

Quantum Nexus Unified Model (QNUM)

Benefits for Science and Industry

Author and Inventor: Carlos Daniel Borrego Romero, MBA, BSc Computer Systems, CISA, CRISC, CDPSE, ISO 27001, CASE .NET

Registered with the World Intellectual Property Organization (WIPO). International application filed with the WIPO International Bureau (IB) under the Patent Cooperation Treaty (PCT). Patent Pending worldwide. This document is licensed CC BY-NC-SA 4.0 and establishes public priority of inventorship; it grants no patent license. All patent rights reserved.

The QNUM proposes that the observable universe and its CPT-conjugate mirror sector form one closed, globally balanced system, so that the matter-antimatter imbalance, the arrow of time, and dark matter emerge from a single bipartite equilibrium. It unifies CPT symmetry, a hyperbolic sector geometry parameterized by one cosmological rapidity, gravitational dark-matter generation, and holographic information conservation with open-system (Lindblad/GKLS) dissipation. The principal inventive advance of this version is genuinely new physics: a single inter-sector coupling rule — gravity only, derived from CPT antiunitarity — that makes the dark sector gravitational by construction, together with two native, falsifiable signatures (a sub-Landauer partial-confinement calorimetric law and an irreducible gravitational-constant variance) that did not exist before and that force two independent measurements to converge on one value.

Benefits for Science

Single gravity-only coupling rule	Introduces a previously non-existent law: gauge currents cancel between sectors, so the universe and its mirror communicate only through gravity — making the dark sector gravitational by construction and confining any new deviation exclusively to gravity, consistent with null force-measurement results.
Cosmology & fundamental physics	Offers a falsifiable, CPT-symmetric account in which matter-antimatter asymmetry, the entropic arrow, and dark matter arise from one globally balanced bipartite system, recovering verified physics as a limit.
Dark-matter & astroparticle research	Links a single geometric rapidity to a testable dark-matter mass via gravitational particle production, giving a concrete, instrument-anchored prediction tied to Planck-anchored constraints.
Gravitation & precision metrology	Predicts an irreducible variance in the Newtonian gravitational constant tied to the same rapidity that sets the dark-matter mass, providing a sharp target for precision-gravity and atomic experiments.

Quantum information & open-system theory	Realizes the dissipative sector as a completely-positive trace-preserving Lindblad/GKLS channel that conserves information under closed evolution and satisfies the second law under open evolution.
Thermodynamics of computation	Derives a falsifiable sub-Landauer calorimetric heat law for partial information confinement, testable by precision single-bit calorimetry in a symmetric double-well.

Benefits for Industry

Quantum computing & error modeling	The CPTP Lindblad/GKLS formulation provides a principled model of dissipation and confinement relevant to noise characterization and open-system control in quantum processors.
Precision instrumentation & metrology	Predicted gravitational-constant variance and calorimetric signatures define concrete specifications for next-generation precision sensors and single-bit calorimeters.
Scientific computing & verification	Numerically validated against CODATA/Planck constants with FIPS-202 provenance and deterministic identity descriptors, supporting reproducible, auditable scientific software pipelines.
Energy-efficient computing	The sub-Landauer confinement regime informs research into ultra-low-dissipation and partially reversible information processing below the standard erasure cost.
Aerospace & space science	IAU reference-system alignment and astrophysical anchoring make the framework suitable for cosmological data analysis, dark-matter surveys, and space-based precision measurement programs.

Benefits in 10 Years and Beyond — with AI and Emerging Technologies

AI-driven cosmological discovery	AI systems could search the QNUM parameter space against survey data, refining the rapidity-mass relation and accelerating tests of CPT-symmetric cosmology with next-generation telescopes.
Experimental tests of the dark sector	Maturing precision-gravity and calorimetry experiments could directly test QNUM's gravitational-constant variance and sub-Landauer heat-law predictions, turning the framework into measured physics.
Open-system quantum engineering	The Lindblad/GKLS confinement model could inform design of engineered dissipation and reservoir engineering in fault-tolerant quantum hardware.

Reproducible physics-at-scale	Deterministic identity descriptors with FIPS-202 provenance could become a standard for auditable, tamper-evident large-scale cosmological and quantum simulations verified by AI.
Unified gravitational-information technology	A mature QNUM-plus-AI program could connect gravitational, informational, and thermodynamic principles, informing far-future sensing and computing at fundamental physical limits.