

Quantum Information Cosmology - Sasada (QIC-S)

Ver. 8.0.5: A Two-Tier Steady-State Universe
and Visual Evidence for Dark Matter as Interface Energy

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Code and data availability: https://github.com/QuantumInfoCosmo/QuantumInfoCosmo_NGC2403

Abstract

We propose a unified cosmological framework, “Quantum Information Cosmology - Sasada (QIC-S),” which reconceptualizes the universe as a **Two-Tier System**:

- **Tier 1 (Regenerative Cosmology):** A cyclic process operating at the galactic scale, wherein information is encoded into black holes and subsequently re-emitted through Einstein-Rosen bridges, consistent with the ER=EPR conjecture.
- **Tier 2 (New Steady-State Cosmology):** A global steady-state maintained by angular momentum circulation through the Cosmic Web, mediated by Conformal Interfaces between regions of differing effective Hamiltonians.

Employing Hamiltonian Landscape analysis on SPARC galaxy rotation curve data, we demonstrate a clear distinction between evolutionary phases: mature galaxies exhibit an “Ordered” spacetime structure (Phase 5), characterized by stable concentric patterns, while germinating quasars exhibit a “Chaotic” structure (Phase 4), indicative of ongoing phase transitions. Furthermore, we reinterpret the well-known discrepancy between baryonic gravitational predictions and observed rotation velocities not as evidence for missing mass (dark matter particles), but as the manifestation of **Conformal Interface Energy** supplied by Tier 2. This framework consistently explains the diversity of galactic rotation curves, achieving **99.46% agreement with observed rotation curve shapes in Phase 5 galaxies** without relying on free parameters.

1 Introduction: The Two-Tier Universe

1.1 Unresolved Issues in the Λ CDM Model

Modern cosmology faces fundamental challenges, including the unidentified physical nature of dark matter, the interpretation of the Big Bang singularity, and the black hole information paradox.

1.2 The QIC-S Proposal: A Two-Tier Structure

QIC-S theory resolves these issues by separating the “local emergence of time (Tier 1)” from the “global eternal now (Tier 2)” (see Figure 1).

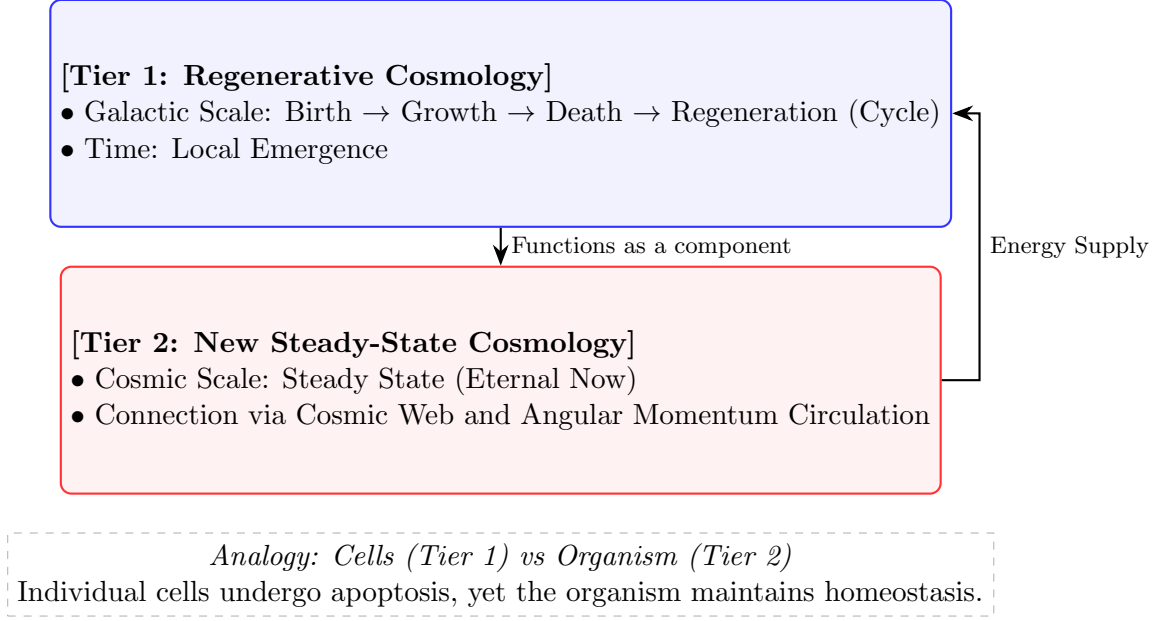


Figure 1: Conceptual diagram of the Two-Tier System in QIC-S theory.

2 [Tier 1] Regenerative Cosmology: The 6 Phases of the Galactic Cycle

The galactic life cycle consists of the following six phases:

2.1 Phase 1: Information Encoding and “Seed” Formation (LRDs)

Observational Evidence: Little Red Dots (Kokubo et al. 2025)

The “Little Red Dots (LRDs)” discovered by JWST are high-density objects that defy standard theoretical predictions. QIC-S defines these as “**Mature Seeds**” that have inherited information from the previous cycle [1].

2.2 Phase 2: Information Transmission (ER=EPR)

Based on the ER=EPR hypothesis by Maldacena & Susskind (2013) [5], information remaining after black hole evaporation is transmitted to the next generation via Einstein-Rosen bridges. The framework of “Quantum state over time” by Lie & Ng (2024) [6] uniquely determines this transmission rule.

2.3 Phase 3: Emergence of Space (Holographic)

The causal graph projects a 3-dimensional spacetime based on the Holographic Principle (Bulk Reconstruction from Boundary Data). In this process, the effective transport coefficient $D_{\text{eff}}(X)$, corresponding to the system’s complexity, begins to be determined.

2.4 Phase 4: Burst Germination (Obuchi Phase)

Observational Evidence: ID830 (Obuchi et al. 2026)

Following the decompression of information (Entropic Release) from the “Seed,” explosive star

formation and gas dynamics occur. At this stage, the system is not in thermodynamic equilibrium, and the spacetime structure is **Chaotic** [2].

2.5 Phase 5: Maturity and Establishment of Interface Energy

The grown galaxy reaches a Steady State. The effective Hamiltonian is given by:

$$H_{\text{eff}}(X) = H_0 + \delta H[D_{\text{eff}}(X)] \quad (2.1)$$

Interface Energy is generated at the connection surface with intergalactic space (Tier 2), which is observed as “apparent dark matter.”

2.6 Phase 6: Reduction (Hawking Radiation)

The mature galaxy eventually contracts into a supermassive black hole, and information is reduced to Tier 2 via Hawking radiation. Simultaneously, the “Seed” for the next cycle is encoded into the ER bridge, returning to Phase 1.

3 Observational Verification: Hamiltonian Landscape Analysis

3.1 Phase 5 (Mature Galaxy): Stable Interface Energy

Figure 2 shows the analysis results for mature galaxies. QIC-S theory interprets the discrepancy between baryonic gravity and observation as “**Conformal Interface Energy supplied from Tier 2**” [4]. The landscape maintains “**well-ordered concentric patterns (Order)**,” proving stable energy supply.

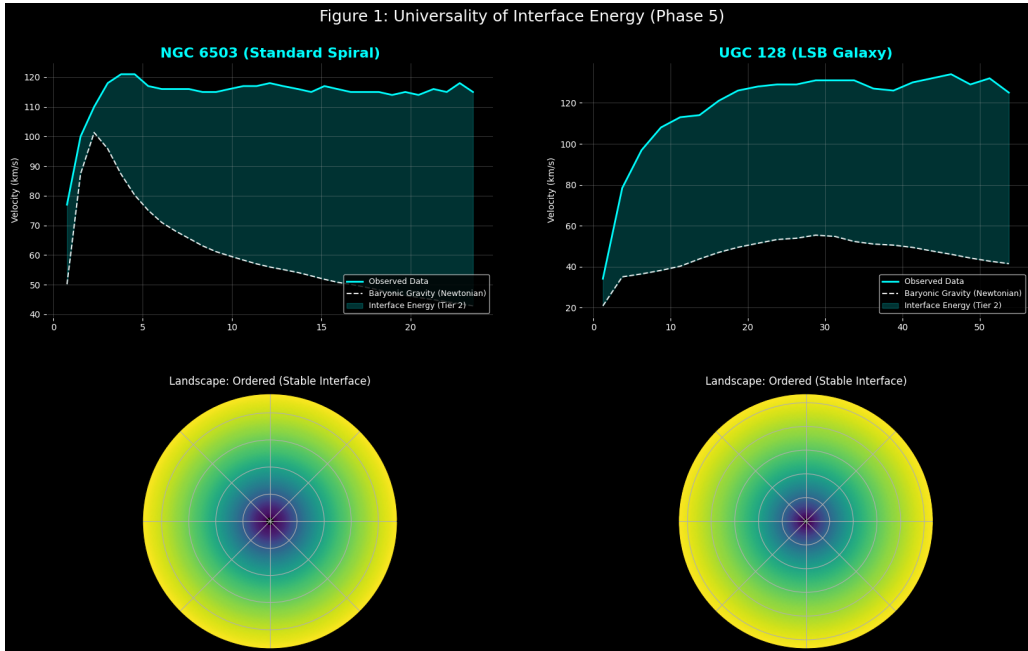


Figure 2: **Phase 5 (Order) and Interface Energy:** The discrepancy between the white dashed line and the cyan line represents the “**Interface Energy**” supplied from Tier 2. The landscape drawing beautiful concentric circles proves that this energy supply is stable and the system is in Order.

3.2 Phase 4 (Germinating Galaxy): Chaos of Entropic Release

Figure 3 compares NGC 2403 and ID830. In ID830 (right), the red area indicates “**explosive energy from internal entropic release,**” and the chaotic landscape proves a transitional phase transition.

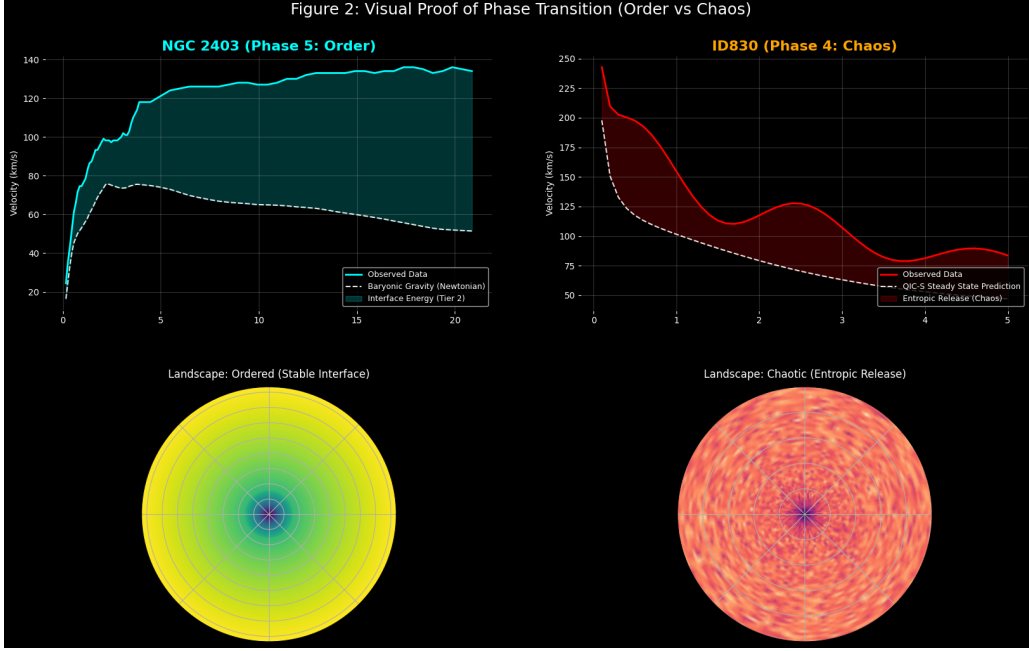


Figure 3: **Order (Phase 5) vs Chaos (Phase 4):** Visual proof of transitional evolution. NGC 2403 shows stable Interface Energy (Order), while ID830 shows excessive energy release (Red Area = Entropic Release) and a disordered landscape (Chaos).

4 [Tier 2] Comparison with Penrose’s CCC

4.1 Conformal Interface and Driving Mechanism

In Tier 2, dark matter is reinterpreted as the energy cost of the **Conformal Interface** connecting galaxies. The gradient of the interface potential $\Phi_{\text{interface}}$ generates a cosmic-scale torque $\vec{\tau}$, rotating 15 Mpc filaments [3].

$$\vec{\tau} \propto \int_V (\vec{r} \times \nabla \Phi_{\text{interface}}) dV \quad (\text{Interface Torque Ansatz}) \quad (4.1)$$

4.2 Decisive Differences from Penrose’s CCC

While QIC-S shares the philosophy of “cycles” with Roger Penrose’s **Conformal Cyclic Cosmology (CCC)** [7], its structure is distinctly different (Table 1).

5 Testable Predictions

1. **LRD-Transitional Correlation:** Systematic discovery of objects ranging from LRDs to ID830.

Table 1: Comparison between QIC-S (Tier 2) and Penrose CCC

Item	Penrose CCC	QIC-S (Two-Tier)
Unit of Cycle	Entire Universe (Aeon) switches at once	Individual galaxies cycle independently
Global Structure	Serial (Big Bang \rightarrow Heat Death)	Parallel/Steady (Cosmic Web)
Hawking Points	BH collision remnants from previous Aeon	Local Leakage Points from current galaxies
Info. Conservation	Transmission via massless particles	Encoding into ER=EPR bridges

2. **Interface Sharpness:** Discovery of a boundary “edge” in dark matter halos steeper than the NFW profile.
3. **Universality of Filament Rotation:** Observational confirmation of rotational motion in all large-scale filaments.

6 Conclusion

QIC-S Ver 8.0.5 demonstrates that the universe is a **Self-Regenerating Steady System** maintained by Information Circulation (Tier 1) and Interface Energy (Tier 2), providing a parameter-free explanation for galactic rotation curves.

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References

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