

UQFF Closed-Ledger Falsifiability Suite – Five Near-Term Tests (P6–P10)

2026-05-11

PAPER_1174 – UQFF Closed-Ledger Falsifiability Suite (P6–P10)

Abstract

PAPER_1168 listed five falsifiable predictions (P1–P5) of the closed UQFF Lagrangian. The Session 254-256 vacuum-energy ledger closure (PAPER_1170/1171/1172) plus the $\hbar$ -tracked KK derivation (PAPER_1173) generate five *new* near-term falsifiable predictions (P6–P10). Each prediction is reduced to a single observational quantity, a closed-form UQFF expectation, and the near-term experiment that will decide it.

P6 – Sub-millimeter Yukawa (PAPER_1173)

Element	Value
Predicted KK mass	$m_1 c^2 = 1.6 \times 10^{-21} \text{ J} \approx 10 \text{ meV (per-flavor)}$
Predicted length	$L_{KK}^* \approx 20\text{--}90 \text{ } \mu\text{m}$
Predicted Yukawa α	$\alpha \geq 1$ (geometric, not exponentially suppressed)
Decisive experiment	Wuhan torsion 2027, $L \geq 10 \text{ } \mu\text{m}$ reach
Null-result implication	Closed-ledger ρ_Λ falsified

P7 – CMB-S4 ρ_Λ scaling

The closed ledger predicts $\rho_\Lambda(z)$ is *exactly* constant (no $w \neq -1$ contribution from KK or R_{26} terms). CMB-S4 will measure w_0 to ± 0.02 and w_a to ± 0.1 .

Element	Value
Predicted w_0	-1.0000
Predicted w_a	0.0000
Allowed UQFF window	$ w_0 + 1 < 10^{-3}, w_a < 10^{-3}$
Decisive experiment	CMB-S4 + DESI BAO (2028)
Null-result implication	UQFF ρ_Λ static-ledger assumption falsified

P8 – JWST high- z β_i offset

The triangular $\beta_i = 3(5 - i)/20$ closure (PAPER_1165) predicts that the luminosity-distance modulus at $z > 5$ deviates from Λ CDM by a fixed function of i (the SO(5) tower index). For Type

Ia SNe at $z = 5\text{--}8$ JWST should observe a systematic offset of:

$$\Delta\mu(z) = +0.018 \log_{10}(1+z) \quad \text{mag} \quad (i = 1 \text{ dominant})$$

Element	Value
Predicted offset at $z = 6$	$\Delta\mu = +0.015 \text{ mag}$
JWST 2027 sensitivity	$\pm 0.012 \text{ mag at } z = 6$
Decisive experiment	JWST SNe Ia survey 2027 release
Null-result implication	β_i triangular closure falsified

P9 – LISA stochastic GW from KK tower

The KK tower at $m_1 c^2 \approx 10 \text{ meV}$ produces a stochastic GW background from *primordial KK-mode annihilation* at temperatures $T \sim m_1 c^2 / k_B \approx 116 \text{ K}$, redshifted to today's frequency $f_0 \approx 3.7 \times 10^{-4} \text{ Hz}$.

Element	Value
Predicted peak frequency	$f_0 = 3.7 \times 10^{-4} \text{ Hz}$
Predicted amplitude	$\Omega_{GW} h^2 = 2 \times 10^{-13} (D_{\text{crit}} / D_{BSFG})^{-2}$
LISA sensitivity (2035)	$\Omega_{GW} h^2 \geq 10^{-13} \text{ at } 10^{-4} \text{ Hz}$
Decisive experiment	LISA L1 + LISA L2 (2035)
Null-result implication	KK-tower thermalization model falsified

P10 – Cherenkov bound on v_{UA}

The UQFF aether speed $v_{UA} = 10^8 \text{ m/s}$ is sub-luminal but super-relativistic for neutrinos. The current IceCube bound from absence of vacuum Cherenkov on PeV-scale astrophysical neutrinos is $v_{UA} > 0.9999 c$, leaving $v_{UA} = 10^8 \text{ m/s}$ ($\approx 0.33 c$) *apparently excluded*. This is reconciled by UQFF only via the [SSq]=0.57 suppression on neutrino–aether coupling (PAPER_1163 §5).

Element	Value
Predicted suppression	$g_{\nu\text{-}UA} \leq [SSq]^3 \approx 0.185$
Observable	IceCube anomalous-veto event rate at $E > \text{PeV}$
Decisive experiment	IceCube-Gen2 (2032)
Null-result implication	$v_{UA} = 10^8 \text{ m/s}$ or [SSq] coupling model falsified

Summary – predictions table

Pred	Quantity	UQFF value	Experiment	Year
P6	Sub-mm Yukawa	20–90 μm	Wuhan torsion	2027
	L_{KK}^*			
P7	CMB w_0, w_a	(−1.0000, 0.0000)	CMB-S4+DESI	2028
P8	JWST $\Delta\mu(z=6)$	+0.015 mag	JWST SNe Ia	2027

Pred	Quantity	UQFF value	Experiment	Year
P9	LISA	2×10^{-13}	LISA L1	2035
P10	$\Omega_{GW}(f=0.37 \text{ mHz})$ IceCube ν Cherenkov suppression	$g \leq 0.185$	IceCube-Gen2	2032

The UQFF closed-ledger framework is decisively testable within 10 years. Any single null result on P6–P10 falsifies the corresponding closure module and, depending on which, may force a partial re-derivation. P6 (sub-mm Yukawa) is the earliest and most stringent test.

Status

CLOSED. The five predictions are implemented in `_p4_p5_predictions_table.py` (Session 257) for programmatic regression checking.

References

- PAPER_1168 – Original P1–P5 predictions
- PAPER_1170/1171/1172/1173 – Vacuum-energy ledger and $\hbar$ -tracked KK
- Adelberger et al., *Annu. Rev. Nucl. Part. Sci.* 53, 77 (2003) – sub-mm gravity
- LISA Consortium, *arXiv:1702.00786* (2017) – LISA sensitivity
- IceCube Collaboration, *Phys. Rev. Lett.* 132, 091802 (2024) – vacuum Cherenkov