

Surtea-Austin Recursive Topology

A Minimal Framework for Topological Objecthood and Recursive Persistence

Draft formulation

May 9, 2026

Abstract

This note gives a stripped-down synthesis of two ideas. Surtea's partition-topological universe supplies the formal meaning of object, interior, closure, boundary, class, and interaction. Austin's recursive survival geometry supplies the meaning of history, persistence, survival weight, and observational dominance. The resulting framework does not place differential equations directly on bare topological supports. The primitive history is discrete. Differential equations enter only after choosing a smooth phase fibre and passing to a continuum approximation of the projected recursive sequence.

Notation

Symbol	Name	Meaning
M	Underlying set	The primitive set of material points in Surtea's topological universe.
\mathcal{D}	Partition of M	A partition of M . Its elements are D -photons.
$D \in \mathcal{D}$	D -photon	An atomic component of the partition \mathcal{D} in the set-theoretic sense. The D -photons are pairwise disjoint and cover M .
$\mathbb{U} = (M, \mathcal{D})$	Surtea universe	The formal topological universe: an underlying set together with a partition.
$\tau_{\mathcal{D}}$	Partition topology	The closed-open topology generated by arbitrary unions of D -photons.
$X \subseteq M$	Topological support	A subset of M considered as the support of a possible object.
$X_n \subseteq M$	Recursive support	The Surtea-topological support of the structured state at recursion step n .
$\text{int}_{\mathcal{D}}(X)$	Surtea interior	The largest $\tau_{\mathcal{D}}$ -open subset contained in X .
$\text{cl}_{\mathcal{D}}(X)$	Surtea closure	The smallest $\tau_{\mathcal{D}}$ -closed subset containing X .
$\text{bd}_{\mathcal{D}}(X)$	Surtea boundary	The boundary of X , defined here as $\text{cl}_{\mathcal{D}}(X) \setminus \text{int}_{\mathcal{D}}(X)$.
$\text{class}_{\mathcal{D}}(X)$	Surtea class	The class assigned to X by its interior-closure relation, for example spation, tempon, korpuskon, undon, lighton, or an exceptional limiting case.
Σ	Structured state space	The space of structured recursive states σ_n .

Symbol	Name	Meaning
σ_n	Structured recursive state	The full state at recursion step n , written $\sigma_n = (X_n, \varphi_n, \mu_n, S_n)$.
φ_n	Phase component	Phase, transport, or recursive-flow data attached to σ_n .
Φ	Phase fibre	A chosen smooth space in which the phase components φ_n live.
μ_n	Physical measure data	The package of physical measures attached to X_n , such as mass, charge, or energy.
$\mathcal{M}(X_n)$	Measure package space	The formal container for physical measure data attached to X_n . It is not assumed to be a full measure space unless one is supplied.
S_n	Survival weight	The persistence weight of the structured state or history at step n .
π_M	Support projection	The projection $\pi_M(\sigma_n) = X_n$, extracting the Surtea support.
π_Φ	Phase projection	The projection $\pi_\Phi(\sigma_n) = \varphi_n$, extracting the smooth phase component.
h	History	A discrete map $h : \mathbb{N} \rightarrow \Sigma$, with $h(n) = \sigma_n$.
h_i	Candidate history	One history in a family of generated candidate histories.
R	Recursive update rule	The rule $\sigma_{n+1} = R(\sigma_n)$ generating the next structured state.
ε_n	Recursion-step weight	The discrete step weight used in the survival update. If a smooth time parameter is introduced, it may be set to Δt .
Θ_n	Phase coordinate	The position-like or ordinal coordinate in the example phase representation $\varphi_n = (\Theta_n, \Pi_n)$.
Π_n	Phase-flow coordinate	The motion-like coordinate conjugate to Θ_n .
κ_n^2	Phase-curvature coefficient	The coefficient controlling the curvature of the finite-difference phase update.
$J(\varphi_n)$	Action norm	The phase norm $J(\varphi_n) = \Theta_n^2 + \ell^2 \Pi_n^2$.
ℓ	Scale factor	A conversion scale allowing Θ_n and Π_n to be compared inside one norm.
$W(\varphi_n)$	Exposure weight	The phase exposure $W(\varphi_n) = \Theta_n^2 / J(\varphi_n)$, with $0 \leq W \leq 1$.
r	Closure or recurrence parameter	A schematic diagnostic for whether the projected recursive phase closes. In simple cases it may be represented by a ratio such as $r_n = \Theta_{n+1} / \Theta_n$, when that ratio is defined.
$L_{\mathcal{D}}$	Topological survival loss	The loss functional controlling survival decay across $\sigma_n \rightarrow \sigma_{n+1}$.

Symbol	Name	Meaning
Δ_{bd}	Boundary-change diagnostic	A non-negative diagnostic measuring change of boundary structure across a transition.
Δ_{class}	Class-change diagnostic	A non-negative diagnostic measuring change of Surtea class across a transition.
Δ_{int}	Interaction-instability diagnostic	A non-negative diagnostic measuring change in boundary-mediated or closure-mediated interaction structure.
λ	Exposure coupling	The non-negative coefficient multiplying the Austin exposure term $W(\varphi_n)$.
α	Boundary penalty coefficient	The non-negative coefficient multiplying Δ_{bd} .
β	Class penalty coefficient	The non-negative coefficient multiplying Δ_{class} .
χ	Interaction penalty coefficient	The non-negative coefficient multiplying Δ_{int} .
$p_i(n)$	Normalised representation weight	The represented weight of history h_i , defined by $p_i(n) = S_i(n) / \sum_j S_j(n)$.
$I_{\mathcal{D}}(X, Y)$	Topological interaction diagnostic	A schematic Surtea-style diagnostic measuring boundary or closure interaction between supports X and Y .
ρ_{mem}	Memory-decay kernel	A weighting kernel for self-history interaction between a present support and its earlier supports.
$m_{\text{eff}}(\sigma_n)$	Effective inertial mass	A schematic self-history mass term, not a completed mass theory.
m_0	Bare mass parameter	The baseline mass parameter before self-history interaction terms are included.
η	Self-history coupling	The coefficient controlling the strength of self-history interaction.

1 Purpose and Limits

The purpose of this note is to isolate the smallest useful Surtea-Austin construction. It deliberately ignores wider substrate claims, cosmological hardware interpretations, numerical conjectures, and external bridge models. The aim is only to ask what remains when Surtea’s partition topology and Austin’s recursive survival filtering are placed in direct correspondence.

The answer is a two-layer framework. The first layer specifies what counts as a formal object. The second layer specifies how histories of such objects persist or fade.

This note therefore makes three limited claims:

- (i) Surtea’s partition topology provides a formal language for support, interior, closure, boundary, class, and interaction.
- (ii) Austin’s recursive survival framework provides a formal language for generated histories, survival weights, and normalised representation.
- (iii) A combined history should be written as a sequence of structured states rather than as a bare sequence of topological supports.

It does not claim that Surtea's topology by itself contains differential dynamics. It does not claim that Austin's survival law is forced by Surtea's topology. It does not claim a final physical theory of mass, charge, gravity, or quantum measurement. It only records a minimal compatibility framework.

This note is not an erratum to the earlier Recursive Survival Geometry paper. It introduces cleaner notation for the combined Surtea-Austin framework, where σ_n denotes the structured recursive state and X_n denotes only the Surtea-topological support.

2 Core Thesis

Principle 2.1 (Separation of roles). *Surtea defines formal objecthood; Austin defines recursive persistence.*

Equivalently, physical objects are represented by Surtea-topological supports, physical histories are represented by recursive sequences of structured states, and observed structure is identified with the high-survival sector after Austin-style filtering.

3 Primitive Data

The minimal framework has four primitive pieces:

$$M, \quad \mathcal{D}, \quad \Sigma, \quad R.$$

Here M is the underlying set, \mathcal{D} is a partition of M , Σ is the structured state space, and R is the recursive update rule.

The Surtea layer acts on subsets of M . The Austin layer acts on structured states in Σ . The bridge between them is the support projection

$$\pi_M : \Sigma \rightarrow \mathcal{P}(M), \quad \pi_M(\sigma_n) = X_n.$$

Thus every structured state has a topological support, but the support is not the whole state.

In compressed form:

$$\begin{aligned} \text{objecthood} & : X_n \subseteq M, \\ \text{statehood} & : \sigma_n = (X_n, \varphi_n, \mu_n, S_n), \\ \text{history} & : h : \mathbb{N} \rightarrow \Sigma, \\ \text{selection} & : S_{n+1} = S_n e^{-L_{\mathcal{D}} \varepsilon_n}. \end{aligned}$$

4 Surtea Layer: Objecthood

Definition 4.1 (Topological universe). *A Surtea universe is a pair*

$$\mathbb{U} = (M, \mathcal{D}),$$

where M is a non-empty underlying set and \mathcal{D} is a partition of M . The elements of \mathcal{D} are called *D-photons*.

The partition \mathcal{D} generates the closed-open topology

$$\tau_{\mathcal{D}} = \left\{ \bigcup_{D \in \mathcal{E}} D : \mathcal{E} \subseteq \mathcal{D} \right\}.$$

Thus the basic topological operations on a subset $X \subseteq M$ are

$$\text{int}_{\mathcal{D}}(X), \quad \text{cl}_{\mathcal{D}}(X), \quad \text{bd}_{\mathcal{D}}(X) = \text{cl}_{\mathcal{D}}(X) \setminus \text{int}_{\mathcal{D}}(X).$$

The same data classify subsets by their relation to interior and closure:

$$\text{class}_{\mathcal{D}}(X) = \text{the Surtea class of } X.$$

Depending on its interior-closure relation, X falls into Surtea's classification scheme, including classes such as spation, tempon, korpuskon, undon, lighton, and exceptional limiting cases.

Definition 4.2 (Topological support). *At recursion step n , the formal support of a physical object is a subset*

$$X_n \subseteq M.$$

No differential structure is assumed on X_n . It carries only the partition topology inherited from (M, \mathcal{D}) , unless additional structure is explicitly supplied.

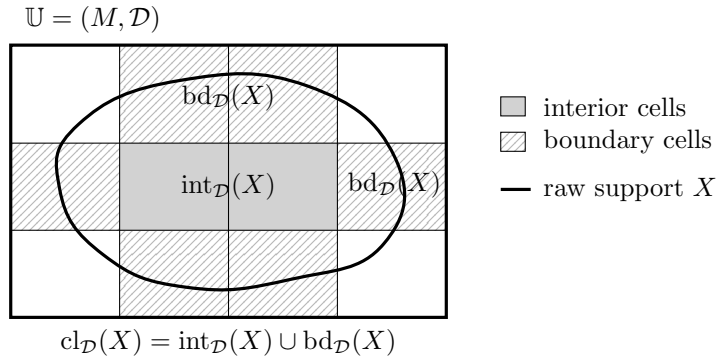


Figure 1: A subset $X \subseteq M$ is read through the partition topology. Interior, closure, and boundary are determined by D -photon cells, not by a smooth manifold structure.

5 Austin Layer: Recursive State and History

The bare support X_n is not the whole physical state. The state must also carry phase or transport data, physical measures, and a survival weight.

Definition 5.1 (Structured recursive state). *Let Σ be the structured state space. A state is written*

$$\sigma_n = (X_n, \varphi_n, \mu_n, S_n),$$

where

$X_n \subseteq M$	<i>is the Surtea-topological support,</i>
$\varphi_n \in \Phi$	<i>is phase, transport, or recursive-flow data,</i>
$\mu_n \in \mathcal{M}(X_n)$	<i>stores physical measures such as mass, charge, or energy,</i>
$S_n \in \mathbb{R}_+$	<i>is the survival weight.</i>

Here $\mathcal{M}(X_n)$ denotes the package of physical measures attached to the support X_n . It is not assumed to be a full measure space unless one is explicitly supplied.

There are two useful projections:

$$\pi_M(\sigma_n) = X_n, \quad \pi_{\Phi}(\sigma_n) = \varphi_n.$$

Surtea topology is applied to $\pi_M(\sigma_n)$. Austin dynamics is applied to the recursive state and, when smooth equations are used, to the phase projection $\pi_{\Phi}(\sigma_n)$.

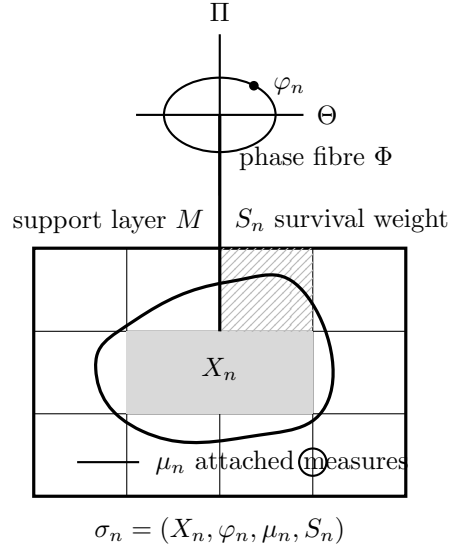


Figure 2: The structured state is not just a support. A smooth phase fibre and measure-survival data are attached to the Surtea support.

Definition 5.2 (History). *A history is a discrete map*

$$h : \mathbb{N} \longrightarrow \Sigma, \quad h(n) = \sigma_n.$$

Equivalently,

$$h = (\sigma_0, \sigma_1, \sigma_2, \dots).$$

The primitive recursive update is therefore

$$\sigma_{n+1} = R(\sigma_n),$$

or, for a family of candidate histories,

$$h_i = (\sigma_{i,0}, \sigma_{i,1}, \sigma_{i,2}, \dots).$$

6 Topological Diagnostics

Each transition

$$\sigma_n \longrightarrow \sigma_{n+1}$$

is diagnosed through the Surtea topology of its supports:

$$\text{int}_{\mathcal{D}}(X_n), \quad \text{cl}_{\mathcal{D}}(X_n), \quad \text{bd}_{\mathcal{D}}(X_n), \quad \text{class}_{\mathcal{D}}(X_n).$$

The basic questions are:

- (i) Did the support remain admissible?
- (ii) Did the interior change?
- (iii) Did the closure change?
- (iv) Did the boundary change?
- (v) Did the object change Surtea class?
- (vi) Did it interact with another support through boundary or closure structure?

This makes topology survival-relevant without making it differentiable.

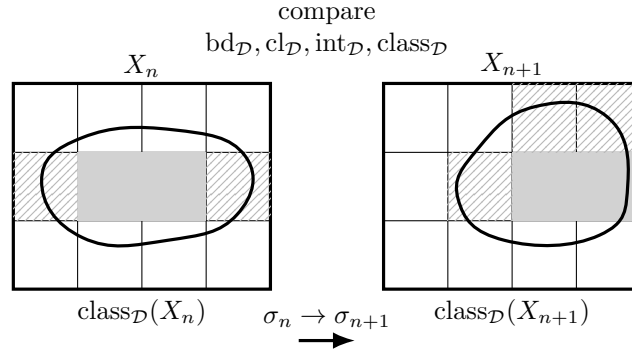


Figure 3: A recursive transition changes the support. The survival diagnostics ask whether boundary, closure, interior, or Surtea class changed across the step.

7 Transition Diagnostics

The diagnostic terms in the survival law are not assumed to be unique. They are placeholders for whatever precise comparison rule is chosen for a given model. The simplest possible version is Boolean: a transition receives a penalty if a relevant topological feature changes.

For example, one may define

$$\Delta_{\text{bd}}(n) = \begin{cases} 0, & \text{bd}_{\mathcal{D}}(X_{n+1}) = \text{bd}_{\mathcal{D}}(X_n), \\ 1, & \text{bd}_{\mathcal{D}}(X_{n+1}) \neq \text{bd}_{\mathcal{D}}(X_n), \end{cases}$$

and

$$\Delta_{\text{class}}(n) = \begin{cases} 0, & \text{class}_{\mathcal{D}}(X_{n+1}) = \text{class}_{\mathcal{D}}(X_n), \\ 1, & \text{class}_{\mathcal{D}}(X_{n+1}) \neq \text{class}_{\mathcal{D}}(X_n). \end{cases}$$

This gives a coarse survival rule: boundary-stable and class-stable histories lose less survival weight than boundary-unstable or class-changing histories.

A more refined version may replace these Boolean penalties by distances or defect measures:

$$\Delta_{\text{bd}}(n) = d_{\text{bd}}(\text{bd}_{\mathcal{D}}(X_n), \text{bd}_{\mathcal{D}}(X_{n+1})),$$

$$\Delta_{\text{class}}(n) = d_{\text{class}}(\text{class}_{\mathcal{D}}(X_n), \text{class}_{\mathcal{D}}(X_{n+1})),$$

where d_{bd} and d_{class} are model-dependent comparison functions.

Similarly, interaction instability may be represented schematically as

$$\Delta_{\text{int}}(n) = d_{\text{int}}(I_{\mathcal{D}}(X_n, Y_n), I_{\mathcal{D}}(X_{n+1}, Y_{n+1})),$$

where $I_{\mathcal{D}}$ is a chosen Surtea-style boundary or closure interaction between two supports.

The point is not that these are the final definitions. The point is that topological instability can be made survival-relevant without assuming that X_n itself is differentiable.

8 Survival Filtering

Austin's original survival idea separates generation from selection: recursion generates candidate histories, and survival weighting determines which histories remain strongly represented. In the Surtea-aware version, the ordinary Austin exposure term is taken to depend on the phase component. For example, if $\varphi_n = (\Theta_n, \Pi_n)$, define

$$J(\varphi_n) = \Theta_n^2 + \ell^2 \Pi_n^2, \quad W(\varphi_n) = \frac{\Theta_n^2}{J(\varphi_n)}.$$

Thus $0 \leq W(\varphi_n) \leq 1$.

The survival update is

$$S_{n+1} = S_n \exp[-L_{\mathcal{D}}(\sigma_n, \sigma_{n+1}) \varepsilon_n],$$

where $\varepsilon_n > 0$ is the recursion-step weight. If a smooth time parameter is later introduced, one may set $\varepsilon_n = \Delta t$.

The topological loss may be written

$$L_{\mathcal{D}}(\sigma_n, \sigma_{n+1}) = \lambda W(\varphi_n) + \alpha \Delta_{\text{bd}}(n) + \beta \Delta_{\text{class}}(n) + \chi \Delta_{\text{int}}(n),$$

where

- $\lambda W(\varphi_n)$ is the ordinary Austin exposure-loss term,
- $\Delta_{\text{bd}}(n)$ measures boundary change,
- $\Delta_{\text{class}}(n)$ measures Surtea-class change,
- $\Delta_{\text{int}}(n)$ measures interaction or coupling instability,
- $\lambda, \alpha, \beta, \chi$ are non-negative coupling or penalty coefficients.

The quantities $\Delta_{\text{bd}}(n)$, $\Delta_{\text{class}}(n)$, and $\Delta_{\text{int}}(n)$ are the non-negative transition diagnostics described above.

A minimal first version may omit the interaction term:

$$L_{\mathcal{D}} = \lambda W(\varphi_n) + \alpha \Delta_{\text{bd}}(n) + \beta \Delta_{\text{class}}(n).$$

For a collection of histories h_i , the represented weight is obtained by normalisation:

$$p_i(n) = \frac{S_i(n)}{\sum_j S_j(n)}.$$

Observed structure is then identified with high-survival histories after this normalisation.

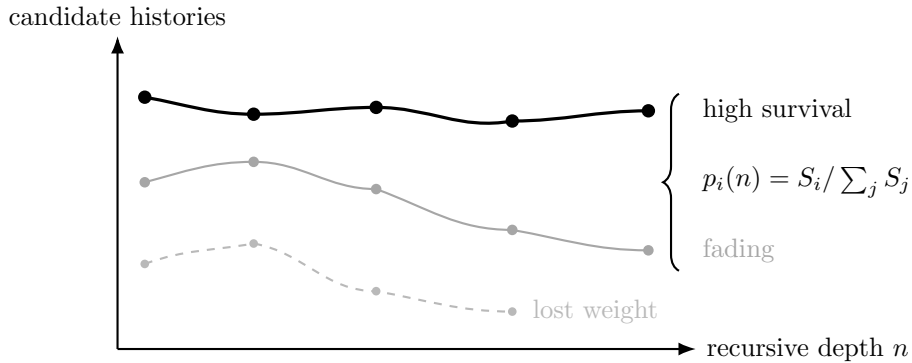


Figure 4: Survival filtering does not select one path at generation. It changes the represented measure by allowing lower-loss histories to retain more weight.

9 Differential Structure: What Is and Is Not Differentiated

Remark 9.1 (No differential equation on bare supports). *The support $X_n \subseteq M$ is a Surtea-topological object. It is not, by itself, a point of a smooth manifold. Therefore equations such as $\dot{X} = f(X)$ are not part of the primitive framework.*

Differential equations enter only after choosing a smooth phase fibre Φ and projecting the discrete state sequence to that fibre:

$$\pi_{\Phi}(\sigma_n) = \varphi_n \in \Phi.$$

For example, take

$$\varphi_n = (\Theta_n, \Pi_n) \in \Phi.$$

A discrete phase update may be written

$$\begin{aligned}\Theta_{n+1} &= \Theta_n + \varepsilon_n \Pi_n, \\ \Pi_{n+1} &= \Pi_n - \varepsilon_n \kappa_n^2 \Theta_n.\end{aligned}$$

Only when the projected sequence admits a smooth interpolation

$$\varphi_n \rightsquigarrow \varphi(t)$$

does the continuum approximation become

$$\frac{d\Theta}{dt} = \Pi, \quad \frac{d\Pi}{dt} = -\kappa^2 \Theta.$$

Thus the differential structure is imposed on the phase fibre Φ , not on the bare Surtea support X_n .

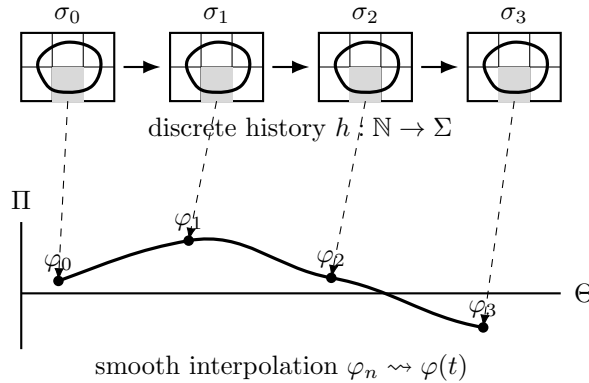


Figure 5: The history is discrete at the state level. Smooth differential equations describe only an interpolated curve in the projected phase fibre.

10 Self-History Interaction and Inertial Mass

A further bridge suggested by Traian Surtea is that inertial mass may be thought of as the gravitational interaction of a body with its own previous positions. In the present notation this becomes a natural self-history term.

Since a history is

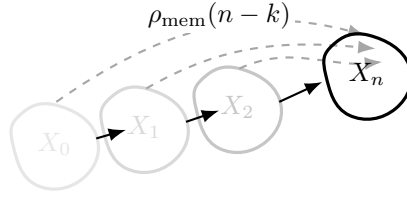
$$h = (\sigma_0, \sigma_1, \sigma_2, \dots),$$

the present support X_n may be compared not only with other supports, but also with its own earlier supports:

$$X_0, X_1, \dots, X_{n-1}.$$

A schematic effective inertial term may then be written

$$m_{\text{eff}}(\sigma_n) = m_0 + \eta \sum_{k < n} \rho_{\text{mem}}(n - k) I_{\mathcal{D}}(X_n, X_k).$$



$$m_{\text{eff}}(\sigma_n) = m_0 + \eta \sum_{k < n} \rho_{\text{mem}}(n-k) I_{\mathcal{D}}(X_n, X_k)$$

Figure 6: Self-history interaction: the present support may couple to earlier supports in its own recursive history.

Here m_0 is a bare mass parameter, η is a coupling coefficient, $\rho_{\text{mem}}(n-k)$ is a memory-decay kernel, and $I_{\mathcal{D}}(X_n, X_k)$ measures a Surtea-style closure or boundary interaction between the present support and a previous support.

In words, inertia may be modelled as resistance induced by recursive interaction between a body's present support and its own prior supports.

This is not asserted here as a completed theory of inertial mass. It is only recorded as a bridge conjecture. Surtea supplies the topology of present and previous supports. Austin supplies the recursive history in which those supports remain ordered.

11 Interpretation

The framework can be summarised as follows:

Surtea topology + Austin recursion and survival = recursive topological persistence.

The framework separates three questions that are often blurred:

- (i) What is the formal support of the object?
- (ii) How does the structured state recurse?
- (iii) Which histories remain strongly represented after survival filtering?

The first question belongs to the Surtea layer. The second and third belong to the Austin layer. The combined framework asks how topological support changes affect survival weight.

In this language, light-like behaviour corresponds to a limiting class of histories in which the phase projection is non-closing, lossless, and norm-preserving, while the support remains boundary-stable:

$$\lambda W(\varphi_n) \rightarrow 0, \quad \Delta_{\text{bd}} \rightarrow 0, \quad \Delta_{\text{class}} \rightarrow 0, \quad r \notin \mathbb{Q}.$$

This is not a claim that a Surtea support is literally a photon in the ordinary field-theoretic sense. It is a structural description of lossless non-closing transport.

Matter-like behaviour corresponds to histories in which recurrence, concentration, or support persistence survives the filter better than competing histories:

$$p_i(n) = \frac{S_i(n)}{\sum_j S_j(n)}$$

becomes large for histories whose total loss remains low. Matter-like structure is therefore associated with high-survival recurrence or concentration of supports.

Interaction corresponds to boundary-mediated or closure-mediated coupling between supports. In schematic form, two supports X_n and Y_n interact when a chosen Surtea interaction diagnostic is non-zero:

$$I_{\mathcal{D}}(X_n, Y_n) \neq 0.$$

The effect of that interaction on persistence is then encoded through Δ_{int} or through a more detailed loss functional.

Thus the combined framework does not begin with forces between already-formed objects. It begins with topological supports, recursively generated histories, and survival-weighted representation.

12 Notation Note

The symbol σ_n is used for the structured recursive state in order to avoid a collision with Surtea's use of K for korpuskons and Austin's earlier use of K_n for recursive states. In the present note:

X_n is the topological support,

σ_n is the full structured state,

and

h is the history.

This separation is not cosmetic. It prevents a bare support from being treated as if it already carried phase, measure, survival, or differential structure.

13 Conclusion

The minimal Surtea-Austin framework is not a speculative substrate theory. It requires only

$$\mathbb{U} = (M, \mathcal{D}), \quad \sigma_n = (X_n, \varphi_n, \mu_n, S_n), \quad h : \mathbb{N} \rightarrow \Sigma, \quad S_{n+1} = S_n e^{-L_{\mathcal{D}} \varepsilon_n}.$$

Surtea supplies the formal topology of objecthood: support, interior, closure, boundary, class, and interaction. Austin supplies recursive history and survival filtering: generated states, persistence weights, and normalised representation. The bridge between them is the structured state

$$\sigma_n = (X_n, \varphi_n, \mu_n, S_n),$$

which keeps support, phase, measure, and survival distinct.

The central claim is:

Observed physical structure is the high-survival sector of recursive histories whose supports are classified by Surtea's partition topology.

The central safeguard is:

No differential equation is imposed on the bare Surtea support X_n ; differential equations apply only to a chosen smooth phase projection.

This gives a compact foundation for later work without forcing Surtea's topological universe, Austin's recursive survival geometry, or any future physical substrate model into the same level of claim.

In its shortest form:

Surtea defines formal objecthood; Austin defines recursive persistence.