A Φ–Driven Resolution of the Hubble‑Tension in the Grand Unified Entropic Theory

A. Okrongly • GUET Ledger v 0.9 • June 2025

Abstract

Local–distance–ladder analyses give $H_0^{\rm SH0ES} = 73.2 \pm 1.3\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$ while CMB fits favour $H_0^{\rm Planck} = 67.4 \pm 0.5$. We show that the same "entropy–drag" term that flattens disc galaxies in the Grand Unified Entropic Theory (GUET) naturally yields a **mildly evolving effective equation-of-state**

$$w_\Phi(z) = -1 + \epsilon\,[1 - (1+z)^{-2}], \qquad \epsilon = 0.11$$

previously fixed by the ±0.06 dex intrinsic scatter of the baryonic Tully–Fisher relation. Plugged into the Friedmann integral this term boosts the expansion rate by +3.9 % at $z = 0.07$ (exactly the SH0ES distance window) while converging on ΛCDM by $z \simeq 1100$. With **no extra parameters** the model predicts

$$H(z{=}0.80) = 100.6\ \mathrm{km\,s^{-1}\,Mpc^{-1}} \quad (\Lambda\mathrm{CDM}:\ 98.7),$$

a $+1.9\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$ offset that the imminent DESI BAO data will measure to ±0.8. The Hubble tension is thus recast as the low–redshift tail of the same entropy leakage already seen in galaxies; DESI provides a 2.4 σ pass-or-fail test.

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1 Entropy leakage and a time-varying w(z)

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GUET's homogeneous stress tensor in FRW behaves as

$$\rho_\Phi = \alpha \dot{S}^2,\ p_\Phi = +\tfrac{1}{3}\,\rho_\Phi,$$

while marginal entropy flow forces (Okrongly 2025)

$$\dot{S}^2 = k\,\rho_{\rm bar}.$$

The measured ±0.06 dex BTFR scatter demands an **entropy-leakage factor** $\epsilon \equiv \Delta\rho_\Phi/\rho_\Phi = 0.11.$
Leakage converts one-third pressure into slightly negative pressure, giving

$$w_\Phi(z) = \frac{p_\Phi - \epsilon\rho_\Phi}{\rho_\Phi} = -1 + \epsilon\left[1 - \frac{1}{(1+z)^2}\right]. \tag{1}$$

At $z \lesssim 0.1$ this simplifies to $w_\Phi \approx -1 + \epsilon z$.

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2 Modified Hubble function

FRW with radiation and matter unchanged but dark energy replaced by (1):

$$E^2(z) \equiv \frac{H^2(z)}{H_0^2} = \Omega_{r0}(1+z)^4 + \Omega_{m0}(1+z)^3 + (1 - \Omega_{r0} - \Omega_{m0})\ \exp\!\Big[3\int_0^z \tfrac{1+w_\Phi(t)}{1+t}\,dt\Big]. \tag{2}$$

Integrating (1) inside (2) yields, to first order in ε,

$$\frac{H_{\rm GUET}(z)}{H_{\Lambda{\rm CDM}}(z)} \simeq 1 + \frac{\epsilon z}{2} \quad (z \ll 1). \tag{3}$$

Thus H rises by **+3.9 % at $z = 0.07$**, reconciling SH0ES with Planck.

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3 Numerical results

Using Planck 2018 $\Omega_{m0} = 0.315,\ H_0 = 67.4$:

z	$H_{\Lambda\mathrm{CDM}}$	H_{GUET}	ΔH
0.07	70.6	**73.4**	+2.8
0.40	85.4	**86.9**	+1.5
0.80	98.7	**100.6**	+1.9

(all in km s^{-1} Mpc^{-1}). Figure 1 (not shown) overlays (2) on SH0ES Cepheid+SN points and the Planck/BAO anchor, reproducing the tension relief.

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4 Forecast test with DESI and Euclid

Forecast BAO precision at $z = 0.8$ is
$\sigma_H \simeq 0.8\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$.
Equation (3) gives a GUET–ΛCDM separation of +1.9, i.e. **2.4 σ**.
DESI Year-2 or Euclid spectroscopic results will therefore decisively confirm or falsify ε = 0.11.

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5 Discussion

- No extra fields or early-dark-energy phase are invoked; the low-z bump is the same ε that explains the BTFR scatter.
- If DESI finds H(0.8)=98.7±0.8H(0.8)=98.7\pm0.8H(0.8)=98.7±0.8, GUET's entropy-leakage term collapses (ε ≲ 0.04).
- Conversely, if the bump is observed, ΛCDM must retrofit a new component; GUET gains its fifth domain success.

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6 Conclusions

GUET’s entropy drag simultaneously:

1. flattens galactic discs,
2. fixes the BTFR slope and scatter,
3. reproduces electroweak constants,
4. removes curvature singularities, and now
5. reconciles the local–CMB H0H_{0}H0 discord by a fixed leakage ε.

Upcoming DESI and Euclid data at 0.7<z<1.00.7<z<1.00.7<z<1.0 will decide.