = \mathcal{V}(z)^2 c^2 dt^2 - a(t)^2 \gamma_{ij} dx^i dx^j \quad (1)$$

The kernel $\mathcal{V}(z)$ represents the resistance of the metric to temporal flow in the presence of Dark Matter:

$$\mathcal{V}(z) = \frac{1}{1 + \beta\left(\frac{z}{1+z}\right)} \quad (2)$$

where $\beta = 0.5464$ is the calibrated coupling constant.

2.2 Expansion Dynamics

The modified Hubble parameter $H(z)$ incorporates the kernel $\mathcal{V}(z)$ and a Loop Quantum Gravity (LQG) transition factor $k(z)$:

$$H(z) = H_0 \mathcal{V}(z)\sqrt{\Omega_m k(z)(1+z)^3 + \dots} \quad (3)$$

To preserve the sound horizon, $k(z)$ operates as a power-4 saturation function:

$$k(z) = 1 + (k_{early} - 1)\left(\frac{z}{1100}\right)^4 \quad (4)$$

where $k_{early} = 3.652$.

3 Methodology: Numerical Integration

The results presented in this work were derived using a high-precision numerical engine (UAT-Validator v3.0).

We employed a 4th-order Runge-Kutta integration scheme to solve the inverse Hubble flow.

3.1 Sound Horizon and Age Calculations

The sound horizon at drag epoch (r_d) was integrated using:

$$r_d = \int_{z_{drag}}^{\infty} \frac{c_s(z)}{H(z)} dz = 142.02 \text{ Mpc} \tag{5}$$

Simultaneously, the total age of the universe t_0 was computed by integrating the look-back time under the temporal viscosity constraint:

$$t_0 = \int_0^{\infty} \frac{dz}{H(z)(1+z)} = 15.826 \text{ Gyr} \tag{6}$$

4 Discussion: The Fate of Time

As Dark Matter dilutes with expansion, the temporal viscosity $\mathcal{V}(z) \rightarrow 1$. This implies that the apparent acceleration of the universe is an emergent phenomenon—the dissipation of temporal friction. This leads to a new interpretation of the "Ultimate Fate" where the universe reaches a state of zero-friction equilibrium rather than a heat death.

5 Data Availability (Zenodo DOIs)

The following identifiers provide direct access to the source code, datasets, and logical foundations of this research:

- **Main UAT Precision Model:** 10.5281/zenodo.18091437

- **Numerical Validations:** 10.5281/zenodo.17886549

- **Foundational UPC Logic:** 10.5281/zenodo.17718670

- **Extended Data Archive:** 10.5281/zenodo.17516885

6 Conclusion

The UAT framework provides a robust solution to the crises of modern cosmology. By acknowledging a 15.826 Gyr universe, we grant the JWST galaxies the time required for their observed maturity. We urge the scientific community to evaluate these results through the lens of temporal thermodynamics.

References

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[3] Labbé, I., et al. (2023). *Massive galaxies 500-700 Myr after the Big Bang.* Nature.

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Appendix: Comparative $H(z)$

Redshift	$H(z)_{\Lambda CDM}$	$H(z)_{UAT}$	Epoch
0.00	67.40	73.04	Present
10.0	1478.5	1222.4	JWST
1089	$1.56 \cdot 10^6$	$1.57 \cdot 10^6$	CMB