

On the Geometric Origin of Time

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1. Introduction

Time is not a dimension.

Time is the geometric driver that unlocks conserved circulation from frozen potential into flowing reality. In the Infinity Model, reality is not a sequence of instants but continuous circulation at invariant rate c across a Möbius-twisted lemniscate substrate. This substrate enforces incomplete phase liberation,

$$\eta < 1,$$

leaving a small but essential residue that prevents perfect crystallisation and allows the universe to evolve.

This note presents the geometric origin of the temporal flow and shows how all features of time—its arrow, continuity, and irreversibility—arise from the same incomplete closure that sustains reality.

2. Circulation on a Möbius Substrate

The Infinity Model begins with one structural fact:

Reality is conserved circulation advancing at the universal tempo c .

This advance is not “motion through spacetime”; it is **the act that generates spacetime**.

Circulation follows a Möbius-twisted figure-eight path. A Möbius structure enforces 4π closure, and the liberation event that freed circulation from perfect symmetry did not complete the 4π cycle. The residual mismatch is encoded in the incomplete-phase parameter

$$\eta = 1 - e^{-2\pi} \approx 0.9981325572682920112,$$

with corresponding deficit

$$1 - \eta \approx 0.001867.$$

This deficit is the “wobble” preventing perfect closure. It is the imperfection that makes time possible.

If $\eta = 1$, circulation would crystallize completely. No twist-writhe exchange would remain. Flow would halt. **Time would end.**

3. The Universal Equivalence Principle for Time

The relation between circulation and its spatial wake is given by:

$$\frac{\partial s}{\partial t} = c(1 - \eta),$$

where:

- s is spatial extension—the distance left behind as circulation advances,
- t is temporal advance—the forward reach of circulation,
- c is the universal circulation tempo,
- $(1 - \eta)$ is the incomplete-phase fraction.

This is the **Universal Equivalence Principle (UEP)** for time: **space is the wake of circulation; time is its advance.**

The universe does not experience time because something “ticks.” It experiences time because circulation cannot fully complete its cycle. Every cycle leaves a residue, and that residue pushes the next cycle forward.

4. Why the Flow of Time Exists

The observed passage of time is simply: **circulation advancing through an incomplete cycle.** Because the 4π closure is not achieved, each traversal carries a slight forward bias. This bias produces temporal flow, the “specious present,” and the continuous sense of becoming. If liberation had completed fully, if the Möbius cycle had achieved perfect closure, the universe would be locked into a static four-quarter symmetry—no motion, no change, no time. Thus, **time is not emergent from entropy. Entropy is emergent from time.**

5. The Arrow of Time

The phase deficit ($1 - \eta$) is irreversible. Increasing η would require adding a fourth writhe floor—a topological operation that is forbidden (see Paper 3: *On the Möbius Origin of Spin-1/2 and the Necessity of Three Generations*). Because writhe floors cannot be removed or added arbitrarily, the deficit cannot be undone. The incomplete closure is permanent. Therefore the direction of circulation is permanent.

Time has an arrow because geometry forbids turning it around.

6. Entropy as Unresolved Micro-Circulation

Entropy is not fundamentally statistical. It counts the number of unresolved micro-circulations on the underlying Möbius substrate.

- Each micro-circulation contributes a small twist–writhe imbalance.
- These imbalances must resolve forward due to the incomplete phase.
- They cannot collectively reverse direction or reduce in number.

Thus the Second Law of Thermodynamics is a geometric necessity:

$$\Delta S \geq 0 \text{ because } (1 - \eta) > 0.$$

Entropy increases locally because global topology forces circulation to resolve in one direction only.

7. Time as the Engine of Becoming

Everything familiar about temporal experience follows from the same geometric residue:

- **Flow:** circulation cannot crystallize.
- **Direction:** writhe floors cannot be un-wound.
- **Continuity:** circulation never halts.
- **Causality:** twist always leads writhe by the minimal delay set by the phase deficit.
- **Irreversibility:** the Möbius closure remains incomplete.

Time is not a dimension waiting to be filled. It is the universe's self-maintenance mechanism—the forward pull of a loop that cannot close.

8. Conclusion

The geometric origin of time is the incomplete liberation of circulation on a Möbius substrate. The universe endures and evolves because the Möbius cycle cannot complete its closure. The residual mismatch $(1 - \eta)$ is small, fixed, and essential.

Time is circulation's incomplete symmetry. Entropy is its accounting.

Change is its consequence. Without the deficit, the universe would freeze. With the deficit, it flows. Thus time is not added to physics.

Time is simply circulation refusing to finish.