# Experimental Tests for Polarized Time Inertia

Revised Edition — Companion Document

David James Milton Hansen

dave@thehansens.com

March 30, 2026

**Abstract**

Companion document to "Polarized Time Inertia" [1] proposing 19 experimental tests organized by axiom and prediction. Each test specifies: PTI prediction, standard prediction, method, and falsification condition. Categories: **A**=confirmed, **B**=reinterpretation, **C**=novel. Tiers: **1**=current, **2**=near-future, **3**=advanced.

## 1 Claim Classification

| Claim | Cat. | Status |
|---|---|---|
| Gravity as spatial flow | A | Equiv. GR; confirmed |
| Photon null geodesic | A | Standard SR/GR |
| Planck-scale discrete gravity | C | Novel; untested |
| Space from entanglement | B | AdS/CFT support |
| QCD color–spatial dim. | C | Conjecture |
| Higgs = spatial mass coupling | B | SM-consistent |
| No dark matter particle | C | Testable now |
| Relational dark energy | B | Alternative to $\Lambda$ |
| Many Points of View | B | Interpretive |
| Null-frame entanglement | B | ER=EPR consistent |
| Cyclical singularity | C | Partially testable |
| Min. entropy production | C | Novel |

## 2 Axiom 1 Tests: Relational Existence

**Test 1.1 — Isolated Quantum Systems (Tier 2).** PTI: anomalous decoherence at extreme isolation. Standard: coupling-dependent only. Falsified if standard theory exact.

**Test 1.2 — Proton Decay (Tier 1–2).** PTI: finite lifetime (cyclical cosmology). Current bound $\sim 10^{34}$ yr [2]. Hyper-K, JUNO, DUNE. Falsified if proven absolutely stable.

# 3 Axiom 2 Tests: Hierarchical Condensation

**Test 2.1 — Space from Entanglement (Tier 1–2).** Tensor network simulators [3]. Falsified if geometry exists without entanglement.

**Test 2.2 — Planck-Scale GW Noise (Tier 1–2).** $S_{\mathrm{PTI}}(f) \sim l_P^2 N/t_P$. LIGO >1 kHz; Einstein Telescope; Holometer [4]. Falsified if perfectly smooth.

**Test 2.3 — Three-Dimensionality (Tier 1–3).** Eöt-Wash sub-mm gravity; CMB topology. Falsified if wrong dimension count.

# 4 Axiom 3 Tests: Frame Decomposition

**Test 3.1 — Unruh Effect (Tier 2–3).** Frame-dependent particle content. Laser acceleration; BEC analogs.

**Test 3.2 — Relativistic Bell Tests (Tier 2).** $S = 2\sqrt{2}(1+\epsilon)$ with gravitational potential difference [5]. Falsified if $S = 2\sqrt{2}$ exactly.

# 5 Gravity Tests

**Test 4.1 — Achromatic Lensing (Cat. A, confirmed).** JWST/Euclid ongoing.

**Test 4.2 — Zero Vacuum Dispersion (Tier 1).** $\Delta v/c = 0$ exactly. Fermi-LAT, CTA [6]. Falsified if any dispersion detected. *Critical.*

# 6 Dark Matter Tests

**Test 5.1 — No DM Particle (Tier 1).** XENONnT, LZ, PandaX, ADMX [7]. *Detection immediately and decisively falsifies.* Most critical near-term test.

**Test 5.2 — Rotation Curves (Tier 1–2).** SPARC database [8]. Requires theory development. Falsified if worse than CDM/MOND.

**Test 5.3 — Bullet Cluster (Tier 1–2).** Must explain mass-baryon separation.

# 7 Dark Energy Tests

**Test 6.1 — $H(z)$ and Hubble Tension (Tier 1–2).** DESI, Euclid, Roman. $H_0$ tension [9]. Falsified if ΛCDM exact.

# 8 Entanglement and Interference Tests

**Test 7.1 — Entanglement Over Distance (Tier 2).** Earth-Moon/Mars [5]. Falsified if systematic vacuum degradation.

**Test 7.2 — Double-Slit Decoherence (Tier 1).** $V_{\mathrm{PTI}} = V_0 e^{-N/N_c}$ vs. $V_{\mathrm{QM}} = V_0\sqrt{1-D^2}$. Tabletop optics. *Most discriminating near-term experiment.*

# 9 Color-Space Tests

**Test 8.1 — Asymmetric Lattice QCD (Tier 1, computational).** Asymmetric $a_x \neq a_y \neq a_z$ should produce color asymmetry. Falsified if no coupling.

**Test 8.2 — 2D Confinement (Tier 1).** PTI: 2 colors suffice in 2D. Falsified if 3 needed.

# 10 Cyclical Cosmology Tests

**Test 9.1 — CMB Anomalies (Tier 1).** Planck reanalysis for cycle residuals [10].

**Test 9.2 — GW Background (Tier 2–3).** LISA, NANOGrav.

# 11 Engine of the Present

**Test 10.1 — Min. Entropy Rate (Tier 2–3).** $dS/dt \geq k_B N/t_P$. Falsified if floor absent.

# 12 Summary

| Test | Prediction | C | T | Falsified If |
|---|---|---|---|---|
| Proton decay | Finite life | C | 1–2 | Proven stable |
| Isolated decoh. | Anomalous | C | 2 | Std. exact |
| GW noise | Planck noise | C | 1–2 | Smooth |
| Holometer | Correlations | C | 1–2 | None found |
| Tensor net. | Geom. from ent. | B | 1–2 | Geom. w/o ent. |
| Unruh | Frame particles | A/B | 2–3 | Absent |
| Rel. Bell | $S$ correction | C | 2 | $S = 2\sqrt{2}$ |
| GRB disp. | Zero | C | 1 | Any found |
| DM detect. | Always null | C | 1 | **DM found** |
| Rot. curves | PTI form | C | 1–2 | Worse fit |
| Bullet Cl. | Model works | B | 1–2 | Can't fit |
| $H(z)$ | Dynamical DE | B | 1–2 | ΛCDM exact |
| Ent. dist. | No degr. | B | 2 | Degrades |
| Dbl-slit | Exponential | C | 1 | Std. exact |
| Lattice QCD | Color-space | C | 1 | No coupling |
| 2D confine. | 2 colors | C | 1 | 3 needed |
| CMB anom. | Cycle residual | C | 1 | None |
| GW bkgnd | Cycl. shape | C | 2–3 | Inflation |
| Min. $dS/dt$ | Floor | C | 2–3 | Absent |

# 13 Priority

**Immediate:** DM nulls (5.1), GRB dispersion (4.2), CMB (9.1), lattice QCD (8.1), 2D confinement (8.2). **Tabletop:** Double-slit (7.2). **Ongoing:** DM searches—detection is fatal. **Theory needed:** Rotation curves, Bullet Cluster, $H(z)$.

# References


[1] David James Milton Hansen. PTI Working Notes. 2024. Unpublished, Aug 2024–Mar 2026.

[2] K. Abe et al. Proton decay. *PRD*, 95:012004, 2017.

[3] M. Van Raamsdonk. Spacetime from entanglement. *Gen. Rel. Grav.*, 42:2323, 2010.

[4] C. Hogan. Planckian interferometry. *PRD*, 85:064007, 2012.

[5] J. Yin et al. Satellite entanglement. *Science*, 356:1140, 2017.

[6] V. Vasileiou et al. Lorentz violation from Fermi. *PRD*, 87:122001, 2013.

[7] XENONnT. First DM Search. *PRL*, 131:041003, 2023.

[8] F. Lelli et al. SPARC. *Astron. J.*, 152:157, 2016.

[9] A. Riess et al. $H_0$. *ApJL*, 934:L7, 2022.

[10] R. Penrose. *Cycles of Time*. Bodley Head, 2010.