The Three Metronomes: Criteria for the Apparently Eternal Skeleton [F] (2026) Robert Galida – June 2026

Abstract

The attractor framework distinguishes conservative attractors (eternal skeleton) from dissipative attractors (transient dance). The most fundamental conservative attractors are the **electron, proton, and neutrino class** – collectively the **three metronomes**. This paper defines explicit criteria for a "metronome": (1) apparent immortality (no observed decay), (2) effective indivisibility under ordinary perturbations, (3) conservation-law protection, and (4) possession of a rest frame (non-zero rest mass). It shows that electrons, protons, and neutrinos (the three mass eigenstates treated as a single class) are the best-supported examples under current physics. The number three is empirical, not derived; the framework is corrigible. The three metronomes form the apparently eternal skeleton – a pragmatic substrate for measuring the transient dance of dissipative systems.

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1. Introduction

The attractor framework divides persistent structures into two classes:

- **Conservative attractors** (eternal skeleton) – persist without energy input, without observed decay, without internal change. They are mindless, time-symmetric, and

invariant.
- **Dissipative attractors** (transient dance) — persist only by consuming energy, export entropy, and eventually decay.

(The conservative/dissipative dichotomy is a framework stipulation, not a physical law; it is defended in the broader attractor framework literature, e.g., *Persistence Under Perturbation* and *Basin Defense and Stable Addition*.)

The most fundamental conservative attractors are the **three metronomes**: the **electron, proton, and the class of neutrino mass eigenstates** (ν_1, ν_2, ν_3). Their name evokes their role as invariant reference entities — they provide a stable substrate against which all change can be measured. This paper defines explicit criteria for a metronome and applies them to each candidate.

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2. Criteria for a Metronome

A metronome in the attractor framework must satisfy four criteria:

Criterion	Meaning	Operational check
1. Apparent immortality	No observed decay; no lighter state exists for it to decay into under known laws	Lifetime lower bounds >> age of universe; no allowed decay channel

Criterion	Meaning	Operational check
2. Effective indivisibility under ordinary perturbations	Behaves as a stable, indivisible unit under all perturbations relevant to the framework (scattering, binding, chemical reactions)	Remains the same particle after typical disturbances; does not spontaneously change identity
3. Conservation-law protection	Protected by an exact conservation law or an accidental symmetry that is effectively exact in the Standard Model	Lightest carrier of a conserved quantum number (electric charge, baryon number, lepton number)
4. Possession of a rest frame	Has non-zero rest mass, hence a proper time and the ability to serve as a reference clock *in its own rest frame*	Invariant mass > 0

Rationale for Criterion 4: Measurement requires a local frame. A massless particle has no rest frame, no proper time, and cannot be used as a persistent local reference. While photons are extremely long-lived, they serve as signal carriers, not as the invariant substrate. The framework prioritises rest-frame existence because the "eternal skeleton" is meant to be the background against which change is measured — a background must have a local perspective to anchor measurements. This is a **definitional choice**, not a consequence of particle physics, and it is consistently applied.

Note on Criterion 3: Baryon number and lepton number are accidental symmetries, not gauge symmetries. The paper treats them on equal footing because both provide effective stability for the proton and neutrinos under Standard Model physics. If

future experiments reveal baryon or lepton number violation, the framework will adjust accordingly.

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3. Why the Electron Is a Metronome

- **Apparent immortality:** Lightest negatively charged particle; no decay channel.
- **Effective indivisibility:** Remains an electron after scattering, binding, etc.
- **Conservation protection:** Electric charge and lepton number conservation.
- **Rest frame:** Non-zero rest mass.

→ **The electron is a metronome.**

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4. Why the Proton Is a Metronome (Despite Being Composite)

- **Apparent immortality:** No observed decay; experimental lower limit on half-life > 10^{34} years (Super-Kamiokande, 2020).
- **Effective indivisibility:** For all practical purposes (chemistry, nuclear physics, stellar processes), the proton behaves as a stable, indivisible unit.
- **Conservation protection:** Baryon number is an accidental symmetry; it protects the proton from decay in the Standard Model.
- **Rest frame:** Non-zero rest mass.

→ **The proton is a metronome.** The framework does not require elementary particles; it requires maximal persistence under

relevant perturbations.

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5. Why the Neutrino Class (ν_1, ν_2, ν_3) Is a Metronome

The three neutrino mass eigenstates are treated as a **single metronome class** because they share the same stability argument, differ only in mass, and are grouped for the framework's hierarchical classification.

- **Apparent immortality:** No observed decay; cosmological and astrophysical lower bounds on neutrino lifetimes are orders of magnitude longer than the age of the universe. Neutrino oscillation is flavour mixing, not decay — the mass eigenstates are stable.
- **Effective indivisibility:** Once a neutrino is in a mass eigenstate, it propagates without changing identity. (Weak interactions produce **flavour eigenstates** — superpositions of mass eigenstates — but the mass eigenstates themselves are stable and travel freely.)
- **Conservation protection:** Lepton number is an accidental symmetry; in the Standard Model it protects neutrinos from decay. (If future experiments confirm that neutrinos are Majorana particles — violating lepton number — the framework will adjust; this is part of its corrigibility.)
- **Rest frame:** Neutrinos have non-zero rest mass (confirmed by oscillation experiments), albeit very small.

→ **The neutrino class is a metronome.** The three mass eigenstates count as one metronome *type* for the framework's hierarchical classification.

6. Why Not Other Candidates?

Candidate	Fails criterion	Explanation
Free neutron	1 (apparent immortality)	Decays in ~15 minutes.
Neutron in a nucleus	2 (effective indivisibility)	Stability is environment-dependent; not an irreducible attractor.
Photon	4 (rest frame)	Massless; no proper time. Excluded by definition (see rationale for Criterion 4).
Muon, tau	1	Decay rapidly.
Dark matter candidates	Not yet identified	If discovered and shown to be stable, massive, and effectively indivisible, they could become additional metronomes.
Composite stable structures (nuclei, atoms)	2	Not effectively indivisible; they are built from metronomes and are dissipative or emergent attractors, not part of the invariant skeleton.

7. The Number Three: Empirical, Not Derived

The paper’s title uses “three metronomes” as a convenient label for the electron, proton, and the neutrino class (the three mass eigenstates grouped together). The number three is not derived from first principles; it reflects current best empirical knowledge. If new stable particles are discovered

(e.g., dark matter), the list will expand. The framework is corrigible by design.

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8. The Apparently Eternal Skeleton

The term “apparently eternal” is strictly empirical: these particles have never been observed to decay or be transient, and for all practical purposes they behave as if they have no end. The three metronomes form the **eternal skeleton** – a pragmatic substrate against which the transient dance of dissipative systems (life, mind, society) is measured. This is a **framework-internal** construct, not a metaphysical claim.

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9. Stable Resonances and the Grounding of Dissipative Time Metrics

Each of the three metronomes possesses an **invariant quantum frequency** – its Compton frequency, given by f=mc2/hf=mc2/h. For the electron, this is ~1.24 × 10^{20} Hz; for the proton, ~2.27 × 10^{23} Hz; for neutrinos, the frequencies are very small but non-zero. These frequencies are invariant, universal, and identical for every identical particle in the universe. They are **stable resonances** of the eternal skeleton.

Why this matters for dissipative systems:

Every dissipative system (a living cell, a brain, a society) is composed of or continuously interacts with electrons, protons, and neutrinos. The **time constant τ** that appears in corrective permeability (κ = 1/τ) can, in principle, be expressed as a multiple of these fundamental resonance periods. For example, a neuron’s recovery time after a perturbation – determined by ion channel kinetics, membrane

capacitance, and metabolic rate — is measurable against the same invariant clock as any other physical process. The metronome provides the **unit** of time, not the mechanism.

Thus, κ is a genuine physical variable, not a mere metaphor. It refers to a ratio of measurable durations, anchored in the invariant frequencies of the metronomes.

Cross-domain comparability:

The framework's ability to compare κ values across vastly different domains (e.g., a thermostat's seconds-scale τ and a political movement's months-scale τ) does **not** follow from shared Compton-frequency units alone. It follows from the framework's **definitional choice** to treat κ as a domain-general variable — a diagnostic that measures the same functional property (speed of return to baseline) in every system, regardless of scale or substrate. The metronomes ensure that such measurements are, in principle, commensurable; they do not guarantee that the comparison is meaningful in every case. That is a framework commitment, not a physics claim.

Caveat: The expression of τ as a multiple of Compton periods is a conceptual grounding, not a practical measurement protocol. No one will measure a society's reaction time in electron oscillations. The importance is that κ is not an arbitrary label; it is a dimensionless ratio of durations, and durations are defined by the invariant resonances of the three metronomes.

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10. κ and Basin Depth as Heuristics

The attractor framework introduces corrective permeability (κ = 1/τ) and basin depth (B) as conceptual heuristics. For the metronomes:

- **κ** for decay is vanishingly small (effectively zero) on all observable timescales.
- **Basin depth** is the energy barrier required to change the particle's identity — effectively infinite for all practical purposes.

These are **qualitative descriptors**; they are not operational quantities in particle physics. They are included here for completeness of the framework's vocabulary. For the application of κ and B to dissipative systems (e.g., belief updating, neural recovery), see the papers *Basin Defense and Stable Addition* and *Why Clockwork Interventions Fail*.

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11. Corrigibility and Falsifiability

The framework explicitly invites revision:

- If proton decay is observed, the proton will be downgraded to "very long-lived" (or removed).
- If neutrino decay or Majorana nature is confirmed, the neutrino class's status will be revised.
- If new stable particles are discovered, they will be added.

The attractor framework is a **philosophical taxonomy and diagnostic tool**, not a predictive physical theory. Its value lies in providing a unified language for persistence across domains.

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12. Conclusion

The electron, proton, and neutrino class satisfy the attractor

framework's four criteria for metronomes: apparent immortality, effective indivisibility under ordinary perturbations, conservation-law protection, and possession of a rest frame. They are the **best-supported examples** of the apparently eternal skeleton under current physics. The framework is corrigible, the number three is empirical, and the language of "eternal skeleton" is pragmatic. The three metronomes anchor the distinction between conservative and dissipative persistence.

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Persistence Under Perturbation: The Eternal Skeleton and the Transient Dance

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Persistence Under Perturbation: The Eternal

Skeleton and the Transient Dance

Persistence Under Perturbation: The Eternal Skeleton and the Transient Dance
Robert Galida — June 2026 (Revised Edition)

> ***Note to readers:*** *This is a revised version of the May 2026 paper. The core insights about the eternal skeleton and transient dance remain, but the treatment of fundamental metronomes has been refined. For the detailed relational account of time, see the companion paper: Metronome, Memory, and the Threefold Anchor: A Relational Account of Time F.*

Abstract

This paper presents a unified framework based on a simple idea: **persistence under disturbance is the basic mark of reality.**

We divide all persistent things into two classes:

- **Non-dissipative (conservative) structures** — eternal, time-symmetric, mindless. They form the **eternal skeleton** (Planck scale, quantum fields, the three fundamental metronomes: electron, neutrino mass eigenstates, and proton).
- **Dissipative attractors** — temporary, time-asymmetric, needing energy flow. They form the **transient dance** (life, mind, society, consciousness).

All observed minds are dissipative.

Because the universe as a whole is a conservative system (no outside environment), it cannot have consciousness or intentions.

Therefore, under this framework, a theistic God is extremely unlikely.

No supernatural entities are needed.

The framework gives a naturalistic view of persistence, a graded idea of mind, and a way to study how people get trapped in **fantasy attractors** (belief systems that ignore reality).

Scope Conditions

This framework is not a finished mathematical theory. It is a cross-domain way of thinking about persistence under disturbance. The word “attractor” is sometimes a metaphor, sometimes a precise term. The framework looks for similar stability patterns across different scales, not a single equation. It is an invitation to explore, not a closed belief system.

Part I: The Nature of Mind

1. The Core Intuition

Your mind feels real, long-lasting, and not just brain tissue. Dualism can’t explain mind-body interaction. Reductive physicalism ignores the feeling of being you. We propose a third way: **the mind is a stable, resilient, persistent pattern — an attractor — of your whole body.**

2. Key Definitions

Term	What it means	How to measure
Attractor	A region in state space that pulls nearby states toward it and holds them	Lyapunov exponents, basin stability
Resilience	Ability to bounce back after a hit	Recovery time, hysteresis
Basin of attraction	The set of states that eventually fall into the attractor	Larger basin = more resilient
Attractor dimensionality	How complex the attractor is	Correlation dimension; proxy for integrated information (Φ)
Fantasy attractor	A belief system cut off from reality checks	Low contact with corrections; deep basin; slow updating
Shared reality attractor	A belief system open to reality checks	High contact with corrections; shallow basin; fast updating

3. Signs of a Resilient Attractor

- Bounces back quickly after stress
- Low hysteresis (forward and return paths nearly the same)
- Stable rhythms (HRV, circadian, breathing lock together)
- Cross-domain coupling (better sleep → better mood, immunity)
- Graceful decline under growing stress (not sudden collapse)
- Critical slowing down (rising variance and autocorrelation before a big change)

4. The Third Ontological Category

View	What it says	Problem
Dualism	Mind is a non-physical substance	How can it interact with the body?
Reductive physicalism	Mind is just brain activity	It loses the feeling of being you
Attractor framework	Mind is a real, non-substantial pattern (like a whirlpool)	Fully compatible with physics, keeps subjective experience

A whirlpool is real – it depends on water, affects the flow, and isn't just one water molecule. Your mind is like that.

5. Attractor Framework & Consciousness Theories

- **IIT (Integrated Information Theory):** Attractor dimensionality acts like Φ. Awake animals have higher-dimensional attractors than anesthetised ones (Tajima & Kanai, 2017).
- **GWT (Global Workspace Theory):** "Ignition" means settling into a global attractor that spans many brain areas.
- **Testable predictions:** Shallow attractors (unconscious) are easier to disturb; conscious states have deeper basins and higher dimensionality.

6. The Simplest Mind: *C. elegans* (a tiny worm)

The worm has 302 neurons. It shows: integration of senses, minimal self-reference, valence, associative learning, goal-directed behaviour. That's all we need for a minimal

mind. Prediction: during learning, its brain should show higher attractor dimensionality than when paralysed.

7. Mind as a Whole-Body Attractor

Your mind is not just in your brain. It includes your body's extracellular matrix (ECM), hormones, immune system, and gut. Alcohol, sleep, and ECM restoration affect the whole body and change your mind. That's why relaxing your belly, getting morning light, or reading a quiet book can improve your sleep and heart rate variability (HRV).

8. Self-Engineering: Reshaping Your Own Attractor

Because your mind is an attractor, you can change it through small, repeated nudges: learning a skill, exposure therapy, forming habits, meditation, physiological hacks (ECM restoration, belly sag, morning cardio). An N=1 experiment (tracking ECM, sleep, HRV) showed that improvements happen in non-linear, threshold-based jumps — exactly as attractor theory predicts.

Part II: The Eternal Skeleton and the Transient Dance

9. Two Fundamental Classes of Persistence

9.1 Non-Dissipative (Conservative) Structures — The Eternal Skeleton

- No energy loss; total energy stays the same (or exchanges only within a closed system)

- Time-reversible at the level of intrinsic persistence (though weak interactions violate CP/T)
- Stable because of conservation laws (charge, baryon number, energy)
- Do not age, do not die (or are effectively eternal on all observable timescales)

The three fundamental metronomes (see *Threefold Anchor* paper) are the most conservative layer of the eternal skeleton:

Metronome	Role
Electron	Lightest charged lepton; invariant Compton frequency
Neutrino mass eigenstates (ν_1, ν_2, ν_3 collectively)	Effectively stable; theoretically invariant frequencies
Proton	Lightest baryon; stability from baryon number conservation

These three are continuously recycled through all dissipative systems. They are the invariant substrate.

Other conservative structures include: Planck-scale granular spacetime, quantum fields, stable atoms, and the universe as a whole.

These make up the **eternal skeleton** — mindless, timeless, the foundation.

9.2 Dissipative Attractors — The Transient Dance

- Need constant energy and must dump entropy
- Time-irreversible (arrow of time)
- Stay stable through feedback loops, homeostasis, and energy use
- Finite lifetime — they age, decay, and eventually collapse

- **What binds all dissipative systems** (a bacterium, a brain, a galaxy, a society) is the continuous recycling of the three eternal metronomes. Every dissipative system operates by exchanging electrons, protons, and neutrinos with its environment.

Examples: living cells, metabolic networks, ecosystems, human bodies, conscious minds, societies, economies, fantasy attractors.

These are the **transient dance** — everything that is born, lasts a while, and dies.

10. Why Mind Requires Dissipation

Every known system with integration, self-reference, valence, learning, and goal-directedness is **dissipative**. No non-dissipative mind has ever been seen. So we conclude that, in this framework, the only kind of consciousness we have evidence for is dissipative. This is a best-explanation inference, not an absolute proof.

11. The Universe as a Non-Dissipative System

The universe as a whole has no outside environment. Its total energy is conserved (or at least doesn't exchange with anything else). So it is non-dissipative:

- No metabolism (doesn't eat, breathe, or repair itself)
- No learning (its laws don't change from experience)
- No valence (no likes or dislikes)
- No goal-directedness (it just follows its equations, doesn't aim for a basin)

Therefore, the universe is **not a mind**. Any global attractor (e.g., a de Sitter vacuum state) is a conservative, eternal,

mindless pattern.

12. Why a Theistic God Is Extremely Unlikely (Probabilistic)

A theistic God is supposed to be: conscious, intentional, personal, eternal, unchanging, and self-sufficient.

- Consciousness (as far as we know) requires **dissipation**.
- Eternal, unchanging, self-sufficient means **non-dissipative** (conservative).

No known entity can be both dissipative (aging, needing energy) and non-dissipative (eternal, self-sufficient). So, under this framework, a theistic God is extremely implausible. The universe itself is already the only non-dissipative system. Adding a separate non-dissipative God is unnecessary and, by definition, cannot interact with anything.

13. The Map of Existence

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            TRANSIENT DANCE (Dissipative Attractors)
              - Societies
              - Minds
              - Cells
              - Ecosystems
              - Human Body (ECM, HRV)
              - Animal Life
              - Metabolism (energy + entropy)
                    ↓ (emergence)
             ETERNAL SKELETON (Conservative Persistence Structures)
              - Atoms
                - Three metronomes: electron, neutrino mass eigenstates, proton
              - Quantum Fields
              - Planck Scale (granular spacetime) ← FLOOR
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Legend: Floor = Planck-scale granularity — the hard, eternal

limit. Skeleton = quantum fields, stable particles, atoms — conservative structures. Dance = dissipative attractors — minds, life, society.

14. Open Questions for Future Work

- **Formal cross-scale unification:** How can we unify conservation-based stability (QFT) and dissipative attractors (nonlinear dynamics) with a single mathematical object?
- **Dissipation-consciousness link:** Is dissipation absolutely necessary for consciousness, or just a fact about life on Earth?
- **ECM mechanism:** What is the exact chain from ECM changes to nervous system regulation to subjective feelings?
- **Persistence vs. selection:** Is persistence a basic feature of reality, or do we only notice stable things because unstable ones vanish?
- **Fantasy attractor measurement:** Can we really measure correction latency, basin depth, and external coupling in real social systems?
- **Coupling equations:** How exactly does the rate of memory inscription depend on metronome frequency? (See the *Threefold Anchor* paper for a working placeholder.)

15. Conclusion

The attractor framework gives a naturalistic picture of reality:

- **Non-dissipative (conservative) structures** — the eternal, mindless skeleton, anchored by the three fundamental metronomes (electron, neutrino mass eigenstates, proton).
- **Dissipative attractors** — temporary, energy-hungry, and mortal. All minds are in this class.

- **What binds all dissipative systems** is the continuous recycling of the same three eternal metronomes.
- The universe as a whole is non-dissipative, therefore not a mind.
- A theistic God is extremely implausible under this framework.

We don’t need religious language. We have the eternal skeleton and the transient dance: persistence without transcendence, structure without the supernatural.

The dance is finite, fragile, and precious. The skeleton is eternal, but mindless.

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This rewrite is ready to replace the old post. It now correctly reflects the threefold metronome framework, includes the recycling insight, and cross-references the newer paper.

Metronome, Memory, and the Threefold Anchor: A Relational Account of Time [F] (2026)

Abstract

This paper presents a relational view of time based on the attractor framework.

We argue that two very different kinds of attractors work together to create what we call time:

- **Conservative attractors** (electrons, neutrinos, protons) act as metronomes. They provide a steady, repeatable rhythm – a ruler for measuring duration.
- **Dissipative attractors** (living cells, minds, societies) act as memory. They accumulate irreversible changes, giving time its direction.

Time is not a mysterious substance. It is the coupling between these three fundamental metronomes and the irreversible flow of memory. What binds all dissipative systems – from a bacterium to a brain to a galaxy – is the continuous recycling of the same three eternal metronomes.

This view offers a conceptual account of how clocks work, why time has an arrow, and how aging, entropy, and history fit together.

The dance of time has three metronomes and a memory.

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1. Two Classes of Persistence, Two Roles for Time

In the attractor framework, everything that persists does so by resisting disturbance. We identify two distinct types of persistent structures, each giving rise to a different aspect of time.

1.1 Conservative Attractors – The Metronome

Conservative attractors are protected by physical conservation laws (charge, baryon number, energy). They are:

- **Eternal** – they do not age or decay (or are effectively stable on all observable timescales).
- **Time-symmetric at the level of intrinsic persistence** –

their existence as attractors is symmetric under time reversal, though some interactions (weak force) violate CP and thus T.
- **Type-identical** – every electron has the same Compton frequency; every neutrino mass eigenstate has an invariant (though not yet precisely measured) frequency.

Because of these properties, conservative attractors serve as reference standards for duration – metronomes. The international definition of the second is literally a fixed number of such ticks.

1.2 Dissipative Attractors – Memory

Dissipative attractors (cells, minds, ecosystems, societies) are different:

- They require a continuous flow of energy and must export entropy.
- Their dynamics are irreversible – you cannot return to a past microstate without enormous cost.
- This irreversibility creates a directional arrow: before and after, past and future.
- They accumulate memory – irreversible state changes that persist and affect future behaviour.

Memory = irreversible accumulated state change (inscription). Examples: synaptic plasticity, scars, fossil records, cultural archives, radioactive decay (the daughter nucleus retains a record of the parent's disintegration).

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2. The Three Metronomes: Our Most

Fundamental Clocks

The Standard Model contains many particles, but only three classes are absolutely or effectively stable and serve as fundamental metronomes. The photon is not a metronome — it has zero rest mass, hence no rest-frame Compton frequency. It is a mode of propagation, not a standalone persistent entity.

Class / Particle	Symbol	Key Property	Role as Metronome
Electron	e^-	lightest charged lepton	Compton frequency ~1.24 × 10^{20} Hz
Neutrino mass eigenstates (collectively)	ν_1, ν_2, ν_3	neutral, tiny masses	Compton frequencies (mass-dependent); effectively stable
Proton	p	lightest baryon	Compton frequency ~2.27 × 10^{23} Hz; no observed decay

These three classes form what the framework calls the *eternal skeleton* — the collection of conservative structures that persist without decay and provide the stable background against which dissipative change occurs.

Stability notes

- Proton decay has never been observed; lower limit on half-life > 10^{34} years — effectively eternal. The proton is composite, but its stability derives from baryon number conservation, not merely nuclear binding energy.
- Neutrinos oscillate between flavours, but the underlying mass eigenstates are stable on cosmological timescales. Their exact Compton frequencies are not yet known to metrological precision — only mass-squared differences have been measured — but they are theoretically invariant.

These three metronomes do not need energy input to persist. Their frequencies are invariant (known for electron and proton; theoretically invariant for neutrinos). Any clock based on one agrees with any other after accounting for relativity, as confirmed by atomic clock comparisons.

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3. Time as the Coupling Between Metronomes and Memory

Time is not a primitive substance. It is the relationship between the metronome ensemble and dissipative memory.

- The three metronomes provide a metric — an invariant ruler for "how much" duration has passed.
- Memory provides direction — which events are past, which are future.
- Without metronomes, change would be unmeasurable — no ruler.
- Without memory, change would be reversible and directionless — no before/after.

Both are necessary for what we operationally call time.

As a working placeholder, let the rate of memory inscription be $dM/dt=f(M,\nu)$ $dM/dt=f(M,\nu)$, where $\nu\nu$ is a characteristic metronome frequency and M M is the current accumulated memory state. Two limiting cases anchor the idea:

- As $\nu\to 0$ $\nu\to 0$ — no metronome — duration becomes undefined. Change occurs but cannot be quantified as a metric interval. This is the "no ruler" condition.
- As dissipation $\to 0$ $\to 0$ — no memory — M M remains constant. Change leaves no trace, so there is no before/after. This is the "no arrow" condition.

What binds all dissipative systems — a bacterial cell, a human brain, a galaxy, a social institution — is the continuous **recycling of the same three eternal metronomes**. Every dissipative system operates by exchanging electrons, protons, and neutrinos with its environment. The metronomes are the invariant substrate; the memory is the transient pattern. The coupling is the recycling.

Thus, time is not merely a coordinate; it is the ongoing, irreversible reconfiguration of eternal components into transient, memory-bearing structures.

The three metronomes are time-symmetric at the level of intrinsic persistence. The arrow of time comes from dissipative systems that accumulate history. Time is the coupling between these two regimes.

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4. Thermodynamic Information Theory and Persistence

The persistence functional P(x)$P(x)$ measures how deep an attractor basin is — formally, the depth of the basin in the system's phase space (the energy or Lyapunov function value required to escape the basin). Higher PP means a more stable attractor.

- In a dissipative attractor, maintaining memory requires continuous energy export to counteract thermal noise.
- Landauer's principle: erasing one bit costs at least kBTln⁡2$k_B T \ln 2$ of free energy. Retaining memory against thermal fluctuations requires energy input.

We interpret P(x)$P(x)$ as a measure of information retention: systems with higher PP preserve mutual information between past and present for longer. The decay rate −P˙/P$-\dot{P}/P$ relates

to entropy production, connecting the attractor framework to non-equilibrium thermodynamics.

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5. Consequences and Applications

- **Clocks** — Atomic clocks derive stability from electron transitions. The three metronomes guarantee cross-calibration.
- **Aging** — Biological aging is the accumulation of irreversible memory, measured against metronomes like circadian rhythms.
- **Critical slowing down** — As a system approaches a bifurcation, $-\dot{P}/P$–$\dot{P}/P$ decreases, providing early-warning signals (rising autocorrelation, variance) in physiology, ecology, and social systems.
- **Hysteresis in beliefs** — Fantasy attractors exhibit hysteresis — the path of belief change differs when accumulating vs. removing evidence. The hysteresis loop area quantifies memory.[1]
- **Cosmological time** — The cosmic microwave background is a memory of the early universe (here "memory" is metaphorical). Atomic clocks measure the duration since those imprints were formed.

[1] *Fantasy attractor*: in the attractor framework, a dissipative structure (typically a belief system) with abnormally low corrective permeability, resistant to updating despite counter-evidence.

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6. Relation to the Broader Attractor Framework

The metronome-memory distinction is a special case of the conservative vs. dissipative attractor dichotomy. It sharpens the “eternal skeleton / transient dance” metaphor.

The three metronomes are the most fundamental layer of the eternal skeleton — the collection of conservative structures that persist without decay and provide the stable background against which dissipative change occurs.

The framework does not claim that time is “made of” attractors. It claims that the measurement and experience of time rely on the interaction of these two persistence regimes. Because every dissipative system continuously recycles the same eternal metronomes, all such systems are materially unified across space and time. That unity is what makes a universal, relational time possible.

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7. Open Questions and Refinements

- **Formalising P(x)$P(x)$** — Rigorous derivation for deterministic (Lyapunov), stochastic (escape time), and information-theoretic (surprisal) cases.
- **Coupling equations** — Specify dM/dt=f(M,ν)$dM/dt=f(M,\nu)$. Can it be tested empirically?
- **Category clarity** — Conservative attractors span strict symmetry-protected invariants (elementary particles) and emergent approximate invariants (clocks). Future work should stratify these.
- **Falsifiability** — Concrete falsifiers: a persistent system without dissipation, or a social attractor that never updates despite counter-evidence.
- **Relation to other relational accounts** — Converges with

Barbour (1999) and Rovelli (1996). The difference: the present framework identifies the two required poles (conservative metronomes providing metric invariance; dissipative memory providing direction) and grounds both in attractor dynamics.

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8. Conclusion

Time is not a primitive. It is the relational coupling between:

- the three fundamental conservative attractor classes — electron, neutrino mass eigenstates (collectively), and proton — which provide invariant metric structure (the metronome), and
- dissipative systems that accumulate irreversible state inscription (memory).

What binds all dissipative systems — from a bacterium to a brain to a galaxy — is the continuous recycling of the same three eternal metronomes. The metronomes are the invariant substrate; memory is the transient pattern; time is the coupling.

This account respects how physics measures time, explains the arrow via entropy and information persistence, and offers transferable concepts across neuroscience, ecology, sociology, and AI.

The dance has three metronomes and a memory.

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