Euclidean Timing Mechanics: Logic Notebook

Joseph Bakhos

May 29, 2025

Contents

1 Axioms

A1 [L]

Nodes are the fundamental entities of ETM. Each node possesses an internal tick counter and phase state.

A2 [L]

Time progresses through discrete ticks. No continuous time exists in the ETM ontology.

A3 [L]

Return eligibility, identity persistence, and reinforcement behavior may reference ancestry and echo memory fields not spatially local to the node under evaluation.

Axiom A4 [L] — Phase-Coherent Identity Reformation

A modular identity may reform in a node only if the following three logical conditions are satisfied:

1. **Ancestry Match:** The identity's ancestry tag A_i satisfies $match(A_i, A_r) = \text{true}$ with the recruiter's ancestry tag A_r.
2. **Phase Tolerance:** The identity's phase θ_i satisfies $|\theta_i - \theta_r| \leq \delta\theta$ (modulo 1), where θ_r is the recruiter phase and $\delta\theta$ is the global return tolerance constant.
3. **Echo Threshold:** The recruiter's echo support satisfies $\rho_r \geq \rho_{\min}$, the minimum required for reformation.

This axiom governs all return logic within ETM and forms the basis for modular rhythm reentry behavior. *Confirmed in Trials 001 (success), 002 (failure), and 003 (threshold sweep).*

Axiom A4b [L] — Refined Echo Scope for Return Evaluation

In addition to phase and ancestry alignment, the echo reinforcement condition in A4 is refined as follows:

- Let ρ_{local} denote the echo at the rotor's own node.
- Let ρ_{neigh} denote the sum of echoes in the 1-hop neighborhood.

Return is permitted if either:

1. $\rho_{\text{local}} \geq \rho_{\min}$, or
2. $\rho_{\text{neigh}} \geq \rho_{\min}$, or

3. A hybrid weighted average satisfies:

$$0.6 \cdot \rho_{\text{local}} + 0.4 \cdot \rho_{\text{neigh}} \geq \rho_{\min}$$

This refinement prevents failure in cases where echo reinforcement is distributed rather than concentrated.

Supported by Trials 004 and 005.

Phase Constraint: Return is additionally gated by tick-phase matching. The modular identity's phase must match the recruiter's phase within:

$$|\theta_{\text{return}} - \theta_{\text{recruiter}}| \leq 0.11 \pmod{1.0}$$

A5 [L] – Symbolic Identity Conflict Gate

No two modular identities with identical ancestry and identical return phase may simultaneously reform into the same modular rhythm structure unless a differentiating condition exists.

Source: Trials 014–016

A6 [L] – Modular Phase Distinction Principle

Two modules with identical ancestry can remain distinct if their recruiter fields enforce a stable tick rhythm offset. This distinction underlies orbital state separation (e.g., ground and excited) in ETM.

Confirmed in Trial 019.

A7 [L] – Recruiter Rhythm Dominance Principle

Return into a recruiter-defined identity module is governed by phase alignment. Rotor ancestry does not override recruiter rhythm match. *Confirmed in Trials 023–024.*

2 Derived Rules

R1 [L]

A modular identity may only re-form at a node if ancestry match and recruiter phase coherence are satisfied within tolerance.

R2 [L]

Phase state updates follow a modular rhythm:

$$\phi_{t+1} = (\phi_t + \Delta\phi) \bmod 1.0 \tag{1}$$

where $\Delta\phi$ is identity-specific.

Rule R3 [L] — Return Window Disqualification

Derived from A4. Return is prohibited at a given tick if any of the three required conditions in Axiom A4 are not satisfied. That is:

$$\neg(\text{Ancestry Match}) \vee \neg(\text{Phase Alignment}) \vee \rho_r < \rho_{\min} \Rightarrow \text{Return Disallowed}$$

This rule enforces strict reformation logic and defines one of the key gating mechanisms for identity evolution in ETM.

Rule R4 [L] — Static Echo Deficit Rule

If a rotor remains stationary and no external identity propagates through its location, then:

$$\lim_{t \to \infty} \rho_{\text{local}}(t) < \rho_{\min}$$

This explains the failure of static return in environments without active echo cycling, as confirmed in Trial 005. *Demonstrated by echo plateauing in Trial 005 static rotor phase.*

Rule R5 [L] — Neighbor Echo Inheritance

To model sustained return in distributed recruiter fields, we define an echo inheritance rule:

$$\rho_{\text{local}}(t+1) = \rho_{\text{local}}(t) + \alpha \cdot \rho_{\text{neigh}}(t)$$

where α is a configurable inheritance factor (e.g., $\alpha = 0.10$).

This rule enables local echo to build over time through steady reinforcement from the neighborhood, even in the absence of direct rotor reinforcement.

Validated in Trial 009.

Rule R6 [L] – Identity Return Lockout (Pauli Conflict Rule)

If two modular identities: - Share the same ancestry tag, - Attempt return into the same node at the same tick, - Have aligned tick-phase,

then both identities are denied return. A lockout is enforced for that node and tick. *Confirmed in Trial 013.*

R7 [L] – Phase Offset Escape

Modular identities with identical ancestry may coexist within the same recruiter basin if their timing phases are sufficiently offset at reformation.
Derived from: A5, A4b
Supported by: Trial 015

R8 [L] – Phase-Gated Return Logic

An identity rotor may reform into a recruiter-defined module only if its current phase matches the recruiter's tick rhythm phase within an acceptable tolerance window. This return condition supports stable transitions between orbital identity states.

Derived from A4b and A6. Confirmed in Trial 019.

- **R9 (Return Window Match)** A rotor may return into a recruiter-defined modular rhythm if and only if the difference between its tick-phase and the recruiter's central phase (modulo 1) is within the maximum phase tolerance:

$$\delta\theta \leq 0.11 \tag{2}$$

  This rule supersedes ancestry or rotor type when recruiter coherence is dominant, but only within fully matching ancestry domains.

- **R10 (Ancestry-Gated Return)** If symbolic ancestry matching is enabled, a rotor may return into a recruiter-defined rhythm only if the recruiter's ancestry symbol matches the rotor's ancestry.

$$\texttt{ancestry}(R) = \texttt{ancestry}(Q) \tag{3}$$

  This condition overrides phase match in contexts where modular identity coherence is enforced.

3 Definitions

- **Tick**: A discrete unit of local time.
- **Phase**: A modular value in $[0.0, 1.0)$ used for resonance and rhythm alignment.
- **Recruiter**: A structure formed by surrounding nodes that reinforces identity or enables return.
- **Echo Field**: A transient ancestry-bearing rhythm memory that may influence node behavior.

4 Open Questions

- Can A3 reproduce all empirically observed Bell-type correlations?
- What is the minimal set of axioms required to derive Pauli-style exclusion behavior?