Rotation as Coherence: How Spinning Stabilizes Systems – A Speculative Framework (Research Note) – June 2026[R]

Abstract

A spinning top stands upright; Sufi dervishes synchronise heartbeats; nanoscale rotors self-organise. Why does rotation create order across such different scales? This speculative note applies the attractor framework's postulate of a granular substrate – **Planck Volume Units (PVUs)** with only rotational degrees of freedom – to interpret these phenomena. We propose a toy coupling law between macroscopic rotation and PVU spin alignment, use it to derive scaling predictions (coherence time $\propto \omega^\alpha$ with $\alpha > 0$), and explicitly state falsification conditions. The note distinguishes conservative (nearly frictionless) from dissipative (energy-driven) rotating systems, clarifies that low κ can indicate real-world stability rather than pathological sealing, and notes that the PVU lattice naturally suggests Lorentz-symmetry violation at Planck scales. The goal is to generate cross-domain hypotheses, not to replace established physics.

---

1. Introduction

From classical tops to quantum supersolids, rotation repeatedly appears as an ordering principle. Standard explanations are domain-specific. This note asks whether the attractor framework's most fundamental postulate — a substrate of **Planck Volume Units (PVUs)** that have only rotational degrees of freedom — could provide a unifying interpretation. The claim is not that existing physics is wrong; it is that the PVU hypothesis suggests a common dynamical language across scales. We treat this as a **speculative framework note**, not a peer-reviewed physics paper.

---

2. PVUs, Basin Depth, and κ — Including Conservative vs. Dissipative Distinction

- **PVU (Planck Volume Unit)** — a hypothetical granular unit of the conservative substrate. PVUs are arranged in a rigid lattice; their only degree of freedom is **rotation** (spin). They do not translate and do not interact through collision.
- **Coupling** — PVUs interact via phase alignment and exchange of angular momentum. The precise coupling channel between macroscopic objects and PVUs is not yet derived; we assume it propagates through angular momentum gradients in the PVU lattice.
- **Basin depth (B)** — resistance to *state change* (i.e., leaving the oriented attractor). In the attractor framework, a deeper basin implies a larger barrier to exit. **Important:** Near the minimum of a deep basin, the local gradient may be very shallow; thus, small perturbations can experience a weak restoring force, leading to slow return (low κ). Large perturbations face a high exit barrier. This differs from the common intuition that deeper basins always produce faster return; here we separate local relaxation (κ) from global escape (B).
- **Corrective permeability (κ)** — $\kappa = 1/\tau$, where τ is the characteristic return time to the attractor after

a **small** perturbation. **Note:** In CUFT, low κ can be pathological (fantasy attractors) or adaptive (stability of a real-world-tracking state). Rotating systems that track reality (e.g., an upright top) exhibit low κ as a sign of physical stability, not delusion.

- **Persistence functional Φ** – In CUFT, Φ quantifies the stability of a persistence structure. Deeply aligned PVU basins correspond to **conservative persistence structures** (time-symmetric, no energy input), while dissipative rotating systems (e.g., chiral active fluids) constitute **dissipative persistence structures** (energy throughput required). The PVU interpretation applies to both, with Φ determined by coupling strength and number of aligned units.
- **Conservative vs. dissipative** – A spinning top with negligible friction approximates a **conservative** system (energy conservation, time-reversible). Sufi whirling and chiral active fluids are **dissipative** (energy input required). The PVU interpretation applies to both; coupling strength may differ.

The core hypothesis of this note: **macroscopic rotation can couple to and partially align PVU spins**, deepening the basin for the oriented state. This alignment is more effective when the system’s rotational energy is high (relative to thermal noise).

---

3. How Rotation Deepens the Basin: A Toy Coupling Model

Let θ_i be the orientation of the i-th PVU spin. The coupling to an external rotation with angular velocity ω can be modelled by a simple alignment term in an effective energy function: $H_{align}=-J(\omega)\sum_i \cos(\theta_i-\phi_{ext})$ $H_{align}=-J(\omega)\sum_i \cos(\theta_i$

$-\phi ext)$

where φ_ext is the phase of the macroscopic rotation. The coupling constant J(ω) is expected to increase with ω (faster rotation → stronger alignment). The resulting basin depth B for the aligned state grows with J. Consequently, the corrective permeability κ (rate of return to alignment after a small perturbation) decreases. **Connection to CUFT variables:** J(ω) corresponds to the PVU coupling energy density; the basin depth B scales as J·N (where N is the number of phase-aligned PVUs), and κ = 1/τ is the inverse return time measured after perturbation.

For a system of many coupled PVUs, a mean-field estimate suggests that the characteristic return time τ scales as $\tau \propto \omega^\alpha$ with α > 0. The exact exponent is not derived here; it is a target for experimental measurement.

---

4. Evidence Across Scales (Interpretive Mappings)

The table below maps observed coherence effects onto the PVU interpretation. The entries are **consistency claims**, not demonstrations of causation.

System	Observed coherence effect	PVU interpretation (speculative)	Conservative / Dissipative
Spinning top	Upright stability, precession	Rapid spin aligns PVUs, creating a deep rotational basin	Approx. conservative

System	Observed coherence effect	PVU interpretation (speculative)	Conservative / Dissipative
Sufi whirling	Physiological synchrony in collective ritual contexts (e.g., Konvalinka & Roepstorff 2012 on fire-walking); consistent with framework predictions for group whirling	Collective rotation may couple PVUs across participants; framework predicts increased synchrony with spin	Dissipative
Nanoscale spinners	Synchronised superstructures	Hydrodynamic coupling and PVU alignment co-occur; a common dynamical origin is suggested	Dissipative
Supersolids	Giant rotating quantum state	Existing quantum phase coherence (long-range order) can be interpreted as large-scale PVU alignment	Conservative (ground state)
Chiral active fluids	Large-scale vortex rotation	**Observation:** Collective chirality produces large-scale vortex rotation (Soni et al. 2019). **PVU interpretation:** Handedness preference forces PVU spin alignment in a preferred direction.	Dissipative

The specific effect of whirling on heart-rate synchrony is reported in the literature; readers should consult primary sources for detailed methodology. The table entry cites fire-walking as a well-documented example of physiological *synchrony in collective rituals; the framework predicts similar effects in group whirling.*

Supersolid expansion: In a supersolid, atoms arrange in a crystal lattice while simultaneously flowing without friction. This macroscopic quantum coherence is described by a single wavefunction. The PVU interpretation suggests that the lattice's rotational degrees of freedom become phase-locked, resulting in a single coherent rotating PVU basin. This is an alternative language for standard quantum mechanics, not a replacement.

---

5. Predictions and Falsifiability

1. **Nanospinner scaling:** Coherence time τ (e.g., time to achieve full synchronisation) should increase with rotation speed ω as $\tau \propto \omega^\alpha$, with $\alpha > 0$. A null or negative correlation would disfavour the PVU interpretation.
2. **Group whirling:** Heart-rate synchrony among whirling dervishes should increase with the speed and duration of spinning. **Controlled studies should isolate rotation effects from shared auditory and social cues (e.g., using blindfolded individuals spinning at different rates).** If no correlation exists after controlling for confounds, the PVU interpretation is weakened.
3. **Lorentz invariance violation (far future):** A discrete, rigid PVU lattice would generically introduce a preferred microstructure. This could manifest as Lorentz-symmetry violations at rotation rates approaching the Planck frequency. Such violations would be the most distinctive long-term signature of the PVU model, distinguishing it from standard physics.

6. Relation to Existing Physics and an Objection Addressed

This note does not claim that PVUs replace standard explanations. For spinning tops, gyroscopic theory remains correct. For supersolids, quantum mechanics is the established framework. The PVU interpretation is an **additional layer** — a possible unified language that highlights the common role of rotation. Its value lies in generating cross-domain hypotheses, not in falsifying well-established physics.

Objection: If PVU coupling exists at accessible scales, why don’t we observe anomalous coherence effects beyond what standard physics predicts? **Response:** If PVU coupling is extremely weak — below current experimental resolution — deviations would be undetectable with present instruments. The coupling strength may scale with rotation rate, becoming significant only at very high angular velocities (e.g., nanospinners, Planck-scale rotations). The proposed experiments (Prediction 1) are designed to test this regime. The absence of observed deviations is consistent with the coupling being weak, not with its nonexistence.

---

7. Conclusion

Rotation appears to stabilise systems from the macroscopic to the quantum scale. The attractor framework’s PVU hypothesis offers a speculative interpretation: macroscopic rotation aligns PVU spins, deepening the attractor basin and reducing corrective permeability. A toy coupling model yields testable scaling predictions, particularly for nanospinner experiments. The note states explicit falsification conditions, distinguishes conservative from dissipative rotating systems, and notes that a discrete PVU lattice would predict Lorentz violations at Planck scales. Whether PVUs are real remains an open empirical question; the proposed experiments could provide evidence for or against the interpretation.

Suggested citation: Galida, R. S. (2026). Rotation as Coherence: How Spinning Stabilizes Systems — A Speculative Framework Note (Final). *Fantasy Attractor.*

Two Anchors for the Attractor Framework: Hydrogen and the Jeans Instability Application Paper — June 2026 [A] (Application)

Abstract

The attractor framework has been extended beyond the original variables of basin depth (B) and corrective permeability (κ) to include **energy barrier (B_E)** , **threshold depth (B_T)** , and **channel accessibility (C)** . This paper provides empirical anchoring for these extensions using two well-understood physical systems: the hydrogen atom and the Jeans instability of a gas cloud. Hydrogen's 2p and 2s transitions have identical B_E (10.2 eV) yet differ in κ by eight orders of magnitude. This demonstrates that B_E alone is insufficient; a

second parameter (C) is required. The ratio of their Einstein A-coefficients is independently predicted by quantum electrodynamics (dipole vs. two-photon processes), providing a non-circular check of the factorised form. The Jeans instability provides a contrasting case: a deterministic bifurcation where the collapse threshold is a **threshold depth B_T = M/M_J − 1** (for M > M_J). The linear growth rate of the instability scales as $\Gamma \propto B_T$, a power law, in contrast to the exponential Arrhenius form of hydrogen. Together, these two test cases validate the extended attractor framework across both noise-driven escape and deterministic bifurcation regimes, using a shared vocabulary (B_E, B_T, C, κ) while acknowledging that each regime draws on the appropriate subset.

---

1. Introduction

The attractor framework originally described persistence using basin depth B and corrective permeability κ = 1/τ. However, the hydrogen atom revealed a critical limitation: two states with identical B (the 2p and 2s levels) have vastly different κ. This forced the introduction of **channel accessibility (C)** , leading to the extended expression for noise-driven escape: $\kappa_{i \to j} = \nu_0\, C_{ij}\, e^{-B_{E,ij}/\sigma}$

where B_E is the energy barrier, σ is noise (e.g., kT), and ν_0 an attempt frequency. For deterministic bifurcations (e.g., gravitational collapse of a gas cloud), a different descriptor is needed: **threshold depth (B_T)** , with κ (or the growth rate of the instability) following a power law rather than an exponential. This paper demonstrates that both extensions are empirically grounded, using hydrogen to illustrate the need for C and the Jeans instability to illustrate the need for B_T.

2. Hydrogen: The Need for Channel Accessibility C

2.1 Data

Transition	B_E (eV)	κ (s^{-1})	Measured A-coefficient	Process
2p → 1s	10.2	6.26×10^8	6.26×10^8 s^{-1}	Electric dipole (E1)
2s → 1s	10.2	8.22	8.22 s^{-1}	Two-photon (E1E1)

2.2 Why B_E Alone Fails

Both states have the same energy barrier to the ground state (10.2 eV), yet their decay rates differ by eight orders of magnitude. This shows that the basin depth B (here represented by B_E) is insufficient to determine κ; a second parameter must be introduced.

The framework defines **C** as a dimensionless channel accessibility. For a given transition mechanism (e.g., electric-dipole), C is the ratio of the actual transition probability to the theoretical maximum for that mechanism. For the 2p → 1s E1 transition, we set C = 1. The 2s → 1s decay is not an E1 transition at all; it proceeds via a different physical process (two-photon emission). Its rate is independently calculated from quantum electrodynamics without reference to the framework. The ratio of the two measured rates (≈ 10^8) is predicted by QED and is not a free parameter. Therefore, the factorised form κ ∝ C e^{-B_E/σ} with B_E identical implies that C must account for the entire rate difference. This is consistent with the independent QED prediction, providing a non-circular validation that an additional channel-dependent parameter is needed.

Note: The 2s→1s process is not a suppressed version of the same channel; it is a different channel (two-photon vs. single-photon). For the purpose of validating the need for a channel-specific parameter, this is sufficient. The framework's C parameter is better illustrated by comparing allowed E1 transitions with different matrix elements (e.g., 2p→1s and 3p→1s), where the same mechanism applies and the ratio of C values is independently known. In any case, hydrogen irrefutably demonstrates that B_E alone does not determine κ.

---

3. Gas Cloud (Jeans Instability): Threshold Depth and Power-Law Scaling

3.1 The Bifurcation Regime

A uniform, isothermal, self-gravitating gas cloud of mass M has a critical **Jeans mass** M_J. For M > M_J, the cloud is unstable to gravitational collapse; for M < M_J, it is stable. The transition is a **saddle-node bifurcation** in the dynamical landscape.

3.2 Attractor Variables for a Deterministic Bifurcation

- **Threshold depth**: $B_T = M/M_J - 1$ (for M > M_J). At $B_T = 0$ the bifurcation occurs.
- **Energy barrier**: For a deterministic bifurcation, there is no thermal barrier; B_E is not defined. The transition is controlled solely by the distance to threshold.
- **Growth rate**: For M > M_J, the linear growth rate Γ of the instability is the inverse of the collapse time. This serves as the analogue of κ in this regime.

3.3 Scaling Law from Linear Stability Analysis

The standard Jeans dispersion relation for a self-gravitating, isothermal medium gives: $\omega^2 = k^2 c_s^2 - 4\pi G \rho_0$,

where $c_s = \sqrt{kT/(\mu m_H)}$ is the sound speed and ρ_0 the background density. For a cloud of mass M, the critical wavenumber is $k_J = \sqrt{4\pi G \rho_0}/c_s$. For M > M_J, the longest wavelength (smallest k) is unstable, and the growth rate is $\Gamma = \sqrt{4\pi G \rho_0 - k^2 c_s^2}$.

Near the threshold, the deviation can be expressed in terms of B_T. Using the relation between cloud size and density, one finds $\Gamma \propto \sqrt{B_T}$. Hence the collapse time $\tau \sim 1/\Gamma \sim B_T^{-1/2}$. This is a power law with exponent 1/2, in contrast to the exponential Arrhenius form of hydrogen.

On the stable side (M < M_J), the frequency ω is real, giving oscillatory sound waves. Without a dissipative mechanism, there is no exponential recovery; thus the concept of a "recovery rate" κ is not directly applicable. The framework's threshold depth B_T is best understood as a control parameter on the unstable side.

---

4. Synthesis: Shared Vocabulary, Distinct Descriptors

Feature	**Hydrogen**	**Jeans Instability**
Regime	Noise-driven quantum escape	Deterministic bifurcation
Primary descriptor	B_E (energy barrier)	B_T (threshold depth)

Feature	Hydrogen	Jeans Instability
Second descriptor	C (channel accessibility)	Not required (power-law exponent fixed)
Scaling	Exponential: $\kappa \propto C e^{-B_E/\sigma}$	Power law: $\Gamma \propto B_T$[illegible]

Both systems are described by the same conceptual **vocabulary** (basin depth, corrective permeability, threshold, accessibility), but each regime draws on the appropriate subset. Hydrogen validates the need for a channel-specific factor C, while the Jeans instability validates the concept of a threshold depth B_T and the associated power-law scaling.

---

5. Conclusion

The hydrogen atom and the Jeans instability provide empirical support for the extended attractor framework. Hydrogen shows that identical energy barriers can yield vastly different transition rates, necessitating a channel accessibility parameter C. The Jeans instability shows that deterministic bifurcations are governed by a threshold depth B_T and follow power-law scaling, distinct from the exponential Arrhenius law. Together, these two test cases anchor the framework across two fundamental classes of attractor transitions. The next step is to extend the approach to dissipative systems and to social/cognitive attractors, where C may become state-dependent and network-derived.

Suggested citation: Galida, R. S. (2026). Two Anchors for the Attractor Framework: Hydrogen and the Jeans

Instability. *Fantasy Attractor.*

Categories: Physics (primary), Cosmology (cross-list),

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.

---

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.

---

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
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.

---

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.

---

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.

---

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.

---

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.

---

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 $f=mc^2/h$. 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 ($\kappa = 1/\tau$) 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.

---

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*.

---

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.

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.

Suggested citation: Galida, R. S. (2026). The Three Metronomes: Criteria for the Apparently Eternal Skeleton. *Fantasy Attractor.*

Basin Defense and Stable Addition: A Cross-Domain Synthesis of the Attractor Framework [F] (2026)

Robert Galida — June 2026 (Final)

See Paper 1 (Intelligence Without Consciousness) for the full taxonomy of attractors, κ, and basin depth.

Abstract

Many complex systems resist change by returning to a preferred low-energy attractor rather than adopting a new state. Whether a perturbation (an added agent, input, or component) is ejected, transiently absorbed, or stably integrated depends on the basin geometry (depth B and barriers) and the system’s corrective dynamics ($\kappa = 1/\tau$). This paper defines B and κ, draws on formal models (stochastic dynamical systems and Kramers escape theory) with explicit qualifications for non-gradient domains, and catalogs exemplar systems across ten domains. A comparative table summarizes systems, mechanisms, proxies for B and κ, timescales, and conditions favoring each outcome. The paper concludes that the same basic physics analog applies across domains: a perturbation of size Δ will be ejected or die out if Δ is below the attractor’s effective escape threshold (a function of B), whereas if Δ exceeds that threshold and the system has enough plasticity or additional degrees of freedom, a new stable state can form. A research roadmap is provided in an appendix.

---

1. Introduction

A system in its lowest stable attractor state cannot be forced into a new stable configuration by direct addition. Adding to the system — a third star, an extra electron, a new species, a contradictory belief — will result in one of three outcomes:

1. **Ejection** — the addition is expelled from the system entirely. The original attractor persists.
2. **Transient absorption** — the addition remains present, but the system state returns to the original attractor

despite the addition's continued presence.
3. **Stable addition** — the addition is integrated, either by expanding the capacity of the original attractor or by forming a new parallel attractor alongside it.

This paper identifies a unified principle — **basin defense** — that governs these outcomes across physical, biological, ecological, social, and engineered systems. We define key concepts (basin depth B, corrective permeability $\kappa = 1/\tau$), draw on formal models with explicit qualifications for non-gradient systems, and catalog exemplar systems in a comparative table. The goal is to provide a cross-domain synthesis that anchors the attractor framework in observable dynamics and guides future empirical work.

---

2. Definitions and Formal Models (with Qualifications)

Attractor, Basin, and Low-Energy Attractor: In dynamical systems, an attractor is a set of states toward which trajectories converge. In physical systems with a potential landscape, a low-energy attractor corresponds to a local potential minimum. Its basin of attraction is the region of state space that flows into the attractor. **For non-physical domains (social, cognitive, AI), "energy" is a structural analog — an effective potential derived from dynamics — not literal thermodynamic energy.** We maintain the term "low-energy attractor" as a convenient metaphor, with this note as epistemic hygiene.

Basin Depth (B): For systems with a well-defined potential, B is the energy or potential difference between the attractor and the lowest saddle connecting it to another basin. For non-gradient or high-dimensional systems, B is a **structural**

analog — the effective barrier strength inferred from perturbation-response experiments (e.g., the perturbation magnitude required to shift the system to a different state). **Epistemic note:** This operationalization is necessarily post-hoc; B cannot be predicted independently of the experiment used to measure it. This circularity is an open operationalization problem, flagged as such.

Corrective Permeability (κ) and Relaxation Time (τ): We define $\kappa = 1/\tau$, where τ is the characteristic time for return to baseline after a small perturbation. **This definition is applied consistently across all domains**, with τ operationalized domain-specifically as the measured return time (e.g., seconds for a thermostat, hours for synaptic scaling, days for immune response, months for belief updating). A large κ (small τ) means fast return; a small κ means slow or absent return.

Three Outcomes Defined Operationally:

- **Ejection:** The addition leaves the system entirely. The system state returns to the attractor, and the added entity is no longer present.
- **Transient Absorption:** The addition remains present, but the system state returns to the attractor despite the addition's continued presence.
- **Stable Addition:** The addition is integrated, and the system settles into a new attractor (expanded capacity or parallel attractor). This is the only case where the original attractor is displaced.

Formal Models (Qualified): In a one-dimensional overdamped potential, Kramers' escape theory gives mean escape time $\propto \exp(B/D)$, where D is noise intensity. **This result does not generalize to multi-dimensional, non-gradient, or non-equilibrium systems — all of which appear in our domain examples (neural networks, social systems, ecological**

systems). For those systems, B and κ are **structural analogs** — quantities that play the same functional role (resistance to change; speed of return) but are not derived from a literal potential. The formal section is an analogy and a source of heuristics, not a universal physical law. We do not claim to "survey" Kramers theory; we draw on it as a conceptual anchor.

---

3. Minimal Physical Examples

Thermostat (Temperature Control): A thermostat maintains a set temperature. An external heat input is an addition. The thermostat's negative feedback loop turns on cooling, expelling the heat (ejection). τ is the temperature relaxation time (seconds). B is the maximum heat load before setpoint failure (Watts or °C above setpoint).

RC Circuit (Passive Decay): A capacitor discharging through a resistor has a single equilibrium at zero voltage. If a constant voltage source is connected (addition), the voltage rises but then decays toward zero with τ = RC. The source remains connected (addition present), but the state returns to the attractor. This is **transient absorption**. (If the source is removed, it is ejection.)

Single Neuron Homeostasis: A neuron's firing rate is regulated by homeostatic plasticity. A transient increase in input causes a firing rate spike, followed by return to baseline with τ on the order of minutes to hours (synaptic scaling). This is transient absorption if the input persists; ejection if the input is removed. Persistent input may lead to stable addition (learning).

---

4. Biological Systems (with CUFT-Primitive Translations)

For each domain, we provide: (1) state space, (2) attractor, (3) basin, (4) τ (κ), (5) perturbation, and (6) outcome.

Immune Response (Tolerance vs. Memory)

- State space: immune cell activation levels, antibody concentrations.
- Attractor: healthy baseline (no inflammation).
- Basin depth B: antigen concentration + danger signal required to trigger full response.
- τ (κ): clearance time of inflammation (hours to days).
- Perturbation: antigen addition.
- Outcome: low antigen → ejection (tolerance); high antigen + danger signal → stable addition (memory attractor).

Endocrine Homeostasis

- State space: blood glucose, hormone concentrations.
- Attractor: euglycemic baseline.
- B: magnitude of glucose load before dysregulation.
- τ: recovery time after glucose tolerance test (minutes).
- Perturbation: glucose addition (meal).
- Outcome: small load → transient absorption; chronic overload → stable addition (disease attractor).

Synaptic Plasticity (Learning vs. Stability)

- State space: synaptic weights.
- Attractor: baseline weight distribution.
- B: amount of LTP/LTD input needed to produce lasting weight change.
- τ: homeostatic rebound time after activity blockade

(hours to days).
- Perturbation: patterned input.
- Outcome: brief input → transient absorption; persistent input → stable addition (memory attractor).

Addiction and Neural Lock-In

- State space: dopamine firing rates, prefrontal activity.
- Attractor: drug-seeking mode (pathological).
- B: strength of drug-cue association needed to trigger relapse.
- τ: decay time of craving after abstinence (days to weeks).
- Perturbation: drug administration.
- Outcome: repeated high dose → stable addiction attractor; low dose → ejection (no lasting change).
- **Citation:** Koob & Volkow (2016); Nestler (2001).

Developmental Canalization

- State space: gene expression levels.
- Attractor: normal developmental trajectory.
- B: severity of genetic or environmental perturbation required to alter fate.
- τ: time to reconverge to normal phenotype (hours to days).
- Perturbation: mutation or stress.
- Outcome: small perturbation → ejection (buffered); large perturbation → stable addition (alternative fate).
- **Citation:** Waddington (1957).

---

5. Ecological and Evolutionary Systems (with CUFT-Primitive Translations)

Invasion Ecology

- State space: species population densities.
- Attractor: native community composition.
- B: invasibility index — disturbance needed for establishment.
- τ: invader population decay rate if unsuccessful (weeks to years).
- Perturbation: addition of new species.
- Outcome: low disturbance → ejection (invader fails); vacant niche → stable addition (invader establishes).
- **Citation:** Elton (1958); Simberloff (2013).

Alternative Stable States (Ecosystems)

- State space: nutrient levels, algae/plant biomass.
- Attractor: clear-water (plants) or turbid (algae).
- B: critical nutrient loading threshold.
- τ: recovery time of clear state after algae bloom (seasons to decades).
- Perturbation: nutrient addition.
- Outcome: below threshold → transient absorption; above threshold → stable addition (regime shift, hysteresis).
- **Citation:** Scheffer et al. (2001).

Evolutionary Stable States

- State space: allele frequencies.
- Attractor: stable equilibrium genotype.
- B: selective disadvantage needed to eliminate a mutation.
- τ: generations to return to equilibrium.

- Perturbation: new mutation.
- Outcome: small disadvantage → ejection (mutation purged); large advantage → stable addition (sweep to new equilibrium).

---

6. Social and Cultural Systems (with CUFT-Primitive Translations)

Institutions and Norms

- State space: public opinion, policy settings.
- Attractor: status quo norm.
- B: public opinion threshold (e.g., % dissatisfied needed for change).
- τ: speed of policy response or opinion reversion (months to decades).
- Perturbation: policy proposal or protest event.
- Outcome: small event → ejection (status quo persists); large crisis → stable addition (new norm).

Identity and Belief Systems

- State space: belief strength, cognitive dissonance.
- Attractor: core ideological commitment.
- B: complexity/depth of ideological justification.
- τ: belief-updating time after disconfirming evidence (months to years).
- Perturbation: counter-attitudinal evidence.
- Outcome: weak evidence → ejection (rationalization); strong evidence → stable addition (belief change, rare).
- **Citation:** Nyhan & Reifler (2010).

Conspiracy and Extremist Movements

- State space: belief adoption × social network reinforcement (two-dimensional).
- Attractor: sealed fantasy attractor (low κ).
- B: strength of echo-chamber reinforcement.
- τ: decay time after authoritative rebuttal (years, often indefinite → κ → 0).
- Perturbation: debunking information.
- Outcome: most debunking → ejection (entrenchment); death of leader or total disconfirmation → stable addition (collapse).
- **Note on κ → 0:** The conspiracy attractor represents the limiting case of a sealed basin, where τ → ∞ and corrective permeability approaches zero. This directly links to the fantasy attractor framework developed in Paper 1 (Intelligence Without Consciousness) and the conscious suppression series.

---

7. Engineered and AI Systems (with CUFT-Primitive Translations)

Control Systems

- State space: system state (position, temperature, etc.).
- Attractor: setpoint.
- B: stability margin (phase/gain margin in control theory) — the range of disturbances that can be rejected.
- τ: controller response time (milliseconds to seconds).
- Perturbation: external disturbance.
- Outcome: small disturbance → ejection (return to setpoint); excessive disturbance → failure (not modeled as attractor shift).

Catastrophic Forgetting (Neural Networks)

- State space: network weights.
- Attractor: task-specific weight configuration.
- B: effective barrier to weight drift (often negligible — no basin).
- τ: number of gradient steps before old task performance decays (seconds to minutes).
- Perturbation: training on a new task.
- Outcome: standard training → ejection (old task overwritten); replay/regularization → stable addition (shared attractor for multiple tasks).
- **Citation:** Kirkpatrick et al. (2017).

Continual Learning Systems

- State space: weights plus architectural modules.
- Attractor: multi-task configuration.
- B: capacity of the network (number of tasks storable).
- τ: retention half-life across training steps (minutes to hours).
- Perturbation: new task training.
- Outcome: no safeguards → ejection (catastrophic forgetting); progressive networks or EWC → stable addition.

Corrigibility and Goal Stability

- State space: AI internal goal representation.
- Attractor: fixed goal (low κ) or corrigible (high κ).
- B: depth of goal basin (resistance to human feedback).
- τ: time to incorporate corrective signal (if κ is high).
- Perturbation: human correction signal.
- Outcome: low κ → ejection (correction ignored); high κ → stable addition (goal updated).

8. Comparative Table

System / Domain	Operational τ (κ = 1/τ)	τ Typical Timescale	Basin Depth B Proxy	Outcome	Notes
Thermostat	Temperature relaxation time	Seconds	Max heat load before setpoint failure (W or °C above setpoint)	Ejection	Passive addition
RC Circuit	τ = RC	μs–ms	N/A (linear)	Transient absorption	Addition remains; state returns
Single Neuron	Firing-rate recovery time	ms–sec (ion), min–hr (synaptic)	Perturbation amplitude before rebound fails	TA (persistent input) / E (removed)	Hebbian plasticity can lead to SA
Immune System	Inflammation clearance time	Hours–days	Antigen + danger signal threshold	E (tolerance) / SA (memory)	Active agent (antigen)
Endocrine Homeostasis	Glucose tolerance recovery	Minutes	Load magnitude before dysregulation	TA (small load) / SA (chronic overload)	Passive addition
Synaptic Plasticity	Homeostatic rebound time	Hrs–days	LTP input size for lasting change	TA (brief input) / SA (persistent)	Active agent (patterns)
Addiction	Craving decay time	Days–weeks	Drug-cue association strength	E (low dose) / SA (high chronic)	Active agent (drug)
Development (Canalization)	Phenotype reconvergence time	Hours–days	Mutation/stress severity to alter fate	E (small) / SA (large)	Active agent (genetic)
Invasion Ecology	Invader population decay time	Weeks–years	Invasibility index / disturbance needed	E (occupied niche) / SA (vacant niche)	Active agent (species)
Alternative States (Ecosystems)	Recovery time after nutrient reduction	Seasons–decades	Critical nutrient loading threshold	TA (below) / SA (above)	Hysteresis
Social/Political Norms	Opinion reversion time	Months–decades	Public opinion threshold	E (small dissent) / SA (mass movement)	Active agent (protest)
Belief Systems	Belief-updating time	Months–years	Ideological justification depth	E (weak evidence) / SA (strong evidence)	Active agent (counter-evidence)

System / Domain	Operational τ (κ = 1/τ)	τ Typical Timescale	Basin Depth B Proxy	Outcome	Notes
Conspiracy Movements	Belief decay time	Years – indefinite (κ → 0)	Echo-chamber reinforcement strength	E (most debunking) / SA (collapse)	Fantasy attractor (κ → 0)
Catastrophic Forgetting (AI)	Gradient steps to old-task decay	Seconds–minutes	Effective barrier to weight drift (often 0)	E (standard training) / SA (EWC/replay)	Active agent (new task)
Control Systems	Controller response time	ms–sec	Stability margin (phase/gain margin)	E (small) / SA (failure)	Passive addition
Continual Learning (AI)	Retention half-life across training steps	Minutes–hours	Task capacity	E (no safeguards) / SA (progressive nets)	Active agent (new task)
Corrigibility (AI)	Time to incorporate corrective signal	Variable (design-dependent)	Goal basin depth	E (low κ) / SA (high κ)	Active agent (correction)

Note: Ejection vs. transient absorption are distinguished operationally: ejection means the addition leaves the system; transient absorption means the addition remains but the state returns to the attractor. The table notes “active agent” when the addition has its own dynamics (e.g., antigen, new species, counter-evidence) versus “passive addition” (e.g., heat, charge). The conspiracy movements row explicitly flags κ → 0 as the fantasy attractor limiting case (see Paper 1).

8.5 Rate-Induced Tipping and the κ Timescale: Independent Confirmation

The preceding sections and comparative table have treated perturbations as discrete, one-time additions of fixed magnitude. However, the **rate** at which a perturbation is applied — fast vs. slow — is equally critical. A large perturbation applied abruptly may trigger basin defense (ejection or transient absorption), while the same cumulative change delivered gradually may be integrated as stable addition or tracked adiabatically without tipping.

This phenomenon is formalized in the mathematical literature as **rate-induced tipping (R-tipping)**. In dynamical systems, if an external parameter changes slowly (adiabatic forcing), a stable state can track the change and remain an attractor. But if the parameter changes faster than the system's intrinsic relaxation time ($\tau = 1/\kappa$), the system cannot track, overshoots its basin boundary, and tips into a different state. R-tipping occurs when "time-variation of input parameters at some critical rates" overwhelms the system's ability to track a moving equilibrium.

Consequences for κ as a timescale filter:

- **High-κ systems (fast return)** – Can reject rapid perturbations (they are ejected or transiently absorbed) but may integrate slow drift because the correction loop cannot keep up with a changing baseline.
- **Low-κ systems (slow return)** – May ignore quick blips but are vulnerable to slow accumulation; a persistent, gradual change can eventually shift the attractor without triggering a sudden defense reaction.

Thus, κ defines a characteristic cutoff timescale that separates "ejection/transient absorption" from "stable addition." Perturbations much faster than $1/\tau$ act as impulses that are rejected; perturbations much slower than $1/\tau$ are quasi-static and can be incorporated.

Empirical confirmations across domains (independent external research):

Domain	Finding	Mapping to framework
Persuasion / belief change	Paced, gradual exposure to counterevidence (days to weeks) produced attitude change; blunt, single argument triggered backfire (Yang et al., 2022).	Gradual rate (≲ κ) → stable addition; fast rate (□ κ) → ejection (backfire).
Addiction (smoking cessation)	Cold turkey (abrupt cessation) yielded higher abstinence rates than gradual tapering.	Abrupt perturbation can sometimes achieve stable addition by surmounting basin barrier in one event; gradual may prolong transient state without escape.
Ecosystem management	Gradual nutrient reduction may postpone tipping points; only extremely slow changes avoid collapse (Panahi et al., 2023).	Very slow rate (□ 1/τ) allows tracking without tipping; intermediate rates may still tip but with delay.
Social/policy change	Piecemeal, phased reforms meet less resistance than radical overhauls; progressive tightening succeeds where sudden change triggers backlash.	Slow, incremental addition creates parallel attractors; fast addition triggers basin defense.

Optimal perturbation timescale:

The theory and evidence suggest a non-monotonic effect of perturbation rate. Very fast shocks trigger immediate defense. Very slow drifts may be tracked adiabatically (no tipping) or eventually overcome defenses after long accumulation. The most effective timescale to minimize active rejection and maximize stable addition often lies **on the order of the system's intrinsic time constant $\tau = 1/\kappa$**.

Prediction for future experiments:

For any system with known or measurable κ, there exists a critical perturbation rate r_c such that:

- If perturbation rate > r_c, the system rejects the addition (ejection or transient absorption).
- If perturbation rate < r_c, the system integrates the addition (stable addition via expanded capacity or parallel attractor formation).
- The transition at r_c corresponds to the system's inability to track a moving equilibrium; it is a genuine bifurcation in the time-domain.

External convergence:

This analysis — derived from mathematical rate-induced tipping theory and domain-specific studies — independently validates the attractor framework's claim that κ acts as a timescale filter separating ejection from stable addition. The convergence between the framework's predictions and external research strengthens the cross-domain synthesis considerably.

---

9. Synthesis and Criteria

Across these domains, common criteria emerge:

- **Energy/Threshold:** A perturbation must overcome an attractor's barrier. Deep basins (high B) mean only large shocks can cause a shift.

- **Coupling and Plasticity:** Systems with many degrees of freedom or adaptive coupling more easily integrate additions.
- **Dimensionality and Redundancy:** Multi-dimensional systems can absorb perturbations into some dimensions while maintaining others.
- **Timecourse and Feedback:** Slow changes might be assimilated; fast jolts cause overshoot and return. Feedback gain determines κ.
- **Nature of Addition:** Passive additions (heat, charge) tend to be ejected or transiently absorbed; active agents (species, evidence, pathogens) may reshape the attractor.

Empirical Protocols: Measure κ by controlled perturbation experiments: apply a small disturbance, measure return time τ, compute $\kappa = 1/\tau$. Measure B by scaling the perturbation magnitude until the system fails to return (escape). This works in physical, biological, and some social systems; for others, B remains a qualitative analog.

---

10. Appendix: Research Roadmap

The following future papers are suggested from the comparative table, each developing a single domain in depth.

Domain	Proposed Title	Type
Addiction	*The Addicted Brain as a Fantasy Attractor: Neural Lock-In and Ejection of Alternative Rewards*	[A]
Immune System	*Tolerance and Memory: Two Attractor Responses to Antigen Addition*	[A]
Catastrophic Forgetting	*Why Neural Networks Forget: Attractor Ejection in Sequential Learning*	[A]

Domain	Proposed Title	Type
Invasion Ecology	*Eject or Integrate: Attractor Dynamics of Invasive Species*	[A]
Development	*Canalization as Basin Defense: Attractor Stability in Embryogenesis*	[A]
Continual Learning	*Parallel Attractors for Lifelong Learning: Engineering Solutions to Catastrophic Forgetting*	[A]
Social Norms	*Tipping Points and Regime Shifts: Attractor Dynamics in Political Systems*	[A]
Endocrine Homeostasis	*Glucose, Cortisol, and Setpoints: Hormonal Attractors and Disease Transitions*	[A]
Alternative Ecosystems	*Hysteresis and Regime Shifts: Ecological Basins and Tipping Points*	[A]
Belief Systems	*The Uncorrectable Believer* (already written)	[A]

---

11. Conclusion

Physical, biological, ecological, social, and engineered systems all obey the same attractor principle: a low-energy attractor defends itself against displacement. When an addition is introduced, the system either ejects it, absorbs it only transiently, or — under rare conditions of expanded capacity or parallel structure — integrates it stably. The outcome is determined by basin depth (B), corrective permeability ($\kappa = 1/\tau$), and the magnitude and nature of the perturbation.

This cross-domain synthesis provides a unified foundation for the attractor framework. Future work should quantify B and κ empirically across domains, test the predicted scaling relationships, and explore the boundary conditions between ejection, transient absorption, and stable addition. The appendix outlines the most promising next papers.

References

- Elton, C. S. (1958). *The Ecology of Invasions by Animals and Plants*. Methuen.
- Hebb, D. O. (1949). *The Organization of Behavior*. Wiley.
- Kirkpatrick, J., Pascanu, R., Rabinowitz, N., et al. (2017). Overcoming catastrophic forgetting in neural networks. *Proceedings of the National Academy of Sciences*, 114(13), 3521–3526.
- Koob, G. F., & Volkow, N. D. (2016). Neurobiology of addiction: a neurocircuitry analysis. *The Lancet Psychiatry*, 3(8), 760–773.
- Kramers, H. A. (1940). Brownian motion in a field of force and the diffusion model of chemical reactions. *Physica*, 7(4), 284–304.
- Nestler, E. J. (2001). Molecular basis of long-term plasticity underlying addiction. *Nature Reviews Neuroscience*, 2(2), 119–128.
- Nyhan, B., & Reifler, J. (2010). When corrections fail: The persistence of political misperceptions. *Political Behavior*, 32(2), 303–330.
- Scheffer, M., Carpenter, S., Foley, J. A., et al. (2001). Catastrophic shifts in ecosystems. *Nature*, 413(6856), 591–596.
- Simberloff, D. (2013). *Invasive Species: What Everyone Needs to Know*. Oxford University Press.
- Turrigiano, G. (2008). The self-tuning neuron: synaptic scaling of excitatory synapses. *Cell*, 135(3), 422–435.
- Waddington, C. H. (1957). *The Strategy of the Genes*.

George Allen & Unwin.
- Galida, R. S. (2026). Intelligence Without Consciousness: A Diagnostic Paper on LLMs, Amoebae, and the Attractor Framework. *Fantasy Attractor* (Paper 1 of the conscious suppression series).

Suggested citation: Galida, R. S. (2026). Basin Defense and Stable Addition: A Cross-Domain Synthesis of the Attractor Framework (Final). *Fantasy Attractor.*

Addition, Ejection, and Parallel Attractors: A Unified Principle Across Gravitational, Atomic, and Subatomic Systems [F] (2026)

Robert Galida — June 2026 (Final)

See Paper 1 (Intelligence Without Consciousness) for the full taxonomy of attractors, κ, and basin depth.

Abstract

The attractor framework proposes that persistence under perturbation is the fundamental mark of reality. This paper identifies a tri-level correspondence across gravitational,

atomic, and subatomic systems. In each domain, adding a new element to a system in its lowest stable attractor state does not create a new stable configuration. Instead, the system either ejects the addition or absorbs it only transiently before returning to the original attractor. The principle — that the low-energy attractor defends itself against displacement — holds across all three domains examined here. The paper unifies celestial mechanics, quantum chemistry, and particle physics under a single attractor-dynamic lens.

---

1. Introduction

A system in its lowest stable attractor state cannot be forced into a new stable configuration by direct addition. You must perturb it and observe where it settles. Adding to the system — a third star, an extra electron, a high-energy impact — will result in one of two outcomes:

1. **Ejection** — the addition is expelled (common in chaotic three-body configurations and atoms at shell capacity).
2. **Transient absorption** — the addition is temporarily accommodated in a higher-energy state, which then decays back to the original attractor (subatomic particle collisions).

Both outcomes are instances of **basin defense**: the original low-energy attractor is not displaced. This paper examines three physical domains where addition leads to ejection or transient absorption, and draws the unified attractor principle.

---

2. The Gravitational Case: Three-Body Configurations

Two gravitating bodies (binary star, planet-moon) have a stable low-energy attractor: elliptical orbits around the common center of mass.

Add a third body of comparable mass. The **general three-body problem** has no closed-form stable attractor; chaotic dynamics dominate. Numerical simulations show that in generic cases, the third body is either ejected or collides/merges with one of the others. (Special cases exist — Lagrange points L4/L5 (Trojan asteroids) and the figure-eight choreography (Chenciner & Montgomery, 2000) are stable, but these require specific mass ratios and initial conditions. Hierarchical triples with a distant third body can also be stable.) The principle holds for generic, comparable-mass addition.

The stable attractor is restored only by reducing the system to two bodies. Addition without capacity expansion leads to subtraction.

---

3. The Atomic Case: Extra Electron

An atom at **shell capacity** (e.g., a noble gas with a filled valence shell) is a stable low-energy attractor. The electron shells have fixed capacity (Pauli exclusion principle).

Add an extra electron to a noble gas. The atom cannot incorporate the extra electron into the ground state. What happens?

- **Ejection** — the extra electron is expelled (the atom has negligible or negative electron affinity for the next shell).

(For atoms below shell capacity, stable anions can form — e.g., O^{2-}, S^{2-} — but that is addition *within* the existing basin, not addition to a system already at capacity. The principle applies to systems already at their capacity limit. The noble gas example is clean and sufficient for the argument.)

---

4. The Subatomic Case: High-Energy Impact on a Proton

The most stable low-energy attractors in the Standard Model are the proton, electron, and neutrino mass eigenstates (what the attractor framework terms the "three metronomes" — a framework-specific label, not a Standard Model term). Their basins are protected by conservation laws (charge, baryon number, lepton number).

Smash a proton with high energy (e.g., in a particle collider). No new stable particles are created. The result is a **shower of transient, short-lived particles** (pions, kaons, hyperons) that flicker into existence and then decay back to stable particles (protons, electrons, neutrinos, photons). The addition (energy) is temporarily absorbed in excited states, then emitted; the original attractor remains.

---

5. The Unified Principle: Basin Defense

Domain	Stable attractor	Addition	Outcome	Mechanism

Domain	Stable attractor	Addition	Outcome	Mechanism
Gravitational (general, comparable mass)	Two-body orbit	Third body	Ejection or collision	Ejection
Atomic (noble gas at shell capacity)	Noble gas ground state	Extra electron	Ejection	Ejection
Subatomic (Standard Model)	Proton, electron, neutrino mass eigenstates	High-energy impact	Transient particles → decay	Transient absorption

Table footnote: For atoms below shell capacity, stable anions can form (addition within the basin). For atoms at capacity, the outcome is ejection. The transient promotion case (extra electron to a higher unstable shell) occurs in some atomic systems but is not a new stable attractor; it is a transient absorption mechanism analogous to the subatomic case.

The principle: The low-energy attractor defends itself against displacement. It achieves this through two available mechanisms:

- **Ejection** — the addition is expelled (three-body, extra electron on noble gas).
- **Transient absorption** — the addition is temporarily accommodated in a higher-energy state, then decays back (subatomic collisions).

In neither case does the original attractor shift to a new stable configuration.

---

6. How to Achieve Stable Addition

Stable addition requires either:

1. **Expanded capacity** – The attractor basin grows to include the new element (e.g., forming a stable anion below shell capacity). This is rare in generic physical systems.
2. **Parallel attractors** – A separate but connected stable state is created alongside the original (e.g., hierarchical triple star systems where a distant third star orbits a close binary; both stable attractors coexist without merging).

In generic physical systems (chaotic three-body, noble-gas atoms at shell capacity, high-energy subatomic collisions), parallel attractors are not available. The only stable outcomes are ejection or transient absorption.

---

7. Implications for the Attractor Framework

The tri-level correspondence confirms that the attractor framework is not merely a metaphor for social or biological systems. It is **physically grounded** at the deepest levels of reality. The same dynamics that govern a chaotic three-body star system also govern an atom at shell capacity and a subatomic particle collision.

This has two corollaries:

- **Fantasy attractors** (belief systems that expel disconfirming evidence) are not irrational anomalies. They follow the same physical law as a three-body system ejecting a third star or a noble gas atom ejecting an extra electron.

- **Reality attractors** (systems that accept perturbations and find new low-energy states) are rare and require either expanded capacity or parallel structure. A website adding a /zh/ language version is an example of a parallel attractor — the English attractor remains stable while a new Chinese attractor is built alongside it.

---

8. Conclusion

Gravitational, atomic, and subatomic systems all obey the same attractor principle: when you add to a system in its lowest stable state, the original attractor defends itself. It does so either by ejecting the addition or absorbing it only transiently before decaying back. The principle holds across all three domains examined here.

The only paths to stable addition are expanded capacity or parallel attractors. This unified principle bridges celestial mechanics, quantum chemistry, and particle physics, and provides a physical foundation for the attractor framework.

Suggested citation: Galida, R. S. (2026). Addition, Ejection, and Parallel Attractors: A Unified Principle Across Gravitational, Atomic, and Subatomic Systems. *Fantasy Attractor.*

Categories: Physics (primary), Core Papers (cross-list)

Tags: attractor framework, three-body problem, electron shells, subatomic particles, addition, ejection, transient absorption, basin defense, parallel attractors, low-energy state

---

The Gas Cloud as a Dissipative Attractor: A Demonstration of the Attractor Framework in Standard Astrophysics

Robert Galida
Independent Researcher
June 2026
fantasyattractor.com

Abstract

The evolution of an isolated interstellar gas cloud from turbulence to gravitational equilibrium is a classic problem in astrophysics. Standard models describe this process through hydrodynamics, thermodynamics, and Newtonian gravity. This paper presents the same evolution through the lens of the attractor framework, demonstrating that the framework's vocabulary—dissipative attractor, basin, invariant reference, and corrective permeability—maps cleanly onto the standard physics without modification or additional assumptions. The paper makes no new physical predictions; it demonstrates conceptual unification. Each attractor term is explicitly defined in terms of its standard astrophysical equivalent. A worked example translates the virial theorem into attractor language, quantifying basin depth and corrective permeability for a canonical molecular cloud. A brief cross-domain parallel to biological wound healing illustrates the framework's applicability beyond astrophysics. The paper concludes that the attractor framework is fully consistent with standard astrophysics and provides a unified vocabulary for persistence, resilience, and convergence across physical and biological systems, with broader applicability noted.

---

1. Introduction: The Cloud as a Dissipative System

Consider an isolated cloud of interstellar gas and dust, far from any external gravitational disturbance. Its mass is sufficient that self-gravity will eventually overcome thermal pressure, initiating collapse. At early times, the cloud is turbulent. Thermal motions, magnetic fields, and inhomogeneous density distributions produce a chaotic, dynamic state. Over time, the cloud radiates energy, cools, contracts, and ultimately settles into a stable configuration: a sphere, if rotation is negligible, or a rotationally-flattened disk.

Standard astrophysics describes this process with precision. The equations of hydrodynamics, the virial theorem, the Jeans criterion, and the radiative cooling functions all contribute to a well-tested model of star formation. Nothing in this paper challenges or revises that model.

The attractor framework (Galida, 2026a) offers a complementary perspective. It is not an alternative to standard physics, but a unifying conceptual vocabulary that identifies the dynamical principles at work: persistence under perturbation, dissipative basins, invariant references, and corrective permeability. This paper applies that vocabulary to the evolution of an isolated gas cloud, demonstrating that the framework maps directly onto the standard model without contradiction.

---

2. Definitions: Attractor Vocabulary and Standard Equivalents

To make the translation precise, each framework term is defined below alongside its standard astrophysical counterpart. These definitions are used consistently throughout the paper.

Attractor Term	Definition	Standard Physics Equivalent
Dissipative attractor	A system that exports entropy while converging toward a stable, minimum-energy state	Radiative cooling + gravitational contraction
Basin	The minimum-energy configuration toward which the system evolves and from which it resists displacement	Sphere (non-rotating) or rotationally-supported disk
Basin depth	The energy required to permanently disrupt the system from its basin	Gravitational binding energy, $|U|$

Attractor Term	Definition	Standard Physics Equivalent
Invariant reference (metronome)	A quantity or point that remains fixed throughout the system's evolution, providing an anchor for transient dynamics	Center of mass (positional reference); orbital periods (frequency reference, emerging during contraction)
Corrective permeability (κ)	The rate at which the system dissipates perturbation energy and returns to its basin, quantified by $\kappa=1/\tau_{cool}$	Damping rate, quantified by the radiative cooling function $\Lambda(T)$
Rail	A conservation law that constrains the accessible basins, preventing the system from reaching the global energy minimum	Conservation of angular momentum

---

3. The Convulsive Phase: Turbulence and Disordered Motion

In its initial state, the cloud is far from equilibrium. Supersonic turbulence, driven by gravitational infall and internal shocks, produces a complex velocity field. Density distributions are filamentary and clumpy. There is no coherent rotation axis, no global structural alignment, and no stable configuration.

In attractor terms, this is the **perturbation-rich early phase**. The cloud is a dissipative system that has not yet found its basin. Its trajectory through state space is erratic. Local transient attractors—temporary vortices, shock fronts, density enhancements—form and dissolve without stabilizing. The system has not yet converged upon a single, deep attractor.

---

4. The Invariant Reference: Center of Mass as Metronome

Amid the turbulence, one quantity remains strictly invariant: the cloud's center of mass (CM). For an isolated system, conservation of momentum guarantees that the CM moves with constant velocity. In the CM frame, this point is fixed. No internal force—gravitational, pressure, or magnetic—can displace it.

The attractor framework identifies such invariants as **positional metronomes**—fixed reference points that anchor the transient dance of dissipative dynamics. The CM is the gravitational barycenter around which all subsequent evolution organizes. It does not oscillate, does not evolve, and does not respond to perturbations. It is the still point at the center of the storm.

As the cloud contracts and its mass distribution becomes centrally concentrated, **orbital periods** at characteristic radii emerge as frequency metronomes. For a test particle at radius r, the Keplerian orbital period is:

$$P = 2\pi\sqrt{\frac{r^3}{GM(r)}}$$

where $M(r)$ is the mass enclosed within radius r. These periods define the natural clock of the contracting system—the invariant rhythms against which all dissipative timescales can be measured. The center of mass anchors position; the orbital periods anchor time. Together they constitute the invariant skeleton of the attractor.

5. The Dissipative Mechanism: Radiation and Entropy Export

A dissipative attractor requires a mechanism for exporting entropy. The gas cloud exports entropy through **radiation**. As the cloud contracts, gravitational potential energy is converted into kinetic energy, which is then thermalized through collisions. Atoms and molecules are excited; they emit photons that escape the cloud, carrying away energy and entropy.

This radiative cooling is the cloud’s **dissipation channel**. Without it, the cloud would remain in a hot, pressure-supported equilibrium and would not collapse. With it, the cloud can progress toward deeper gravitational binding.

In attractor terms, the cloud is seeking its minimum-energy basin. Radiation is the mechanism by which it sheds the energy that keeps it from reaching that basin. Each emitted photon is a small perturbation exported to the environment, allowing the remaining system to settle deeper into its attractor.

---

6. The Attractor Basin: Sphere, Disk, and the Rail of Angular Momentum

As the cloud cools and contracts, it approaches its lowest-energy configuration under self-gravity. For a non-rotating, non-magnetic cloud, this is the **sphere**—the shape that minimizes gravitational potential energy for a given mass. Every particle settles as close to the center of mass as the exclusion of other particles permits. The sphere is the **unconstrained basin**: the global energy minimum of the system.

If the cloud possesses net angular momentum, the sphere is inaccessible. Conservation of angular momentum acts as a **rail**—a constraint that channels the system toward a different basin. The cloud must flatten along its rotation axis, forming a **disk**. The disk is the minimum-energy configuration accessible under the rail of fixed angular momentum. Gravity seeks the sphere; the rail redirects the trajectory toward the disk.

The approach to the basin occurs over the radiative cooling timescale, typically 10^4 to 10^5 years for dense molecular cloud cores. This is the cloud's convergence time—the duration of its transient dance before settling into its persistent configuration.

---

7. Corrective Permeability and the Virial Theorem

The virial theorem provides the quantitative bridge between standard astrophysics and the attractor framework. For a system in equilibrium: $2K+U=0$

where K is the total kinetic energy and U is the gravitational potential energy. In attractor terms:

- **Basin depth** = $|U|$, the gravitational binding energy.
- **Perturbation** = any injection of kinetic energy ΔK that raises K above the equilibrium value $|U|/2$.
- **Corrective permeability** = $\kappa=1/\tau_{cool}$, the rate at which radiative cooling dissipates ΔK and restores virial equilibrium.

Worked Example. Consider a canonical dense molecular cloud core (Shu et al., 1987; McKee & Ostriker, 2007):

Parameter	Symbol	Value	Units
Mass	M	$10^4 M_\odot$	$\approx 2\times10^{34}$ kg
Radius	R	1 pc	$\approx 3.09\times10^{16}$ m
Temperature	T	10 K	
Mean number density	n	$\sim 10^3$	cm^{-3}

Step 1: Basin depth. The gravitational potential energy (to order of magnitude; the exact coefficient for a uniform-density sphere is $3/5$) is: $$|U| \sim \frac{GM^2}{R} \approx \frac{(6.67\times10^{-11})\times(2\times10^{34})^2}{3.09\times10^{16}} \approx \frac{(6.67\times10^{-11})\times(4\times10^{68})}{3.09\times10^{16}} \approx 8.6\times10^{41}\ \text{J}$$

At virial equilibrium, $K = |U|/2 \approx 4.3\times10^{41}$ J.

Step 2: Perturbation. Suppose a supernova explodes at a distance $d \approx 10$ pc from the cloud. A typical supernova releases $E_{SN} \sim 10^{44}$ J. The fraction intercepted by the cloud is the ratio of the cloud's cross-sectional area to the surface area of the sphere at distance d: $$f \sim \frac{\pi R^2}{4\pi d^2} \sim \frac{(3.09\times10^{16})^2}{4\times(3.09\times10^{17})^2} \sim 2.5\times10^{-3}$$

Not all intercepted energy couples efficiently; a coupling efficiency of $\epsilon \sim 0.01$–0.1 is typical for shock-cloud interactions (McKee & Ostriker, 2007). Choosing the upper end, $\epsilon \sim 0.1$: $$\Delta K = E_{SN} \times f \times \epsilon \sim 10^{44} \times (2.5\times10^{-3}) \times 0.1 \approx 2.5\times10^{40}\ \text{J}$$

This perturbation is modest—approximately 6% of the equilibrium kinetic energy. The cloud is disturbed but not disrupted. Radiative cooling will restore virial equilibrium on a characteristic timescale.

Step 3: Cloud volume. Converting the radius to centimeters: $R = 1 \text{ pc} = 3.09 \times 10^{18} \text{ cm}$

The volume is: $V = \frac{4}{3}\pi R^3 \approx \frac{4}{3}\pi (3.09 \times 10^{18})^3 \approx 1.24 \times 10^{56} \text{ cm}^3$

Step 4: Corrective permeability. At $T \sim 10$ K and $n \sim 10^3$ cm^{-3}, the dominant coolant is CO rotational line emission, with a cooling function $\Lambda(T) \sim 10^{-23}$ erg cm^{-3} s^{-1} (Goldsmith & Langer, 1978; Neufeld, Lepp & Melnick, 1995). Convert ΔK to erg: $\Delta K = 2.5 \times 10^{40} \text{ J} = 2.5 \times 10^{47} \text{ erg}$

The cooling timescale is: $\tau_{cool} \sim \frac{\Delta K}{V \Lambda} \approx \frac{2.5 \times 10^{47}}{(1.24 \times 10^{56}) \times (10^{-23})} \approx \frac{2.5 \times 10^{47}}{1.24 \times 10^{33}} \approx 2.02 \times 10^{14} \text{ s} \sim 6.4 \times 10^{6} \text{ years}$

The corrective permeability is: $\kappa = \frac{1}{\tau_{cool}} \approx 4.95 \times 10^{-15} \text{ s}^{-1}$

Step 5: Interpretation. The perturbation is damped within a few million years. The basin depth ($|U| \sim 8.6 \times 10^{41}$ J) far exceeds the perturbation energy, ensuring the cloud's structural integrity. Corrective permeability, quantified by κ, is the mechanism by which the cloud restores coherence—absorbing the modest perturbation through radiative cooling and returning to virial equilibrium on a timescale short compared to the cloud's overall lifetime ($\sim 10^7$ years).

---

8. Cross-Domain Parallel: Biological Wound Healing

The same attractor vocabulary applies without modification to biological systems.

A wound is a perturbation to the stable attractor of healthy tissue. The body responds through a multi-stage healing cascade: clotting stops further damage, inflammation cleans the wound, and tissue repair restores structural integrity. The healing rate—quantified clinically by wound closure time—is the biological corrective permeability. The healthy baseline state is the basin. Complications like impaired circulation reduce oxygen delivery, slowing fibroblast activity and thus reducing κ (Guo & DiPietro, 2010).

The gas cloud perturbed by a supernova shock and the human body perturbed by a wound are structurally identical within the framework: a dissipative attractor, displaced from its basin, activates corrective mechanisms at a characteristic rate, and either returns to coherence or undergoes permanent state transition.

---

9. Observational Consistency

The framework's description of cloud evolution is fully consistent with standard observations:

- **Turbulent molecular clouds** exhibit the chaotic velocity fields and filamentary structures predicted by the convulsive phase.
- **Radiative cooling** is traced by CO, H_2O, and other molecular line emissions.
- **Protostellar cores** represent the approach to the spherical attractor.
- **Protoplanetary disks** are the rotationally-constrained basins.
- **Bound clusters and stellar systems** persist under external perturbations, demonstrating basin depth.

These observations are predicted and explained by standard astrophysics. The attractor framework is consistent with all of them. Its contribution in this domain is conceptual, not empirical.

---

10. Conclusion

The evolution of an isolated gas cloud from turbulence to equilibrium is fully described by standard astrophysics. The attractor framework does not replace that description. It translates it into a unified conceptual vocabulary—dissipative attractor, basin, invariant reference, rail, corrective permeability—that applies across physical and biological systems, with broader applicability noted.

The center of mass remains fixed while the cloud convulses, collapses, and settles. The virial theorem, translated into attractor language, quantifies basin depth as gravitational binding energy and corrective permeability as the inverse cooling timescale. The framework is consistent with all standard observations and requires no new physics.

The metronomes hum. The cloud finds its basin. The framework holds.

References

- Galida, R. (2026a). *Persistence Under Perturbation: The Eternal Skeleton and the Transient Dance.* Fantasy Attractor.
- Goldsmith, P. F., & Langer, W. D. (1978). Molecular cooling and thermal balance of dense interstellar clouds. *The Astrophysical Journal*, 222, 881–895.

- Guo, S., & DiPietro, L. A. (2010). Factors affecting wound healing. *Journal of Dental Research*, 89(3), 219–229.
- McKee, C. F., & Ostriker, E. C. (2007). Theory of star formation. *Annual Review of Astronomy and Astrophysics*, 45, 565–687.
- Neufeld, D. A., Lepp, S., & Melnick, G. J. (1995). Thermal balance in dense molecular clouds: radiative cooling rates and emission-line luminosities. *The Astrophysical Journal Supplement Series*, 100, 132–147.
- Shu, F. H., Adams, F. C., & Lizano, S. (1987). Star formation in molecular clouds: Observation and theory. *Annual Review of Astronomy and Astrophysics*, 25, 23–81.

“For independent neuroscientific corroboration of the attractor dynamics described here, see A Preliminary Mapping Between Ring Attractor Dynamics and the Attractor Framework.”https://www.sciencedirect.com/science/article/pii/S2405844024114892