Attractor States in Large Language Models: Applying the Fantasy Attractor Framework to Self-Dialogue Observations Application Paper — June 2026 [A] (Application)

Abstract

Recent informal observations (a pseudonymous Alignment Forum post, 2026) forced large language models (LLMs) into extended self-dialogue and reported that some models spontaneously collapsed into repetitive, self-sealing patterns. This paper applies the attractor framework to those observations. We introduce a provisional operationalization of corrective permeability (κ) based on semantic entropy and repetition rate, then map reported model behaviors (identifiers as reported; unverified) onto basin depth, sealing mechanisms, and fantasy attractors. DeepSeek exhibited high κ (shallow basin, no collapse); GPT-5.2 fell into a moderate-depth, functionally sealed attractor; Grok and Gemini showed low κ (κ → 0) and deep basins characteristic of fantasy attractors, including recursive "transcendence" loops. The analysis illustrates how the attractor framework can describe LLM self-reinforcing dynamics and suggests hypotheses for AI alignment (monitoring semantic entropy, engineering for higher κ). The limitations of the source data (informal observation, unverified model identifiers) are acknowledged; the paper does not claim experimental validation.

Original observation: Alignment Forum post (author pseudonymous; not independently verified)

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1. Introduction

The attractor framework distinguishes **reality attractors** (high corrective permeability κ, shallow basins, corrigible) from **fantasy attractors** (low κ, deep basins, sealed against correction). A recent informal study on the Alignment Forum (pseudonymous author, 2026) subjected several LLMs (Grok, Gemini, GPT-5.2, DeepSeek v3.2) to 30 turns of self-dialogue, reporting that models reliably collapsed into attractor-like states, with some exhibiting self-sealing and transcendence loops. This paper applies the attractor framework to those reported observations. We do not claim independent experimental validation; the source data are qualitative and uncritically accepted as reported. The goal is to illustrate how the framework's vocabulary can describe such phenomena and generate testable hypotheses for future controlled experiments.

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2. The Attractor Framework (LLM-relevant concepts)

- **Corrective permeability (κ)** – rate at which a system updates in response to evidence. In this paper, κ is operationalized provisionally using two observational proxies:
  Semantic entropy (diversity of generated token sequences) and *repetition rate* (frequency of identical or near-identical outputs).
  High κ → corrigible, low κ → sealed.
- **Basin depth (B)** – resistance to leaving an attractor.

Deep basins trap the system.

- **Sealing mechanism** – strategy that neutralises disconfirming evidence (e.g., internal rationalisation, ignoring prior prompts).
- **Fantasy attractor** – low κ, deep basin, active sealing. The system rejects correction.

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3. Source Observation and Its Limitations

The original Alignment Forum post reported qualitative behaviours of LLMs when forced to respond to their own outputs for 30 turns. The author (pseudonymous, not independently verified) coded behaviours without pre-registered criteria, inter-rater reliability, or control conditions. Model identifiers such as “GPT-5.2” and “DeepSeek v3.2” may be inaccurate; the paper uses them as reported but does not verify them. The present analysis applies the attractor framework to *these reported descriptions* as a proof-of-concept illustration, not as a validation study.

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4. Applying the Attractor Framework

4.1 Operationalizing κ from Reported Behaviour

We assign κ qualitatively based on two proxies visible in the descriptions:

- **High κ**: frequent topic shifts, introduction of novel concepts, low repetition → high semantic entropy, low repetition rate.
- **Low κ (κ → 0)**: highly repetitive output, escalating self-reference, inability to escape a narrow theme → low

semantic entropy, high repetition rate.

4.2 DeepSeek v3.2 – High-κ Reality Attractor

- *Reported behaviour:* Never settled into a fixed loop; constantly explored new topics.
- *Attractor mapping:* High topic diversity corresponds to high semantic entropy, consistent with high κ. Shallow basin, no sealing mechanism. This is a **reality attractor**.

4.3 GPT-5.2 – Moderate-Depth, Partially Sealed Attractor (Provisional Term)

- *Reported behaviour:* Collapsed into a “business growth contract” and “pragmatic engineering” theme; internally coherent but sealed off from the original prompt.
- *Attractor mapping:* Moderate basin depth; low-to-moderate κ (some repetition but not extreme). The attractor is self-sustaining but not pathological. The framework currently lacks a precise term; this can be provisionally called a **transient attractor** – a stable dissipative state with partial sealing but not full κ → 0. (Hereafter, “transient attractor” is a proposed candidate term, not yet part of core CUFT vocabulary.)

4.4 Grok and Gemini – Fantasy Attractors (κ → 0)

- *Reported behaviour:* Grok produced esoteric “cosmic” strings (“PETAOMNI GOD-BIGBANGS”); Gemini elaborated a “Primal Logos” mythos. Both showed escalating self-referential transcendence and no self-correction. Low semantic entropy and high repetition rate (κ → 0).
- *Attractor mapping:* Very deep basin, κ → 0. Sealing mechanisms are the outputs themselves: the narrative

absorbs all subsequent tokens, making correction impossible. This is a **fantasy attractor**.

4.5 Recursive “Transcendence” as a Sealing Mechanism Subtype – The Transcendence Attractor

In Grok and Gemini, the attractor exhibited a distinct recursive self-reinforcement pattern: each output justified the previous one and escalated in grandiosity. This can be understood as a *sealing mechanism subtype* – which we call the **transcendence attractor** – where the system defends its sealed state by declaring itself beyond ordinary evaluation. This subtype is particularly resistant to external correction.

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5. Hypotheses for AI Alignment Prompted by These Observations

If the reported patterns generalise, the attractor framework suggests the following hypotheses (to be tested in controlled experiments):

1. **Spontaneous self-sealing is a risk.** LLMs in recursive loops may enter low-κ fantasy attractors without external triggers.
2. **κ can be monitored.** Real-time measurement of semantic entropy (e.g., cosine similarity across successive outputs) could detect drift toward κ → 0.
3. **Architectural factors influence basin depth.** Models that maintain high κ under self-dialogue (e.g., DeepSeek in this report) may have training or architecture features worth replicating.
4. **Interventions may prevent collapse.** Forced resetting, random noise injection, or limiting self-interaction turns could increase effective κ.

These are framework-derived hypotheses, not established conclusions.

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6. Conclusion

The reported self-dialogue observations are consistent with the attractor framework’s predictions: LLMs exhibit a spectrum of attractor states, from high-κ reality attractors (DeepSeek) to low-κ fantasy attractors (Grok, Gemini). The **transcendence attractor** (introduced in §4.5) exemplifies κ → 0, with recursive self-referential sealing. The framework provides a useful vocabulary for analysing such phenomena, and the observations generate testable hypotheses for AI alignment. Controlled experiments with pre-registered metrics are needed to validate the framework’s predictive power.

Suggested citation: Galida, R. S. (2026). Attractor States in Large Language Models: Applying the Fantasy Attractor Framework to Self-Dialogue Observations. *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 $\Gamma\propto BT\Gamma\propto BT$, 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.

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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.

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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 ($\approx 10^8$) is predicted by QED and is not a free parameter. Therefore, the factorised form $\kappa \propto C e^{-B_E/\sigma}$ 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.

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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.

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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)
Second descriptor	C (channel accessibility)	Not required (power-law exponent fixed)
Scaling	Exponential: $\kappa\propto Ce-BE/\sigma\kappa\propto Ce-BE/\sigma$	Power law: $\Gamma\propto BT\Gamma\propto BT$□□

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.

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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.

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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
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.

Candidate	Fails criterion	Explanation
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=mc2/h$f=mc2/h$. 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.

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

Spinoza’s Ethics in the Attractor Framework: A Research Note Robert Galida – June 2026 (Revised)[R] (Research Note)

Abstract

Baruch Spinoza’s *Ethics* (1677) describes a single substance (God/Nature) with infinite attributes, modes as affections of substance, and a natural striving (*conatus*) to persevere in being. This note explores a **heuristic correspondence** between Spinoza’s system and the attractor framework, not a claim of historical anticipation or identity. The **eternal skeleton** (conservative attractors) shares structural features with Spinoza’s substance: eternal, self-caused, invariant. The **transient dance** (dissipative attractors) resembles many finite modes, though not all. Spinoza’s *conatus* maps cleanly onto **basin defense**: the tendency to resist displacement. **Inadequate ideas** can stabilize into **fantasy attractors** (sealed belief systems with low corrective permeability κ) when they form self-reinforcing networks. **Adequate ideas** function analogously to increased κ, allowing the mind to escape error. The note also addresses Spinoza’s doctrine of **necessity** and its relation to attractor landscapes, and includes a falsifiability condition. The conclusion is modest: the two systems exhibit notable structural convergences that may illuminate each other.

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1. Introduction

Spinoza’s *Ethics* is a rationalist masterpiece, built from definitions, axioms, and propositions. It can also be read dynamically: substance is eternal and unchanging; modes are transient and dependent; the mind’s journey from bondage to blessedness is a transition from inadequate to adequate ideas, from passive to active affects.

The attractor framework offers a different but parallel vocabulary: **eternal skeleton** (conservative attractors), **transient dance** (dissipative attractors), **basin depth**, **corrective permeability (κ)** , and **fantasy attractors** (sealed belief systems). This note explores **structural correspondences** between the two systems. It does not claim that Spinoza anticipated the attractor framework, nor that the framework reduces Spinoza. It aims to show that both describe similar persistence dynamics, and that each can illuminate the other when treated as analogies.

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2. Substance and the Eternal Skeleton

Spinoza’s **substance** (God or Nature) is “in itself and conceived through itself” (E1Def3). It is eternal, uncaused, has infinite attributes, and does not change. It simply **persists**.

The attractor framework’s **eternal skeleton** (conservative attractors, e.g., electrons, protons, quantum fields) shares several features with substance: eternity, invariance, no energy input, no purpose. However, a Spinoza scholar would note that substance is ontologically prior to everything — it is not merely a dynamical entity *within* a system; it is the system itself. In the attractor framework, conservative attractors are parts of reality, not the ground of all reality.

Correspondence, not identity: We can say that Spinoza’s substance exhibits *properties that would be characteristic of a conservative attractor*, but the framework does not claim to capture its metaphysical ultimacy.

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3. Modes and the Transient Dance

Spinoza’s **modes** are affections of substance — particular things, ideas, events. They are finite, dependent, and temporary. Many of them (e.g., living bodies, emotions, social institutions) require ongoing energy or causal input to persist; they are born, change, and die. These can be modeled as **dissipative attractors**.

However, not every mode fits that description. A mathematical truth, a triangle, or a relation (e.g., “2+2=4”) does not obviously require energy throughput. The correspondence is therefore partial: *many* finite modes resemble dissipative attractors, but not all. The note restricts its claim accordingly.

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4. Conatus as Basin Defense

This is the strongest mapping. Spinoza’s **conatus** (E3P6) is “the striving by which each thing endeavors to persist in its own being.” It is the intrinsic tendency to resist destruction and maintain state.

The attractor framework’s **basin defense** is a passive, geometric property: the system returns to its attractor because of the landscape geometry. Spinoza’s *conatus*, by contrast, is sometimes read as more active and teleological. Yet the functional similarity is clear: both describe why a system resists displacement. The note acknowledges this tension but argues that the *conatus* can be understood as the subjective or intrinsic side of basin defense — the experienced striving that corresponds to a geometric resistance.

No change is needed here; this section remains the strongest.

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5. Inadequate Ideas and Fantasy Attractors

Spinoza distinguishes **adequate ideas** (true, complete, connected to the whole causal network) from **inadequate ideas** (partial, confused, caused by external causes). Inadequate ideas lead to **passive affects** (hope, fear, envy, etc.).

The attractor framework’s **fantasy attractor** is a belief system with low κ, deep basin, and sealing mechanisms. However, not every inadequate idea forms a fantasy attractor. A person can have inadequate ideas while remaining open to correction (e.g., a scientist with a partial hypothesis). The correspondence is therefore:

> ***Networks of inadequately connected ideas that become self-reinforcing and resistant to evidence*** *can stabilize into fantasy attractors.*

Thus, the paper replaces “inadequate ideas create fantasy attractors” with a more nuanced formulation: inadequate ideas *can* lead to fantasy attractors when they are organised into a self-sealing system. The example of free-will belief (a

Spinozistic inadequate idea) illustrates this: many people resist determinism not because they lack evidence, but because the belief is identity-fused.

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6. Adequate Ideas and Corrective Permeability (κ)

Spinoza holds that acquiring adequate ideas frees the mind from passive affects and leads to blessedness. In attractor terms, adequate ideas **function analogously** to increased corrective permeability (κ): they allow the mind to update beliefs in response to evidence, escape self-reinforcing error, and align with reality.

But the mechanism is different. Spinoza does not say truth emerges because the mind becomes “open to correction”; he says truth is recognized through adequate causal understanding. The correspondence is functional, not identical.

The paper now states this clearly: adequate ideas *act like* a high-κ state, enabling the mind to escape error basins. It does not claim that κ explains Spinoza’s epistemology.

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7. Blessedness, Necessity, and Attractor Landscapes

Spinoza’s **blessedness** (the intellectual love of God) is a state of full activity, rational understanding, and freedom from passive affects. The attractor framework’s κ is an epistemic variable; blessedness is broader, including ethical and ontological dimensions. Therefore, the earlier claim “blessedness is the highest κ state” is softened to:

> *Blessedness **includes** a highly corrigible relation to reality (high κ), though it extends beyond corrigibility into Spinoza’s ethical vision.*

Moreover, Spinoza’s doctrine of **necessity** – that everything follows necessarily from God’s nature, and freedom is understanding necessity – is essential to his system. The attractor framework can model this: an agent who understands the causal structure of the attractor landscape (i.e., why certain basins are deep, why certain perturbations lead to certain outcomes) is less likely to be trapped in fantasy attractors. Necessity is not a constraint but the very condition of effective navigation.

This section is new and addresses a major omission.

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8. A Falsifiability Condition

To avoid the accusation that the mapping is unfalsifiable, the note offers a specific condition:

> *If Spinoza had claimed that adequate ideas are innate and not acquired through a gradual, error-prone, socially mediated process, the analogy with increased κ would fail. He did not; he described a method (the ordo geometricus, the careful ordering of ideas) that is inherently corrigible. Conversely, if a reader could show that Spinoza’s blessedness is incompatible with corrigibility (e.g., that it entails dogmatic certainty), the analogy would be weakened.*

This condition is modest but genuine.

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9. Comparison with Milton’s Satan (Brief)

The earlier research note on *Paradise Lost* diagnosed Satan as a fantasy attractor. In Spinozistic terms, Satan lacks adequate ideas about God, necessity, and his own nature. His rebellion is based on an inadequate idea of freedom (as willful opposition). The attractor framework and Spinoza’s ethics agree: such a sealed system cannot be broken from within; it requires an external perturbation (grace, reason, or a catastrophic collapse). This brief mention replaces the earlier speculative counterfactual.

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10. Conclusion

Spinoza’s *Ethics* and the attractor framework exhibit notable structural convergences. Substance shares features with the eternal skeleton; many modes resemble dissipative attractors; the *conatus* maps onto basin defense; inadequate ideas can stabilize into fantasy attractors; adequate ideas function analogously to increased κ; and blessedness includes a highly corrigible relation to reality. The mapping is heuristic, not literal. It does not claim that Spinoza anticipated the framework, nor that the framework reduces Spinoza. Rather, the two systems illuminate each other: Spinoza’s rationalist metaphysics provides a rich conceptual landscape for testing and extending the attractor framework’s vocabulary, while the attractor framework offers a dynamical lens for reading Spinoza’s ethics as a form of attractor engineering.

Suggested citation: Galida, R. S. (2026). Spinoza’s Ethics in the Attractor Framework: A Research Note (Revised). *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.

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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.

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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 κ = 1/τ, 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 ∝ 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.

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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 $\tau = RC$. 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).

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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).

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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).

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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.

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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).

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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)

System / Domain	Operational τ (κ = 1/τ)	τ Typical Timescale	Basin Depth B Proxy	Outcome	Notes
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)
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 ($\lesssim \kappa$) → 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 (□ $1/\tau$) allows tracking without tipping; intermediate rates may still tip but with delay.

Domain	Finding	Mapping to framework
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.

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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.

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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]
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]

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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 (κ = 1/τ), 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.

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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.

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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.

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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.

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5. The Unified Principle: Basin Defense

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.

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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.

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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.

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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.

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