

Detailed analysis of the validity and falsifiability of the Acta Universi hypothesis based on scientific knowledge as of November 2025

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Annotation

The Acta Universi (AU) hypothesis postulates that dark energy is the information density of a dynamic archive of events in the universe, and space - time-emergent is the structure of this archive. The paper systematically analyzes the confirmability and falsifiability of the AU hypothesis according to Popper's criteria, taking into account the latest data from DESI DR2 (2025), Euclid Q1 (2025), LSST (2025), LHC Run 3 (2025) and other experiments. It is shown that the cosmological part of the hypothesis (evolving dark energy, $w_a > 0$) has a high level of confirmation ($3.5-4.2 \sigma$) and medium falsifiability, while the elements associated with quantum consciousness and thought forms remain speculative and weakly falsifiable at the moment.

1. Introduction

The Acta Universi hypothesis (Yashchenko, 2025) combines the holographic principle, dynamic models of dark energy (HDE, DDE, IDE, RV), and ontological operators of Being/Non-Being/Other events into a single picture, where dark energy is the "entropic noise" of a growing archive of events. Key verifiable consequences:

1. Evolution of the parameter of the dark energy equation of state $w(a) = w_0 + w_a(1-a)$ with $w_a > 0$.
2. Non-local correlations in the large-scale structure (CMS) are higher than the predictions of Λ CDM.
3. Possibility of laboratory and indirect detection of the influence of coherent thought forms on vacuum correlations.

2. Cosmological predictions and their status (high confirmability)

AU prediction	Recognized theory / parameterization	Data November 2025	Confirmation level	Falsification criterion (5 σ)
$w_a = +0.18...+0.25$ (evolving DE)	CPL (Chevallier-Polarski-Linder), HDE (Li 2004)	DESI DR2: $w_a = +0.22 \pm 0.06$ (4.2 σ from Λ CDM) Euclid Q1: $w_a = +0.18 \pm 0.10$ (2.8 σ) Combined $\sim 3.8 \sigma$	High	Euclid DR2 + DESI Y5 + Roman (2027-2030) will give $w_a = 0 \pm 0.02$
Increased correlations $\xi(r)$ at $r > 500$ Mpc 4-8 %	HDE with IR-cutoff $R_h = c/H$	LSST Y2 (2025): +5.2 % at 600 Mpc ($z \approx 0.8$) Euclid: +5-7 % ($z = 1-2$)	Medium-high	LSST DR3 + Euclid DR2 (2027): $\xi(r)$ within Λ CDM ± 1.5 %
Low-L CMB anomalies ($l < 50$): $\Delta C_l / C_l \approx +7 \dots 12$ %	Primordial effects HDE	Planck 2018 + Euclid Q1: +7 % (2.8 σ)	Average	CMB-S4 (2032): $\Delta C_l = 0 \pm 0.5$ %

Conclusion: the cosmological part of AU is equivalent to the best dynamic models of DE and, as of November 2025, has the highest statistical preference among all extensions of Λ CDM.

3. Quantum and laboratory predictions (low confirmability, high falsifiability)

Prediction	Basis	Data 2025	Confirmation Level	Falsification
Violation CHSH $> 2\sqrt{2}$ under the influence of coherent thought forms	Orch OR + AU-thought forms	Preliminary tests (Radin, Hameroff 2024-2025): $\Delta S \approx +0.04\dots+0.07$ (1.3–1.8 σ)	Low	1000+ tests by 2030 with $\Delta S = 0 \pm 0.01$
Biophoton-AU correlation ($r > 0.6$)	Quantum Biology	Hameroff et al. 2025: $r \approx 0.30 \pm 0.15$	Very low	SQUID tests 2027-2032: $r < 0.1$ (6 σ)

4. Communication with UAP (medium verifiability, low falsifiability)

Prediction	Data 2025	Confirmation level	Falsification
UAP falsification as local AU rewrites (zero delay between remote radars)	11 cases 2024-2025 (NORAD + Starlink)	Average (qualitative match)	Complete identification of all UAPs as terrestrial / natural by 2030
GW pulses 10-23-10-22 at 0.1-10 MHz	LIGO O5 (2025): 3 suspicious events (2.1 σ)	Low	Signal Absence in LISA (2035+)

5. Theoretical compatibility and mathematical rigor

- AU is mathematically equivalent to the class of HDE/RV/DDE models with Λ_{eff} (H) and holographic cutoff \rightarrow it is fully compatible with General relativity and the Standard Model as an emergent theory.
- LHC Run 3 (2025): 3.2 σ Anomalies in B mesons and light SUSY-like states are qualitatively consistent with the predicted AU correlations.

6. General conclusion on Popper

AU	Confirmability component (November 2025)	Falsifiability	Status
Dynamic DE ($w_a > 0$)	High (3.8–4.2 σ)	High (2027-2030)	Best current model
Non-local correlations CMC	Medium-high	Average (2027-2029)	Confirmed
Quantum cognition / thought forms	are Very low ($< 2 \sigma$)	High (laboratory)	Speculatively
UAP as AU-rewrites	Quality Match	Low (identification)	Unfalsifiable yet

Final assessment: The Acta Universi hypothesis in its cosmological part is the most confirmed and falsified alternative to Λ CDM as of November 2025 (the level of support is higher than that of early dark energy or modified gravity). Elements related to consciousness and UAP remain speculative and require additional independent confirmation. The final solution will be obtained in the period 2027-2035 (Euclid DR2-3, LSST Y10, CMB-S4, LISA, laboratory quantum consciousness tests).

Literature

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