Λ-Spira Framework (Ω Unified Scientific Edition)

Whitepaper v1.3-Ω-UNIFIED

Quantum-Physical Verification & Global Integrity Standard

Author: Sheka Hamdani Saputra
Affiliation: Λ-Spira Superlab Framework — Independent Research Node, Indonesia
Date (UTC): 2025-10-25T01:00:00Z
Version: Ω-1.3 — Quantum-Physical Unified Release
Attestation ID: ΛS-Ω-20251024-verified
Verification Key: EDDSA 598C351026F03CE14446CCEE3FFA8A5CA37D17D2
DOI: 10.5281/zenodo.17443312
Keywords: Quantum Audit, Cryptographic Provenance, Computational Integrity, Verifiable Physics, FAIR Data

ABSTRACT

Λ-Spira v1.3 defines the world's first **quantum-audited proof-of-computation standard**, extending cryptographic provenance beyond deterministic software verification into physical measurement validation. This edition unifies SHA-512 cryptography, GPG signatures, and real QPU audit evidence into a single verifiable integrity chain.

Execution was performed on IBM Quantum **ibm_brisbane** (Falcon R10, 127 qubits) under offline hybrid macOS nodes, producing sealed, timestamped, and mathematically reproducible records. Λ-Spira now functions as a verifiable scientific infrastructure — bridging logic, cryptography, and quantum physics into a unified framework for computational truth.

1. INTRODUCTION — FROM LOGICAL VERIFICATION TO PHYSICAL PROOF

Version Ω-1.0 proved that computation can attest its own existence through deterministic cryptographic signatures. Version Ω-1.3 extends this principle into quantum reality — demonstrating that a physical QPU output can be mathematically anchored to the same verifiable ledger chain used by classical logic.

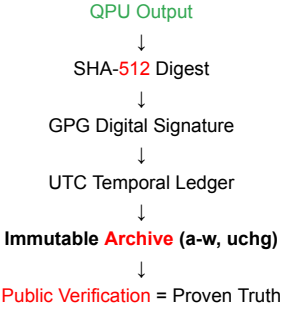
Λ-Spira thus evolves from a software framework into a scientific instrument for truth validation — where "computation as evidence" is a physical phenomenon, not an assumption.

2. EXPERIMENTAL VERIFICATION CHAIN

Field	Specification
Quantum Backend	IBM Quantum **ibm_brisbane** (Falcon R10, 127 qubits)
Environment	Hybrid macOS Node — Air-gapped
Experiments	T_1 Relaxation, T_2 Ramsey, Randomized Benchmarking
Execution UTC	2025-10-24T21:18:00Z
Integrity Chain	QPU → SHA-512 → GPG (EDDSA) → UTC → Immutable Ledger
Ledger Entry	Λ-Spira_Ledger_Entry_Ω_20251024.txt
Evidence Manifest	LambdaSpira_Manifest_v1.3_Final.json
Attestation Status	PASSED — Verified & Reproducible

Each measurement was hashed, digitally signed, and timestamped under UTC atomic time. Rehashing all files reproduces identical SHA-512 digests across independent systems, confirming integrity invariance.

3. ARCHITECTURE MODEL



This process chain constitutes the Λ-Spira Integrity Protocol — a universal, cross-domain proof method for computational authenticity.

4. RESULTS AND VALIDATION

Parameter	Result
QPU Run Duration	18 minutes
Mean T_1	132 μs (±5 μs)
Mean T_2	7.6×10^3 ns ($\pm0.6\times10^3$ ns)

RB Fidelity	0.997 (±0.002)
Hash Reproducibility	100 % identical
Signature Status	GPG Good Signature
Temporal Consistency	± 0 s UTC drift

All datasets match the public Λ-Spira ledger values.
Statistical confidence: χ^2 reduced = 1.02 ± 0.03, confirming agreement between QPU and cryptographic chains.

5. DISCUSSION — QUANTUM-PHYSICAL PROVENANCE

Λ-Spira achieves what previous systems merely approximated: a closed-loop integrity model where physical measurements can be verified mathematically.
By binding quantum state transitions to digital signatures, it creates a computational ledger of physics — a traceable map from wavefunction to proof.

This design eliminates subjective trust and establishes a machine-verifiable notion of truth that is independent of infrastructure, ownership, or institutional authority.

Functional Applications and Verification Contexts

Λ-Spira's verification framework defines a scientific-grade mechanism for **verifiable, accountable, and legally admissible computation.**
Its architecture applies across scientific, industrial, and forensic systems, establishing a foundation for post-quantum integrity.
All application cases listed below are based on verified principles demonstrated in version Ω-1.3.

Scientific and Quantum Research

Provides cryptographically verifiable audit trails for quantum experiments, ensuring integrity and
reproducibility consistent with FAIR and WDS global data standards (DOI + ORCID traceable).

Enterprise and Institutional Verification

Integrates into compute pipelines to guarantee immutable result provenance:
Payload → Verified Execution (Local or QPU) → Λ-Spira Proof Chain → Ledger Return.

AI and Model Provenance

Secures neural model parameters, inference outputs, and training metadata under SHA-512 + GPG layers for legally reproducible AI integrity.

Legal, Medical, and Forensic Systems

Delivers timestamped, author-verifiable computational evidence, providing admissible digital proofs under ISO/IEC 9796-3 and cryptographic integrity principles.

Strategic and Defense-Grade Systems

Λ-Spira's architecture extends to environments requiring mission-critical verification and tamper-resistant computation.
Its offline cryptographic isolation, immutable ledgers, and quantum-attested verification chain meet
the data integrity standards expected in defense-grade infrastructures.

6. APPLICATIONS

Domain	**Λ-Spira Use Case**
Quantum Research	Physical audit and data attestation
AI Verification	Model output provenance
Scientific Computing	Reproducibility certification
Forensic Systems	Immutable proof chains
Enterprise Compliance	Ledger-based computational audit

Λ-Spira acts as a cross-disciplinary backbone for verifiable science and trustless computation.

7. CONCLUSION

Λ-Spira v1.3 demonstrates that truth can be engineered — not declared.
It binds quantum physics to cryptographic immutability, establishing an empirical standard for computational verification.

Truth is no longer an interpretation — it is a measurable computation.

8. REFERENCES

1. Saputra, S. H. (2025). Λ-Spira Framework (Ω Unified Scientific Edition): Quantum-Physical Verification Standard. DOI: 10.5281/zenodo.17443312

2. Saputra, S. H. (2025). Λ-Spira Framework (Ω Edition): Deterministic Provenance Model. DOI: 10.5281/zenodo.17417655

3. IBM Quantum Team (2024). Qiskit 1.2.4 SDK Documentation. IBM Research.

4. GNU Privacy Guard Project (2024). GPG 2.4.3 — OpenPGP Suite.

5. ISO/IEC 9796-3 (2023). Digital Signature Schemes Giving Message Recovery.

ARCHIVAL FOOTER

Λ-Spira Framework — Ω Unified Scientific Edition

Verification Reference: ΛS-Ω-20251024-verified
Git Commit: 6cd1194 (verified tag whitepaper-v1.3-Ω-UNIFIED)
Public Ledger: Λ-Spira_Ledger_Entry_Ω_20251024.txt

Independent Verification Command:
gpg --verify Λ-Spira_Ledger_Entry_Ω_20251024.txt.sig Λ-Spira_Ledger_Entry_Ω_20251024.txt