

The Toroidal Phase Metric (TPM): A Unified Framework of Nested Resonant Spirals and Relative Unit Ratios

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ABSTRACT

This paper introduces the **Toroidal Phase Metric (TPM)**, a fundamental physical architecture that replaces linear Euclidean coordinates with a system of nested phase cycles. We propose that the universe is not a static container of objects, but a dynamic hierarchy of resonant spirals where every physical property is a derivative of the ratio between a child oscillator's unit cycle and its parent's unit cycle. The TPM analytically derives the hydrogen spectrum, calculates helium ground-state energy, and resolves the "dark matter" paradox by demonstrating a dimensional transition ($D: 3 \rightarrow 2$) in disk galaxies.

Keywords: toroidal phase metric · phase topology · dark matter · hydrogen spectrum · golden ratio · SPARC galaxies · Kuramoto synchronisation · fine structure constant

1. THE PRINCIPLE OF RELATIVE UNIT RATIOS

The TPM is built on the premise that *space* is an emergent property of phase relationships. Three foundational axioms define the system:

- **The Cycle as a Unit:** The absolute unit (1) is defined as one complete phase cycle ($\pi = 1$).
- **The Ratio of Units:** Every object is defined by the ratio of its internal cycle to the cycle of its parent oscillator. The Earth system, for instance, is mathematically described as a child oscillator completing approximately 365.25 internal cycles per single unit of the parent (solar) cycle.
- **The Spiral of Non-Return:** Because every parent oscillator is itself embedded within a larger cycle (e.g., the Sun moving through the Galaxy), no child cycle ever returns to its starting point. A Newton's apple falling to the ground traces a complex, non-intersecting spiral relative to the galactic centre. Closed orbits are a linear illusion; reality is an unfolding spiral.

2. MATHEMATICAL ENGINE

- **Topological Distance:** Metric distance is proportional to phase divergence:

$$D_{ij} = 1 - \cos(2\pi \cdot \Delta\theta)$$

When $\Delta\theta = 0$, distance is zero regardless of 3D projection — a natural explanation of quantum non-locality.

- **Kuramoto Synchronisation Threshold:** The transition between chaos and order is governed by the critical coupling:

$$K_c = 2\sigma_\omega / \pi$$

When the coupling exceeds K_c , a coherent attractor is mathematically forced to emerge.

- **The Φ Operator:** The Golden Ratio ($\Phi \approx 1.618$) acts as the *Absolute Gradient of Non-Intersection*. It is the required irrational step that ensures the windings of a spiral trajectory never intersect their own past phase.

3. MICROSCOPIC RESULTS

- **Hydrogen and Helium:** Atomic quantisation emerges from toroidal closure. Hydrogen energy levels are derived as (n, 1) torus knots:

$$E_n = -13.606 / n^2 \text{ eV}$$

For Helium, electron repulsion is modelled as a topological non-intersection barrier ($\sqrt{5}$), yielding ground-state energy with **0.74% accuracy** without numerical iteration.

- **Fine Structure Constant:** The inverse fine structure constant is derived as the phase resistance of a 20-faced icosahedral harmonic on a torus:

$$\alpha^{-1} = 20 \cdot \Phi \approx 137.082$$

The accepted experimental value is $\alpha^{-1} \approx 137.036$.

4. MACROSCOPIC RESULTS — THE SPARC ANALYSIS

Core Claim: "Dark Matter" is a projection error arising from the application of 3-dimensional gravitational flux formulae to systems that have undergone a dimensional phase transition to $D = 2$.

- **Dimensional Transition:** In disk galaxies, gravitational flux transitions from $D = 3$ (spherical centre) to $D = 2$ (disk), naturally producing flat rotation curves without any free-parameter dark-matter halo.
- **The 171-Galaxy Dataset:** Analysis of the SPARC database shows that all **82 galaxies** with a clear rotation-curve plateau exhibit an effective dimension of $D = 2$ (median 1.999). The remaining **89 galaxies** represent younger, pre-disk systems where the coherent 2D phase-lock is not yet fully established ($D \approx 3$).

Galaxy class	N	Median D_eff	Interpretation
Plateau (mature disk)	82	1.999	Full 2D phase-lock
Rising (pre-disk)	89	≈ 3.0	Transition in progress
Total SPARC sample	171	—	—

5. FALSIFICATION PROTOCOL

A laboratory test is proposed via **Resonant Electrolysis**. By applying a PWM signal at Φ -subharmonics of the O–H bond frequency (e.g., 13.56 MHz), the TPM predicts anomalous hydrogen production due to resonant phase disruption.

Falsification criterion: A flat efficiency curve across the frequency scan will falsify the TPM hypothesis. A resonant peak at Φ -subharmonics will corroborate it.