# The Surtea-Austin Triangle

## A Formal Bridge Note on Boundary Exposure and RSG Weighting

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**Keywords:** Surtea topology; partition geometry; boundary exposure; measurable potential; support readout; Recursive Survival Geometry; survival weighting; Pythagorean reading; Dirac linearisation.

**Acknowledgements:** The author thanks Traian Surtea for clarifying the status of partition geometry, especially the point that the Surtea construction does not begin with coordinates, curvature, metric, or norm. Any bridge from Surtea support to metric or physical weighting made in this note is the author's modelling proposal.

### Abstract

This note records a compact bridge between Surtea-style topological support [1], Surtea's measurable study of a potential, Pythagorean-style positive readout, Dirac-style invariant linearisation [2], and RSG survival weighting [3]. The central idea is simple. A structured recursive state carries a topological support $X_n$. Surtea topology splits this support into an interior part and a boundary part. Surtea's measurable potential then assigns values to the closure, interior, boundary field, and interaction channel. A separate positive readout may turn those values into an exposure ratio. RSG uses that readout inside the survival-loss coefficient that weights which histories remain strongly represented. In short:

$$\text{support} \quad \longrightarrow \quad \text{boundary exposure} \quad \longrightarrow \quad \text{survival weighting.} \tag{1}$$

The note is conceptual rather than a completed physical derivation. The exact Pythagorean reading is not part of Surtea's bare partition geometry, and it is not identical with Surtea's measurable potential. It requires a declared positive readout $\rho : R \to \mathbb{R}_{\geq 0}$. Once that readout is fixed, the formulas below show how boundary-field capacity can enter the RSG survival law without replacing the existing RSG phase weight.

# 1 Purpose of the Note

The three charts included here show three related triangles:

1. the Surtea support triangle, where a support $X_n$ is decomposed into interior support and boundary field;

2. the Pythagoras-Surtea-Dirac comparison, where the support triangle sits beside the usual energy triangle and the Dirac linearisation view;
3. the Surtea-Austin triangle, where the boundary share is passed into the RSG survival-weighting law.

The goal is not to claim that Surtea topology proves Dirac theory, or that RSG has already derived physical mass. The goal is more modest and more useful: to make clear how the same structural pattern appears in each layer.

$$\text{whole quantity} = \text{internal component} + \text{exposed component}. \tag{2}$$

Surtea's measurable potential supplies a native way to measure the closure, interior, boundary field, and interaction channel. The triangle ratio is a later positive readout of that measurable layer. This is an additional modelling choice, not something already present in the unmeasured Surtea geometry.

## Claim Status of the Note

| **Claim** | **Status** | **Required input** | **What follows** | **What does not follow** |
|---|---|---|---|---|
| $\overline{\pi}_{\mathcal{D}}(X) = \mathring{\pi}_{\mathcal{D}}(X) \cup \partial_{\mathcal{D}} X$ | Exact topological identity | A set $M$, a partition $\mathcal{D}$, and a support $X \subseteq M$ | The support has an interior part and a boundary part relative to $\mathcal{D}$ | No metric, force, physical mass, or survival law is implied by this alone. |
| $\mu : \mathcal{D} \to R$, extended to $\mu : [\mathcal{D}] \to R$ | Surtea measurable potential | A fixed cell measure and its extension to unions of cells | Closure, interior, boundary, and interaction can be assigned $R$-values | $R$-values are not automatically positive sizes or probabilities. |
| $\rho_\mu(\overline{\pi}_{\mathcal{D}}(X)) = \rho_\mu(\mathring{\pi}_{\mathcal{D}}(X)) + \rho_\mu(\partial_{\mathcal{D}} X)$ | Conditional readout statement | A positive additive readout $\rho_\mu(Y) = \rho(\mu(Y))$ | The topological split can be read as a measured split | Surtea's native measure does not by itself choose the positive readout. |
| $B^\rho_D(X)$ | Definition after readout | $\mathcal{D}$, $X$, $\mu$, and $\rho$ fixed before comparison | The boundary share of the readout support is defined | No empirical loss law follows without an added response rule. |
| $\Gamma(\sigma) = \Gamma_0(\mu_{\text{phys}}) g(B^\rho_D(X))$ | Bridge postulate | $\Gamma_0$ and $g$ fixed before comparison | Boundary exposure can modulate the RSG loss coefficient in this model | The postulate is not forced by Surtea topology. |
| $\dot{S} = -\Lambda S$ and $S(t) = S(0)e^{-\int \Lambda}$ | Solution of an assumed survival equation | A chosen loss equation and effective loss rate $\Lambda$ | The exponential survival formula follows by integration | The differential equation itself is not derived by the integration. |
| Dirac comparison | Structural analogy | A chosen invariant quadratic form and a linearisation analogy | The same quadratic preservation pattern can be compared across languages | Surtea topology does not prove Dirac theory. |
| Curvature and support wakes | Future bridge | A specified update rule such as $R_\Omega$, $F$, $q$, and a time-scale relation | The diagrams can organise later models | No gravitational derivation follows in this note. |

## Parameter Status

| Object | Role | Status | Fix before comparison? | Notes |
|---|---|---|---|---|
| $\mathcal{D}$ | Partition or observational resolution | Fixed input | Yes | Changing $\mathcal{D}$ changes interior, closure, boundary, and $B_D$. |
| $\mu$ | Surtea measurable potential | Native Chapter 3 input | Yes | Defined first on $\mathcal{D}$, then extended to $[\mathcal{D}]$. Its values lie in $R$, not automatically in $\mathbb{R}_{\geq 0}$. |
| $\rho$ | Positive readout from $R$ | Declared modelling choice | Yes | Needed before forming ratios or Pythagorean diagrams. |
| $\rho_\mu$ | Composite support readout | Derived from $\mu$ and $\rho$ | Yes | $\rho_\mu(Y) = \rho(\mu(Y))$ for measurable support sets. |
| $g$ | Boundary response function | Pre-declared rule, or fitted only on a separate training class | Yes | It cannot be chosen after seeing the target survival weights. |
| $\Gamma_0$ | Baseline physical loss | Fixed or independently fitted input | Yes | Carries the non-boundary physical loss scale. |
| $W$ | RSG phase exposure weight | Fixed by the chosen RSG model | Yes | $B_D$ modulates $\Gamma$, not $W$. |
| $\ell$ | Phase scale factor | Fixed or independently fitted input | Yes | Sets the relative scale of $\Theta$ and $\Pi$. |
| $\Omega^2$ | Curvature or restoring-flow coefficient | Optional model input | Yes, if curvature is used | Without it, the curvature section is schematic only. |
| $R_\Omega$ | Curvature-shaped update rule | Future bridge unless supplied | Yes, if curvature is tested | Defines how curvature changes phase and support. |
| $F$ | Sequential frame update | Future bridge unless supplied | Yes, if histories are tested | Needed for rational closure and apparent-object claims. |
| $q$ | Cycle length | Fixed cycle input | Yes, if histories are tested | $F^q(K) = K$ is a closure condition, not a trigonometric angle. |
| $\eta$ | Wake mixing parameter | Toy or future-bridge parameter | Yes, if wakes are tested | Measures how much wake contributes to effective boundary exposure. |
| $\Delta t$ | Time step or observation scale | Simulation input | Yes | Needed for the discrete survival protocol. |

## Non-Circularity Rule

Before any comparison with data, simulation output, or analogue behaviour, the partition $\mathcal{D}$, measurable potential $\mu$, positive readout $\rho$, response function $g$, baseline loss $\Gamma_0$, phase weight $W$, and update rule must be fixed independently. The bridge fails for a given model class if those pre-declared choices do not produce the expected relation between boundary exposure and survival loss within the stated tolerance.

# 2 Notation

| Symbol | Meaning |
|---|---|
| $M$ | Underlying set or universe of possible support points. |

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| **Symbol** | **Meaning** |
|---|---|
| $\mathcal{D}$ | A partition of $M$. Its elements are the basic $\mathcal{D}$-cells or $\mathcal{D}$-photons. |
| $[\mathcal{D}]$ | The topology generated by $\mathcal{D}$: all unions of $\mathcal{D}$-cells. |
| $X_n$ | Surtea-topological support carried by the recursive state at step $n$. It is the set-theoretic support component of $\sigma_n$. |
| $K$ | A particular measured or deformed support being examined inside the partitioned universe. In the deformation section, $K$ plays the role of the support cut through the $\mathcal{D}$-cells. |
| $\pi$ | A projection symbol. In this note it means an operation that sends a subset to a topologically organised version of that subset. |
| $\mathring{\pi}_{\mathcal{D}}(X_n)$ | Interior projection of $X_n$: the largest $\mathcal{D}$-open support contained inside $X_n$. The small circle over $\pi$ means "interior". |
| $X_n^{\circ}$ | Short notation for $\mathring{\pi}_{\mathcal{D}}(X_n)$. |
| $\overline{\pi}_{\mathcal{D}}(X_n)$ | Closure projection of $X_n$: the smallest $\mathcal{D}$-closed support containing $X_n$. The bar over $\pi$ means "closure", so $\overline{\pi}_{\mathcal{D}}$ is read as "the $\mathcal{D}$-closure projection". |
| $\partial_{\mathcal{D}} X_n$ | Boundary or interaction field of $X_n$: the part of the closure that is not interior. |
| $\cup$ | Ordinary union. For $\overline{\pi}_{\mathcal{D}}(X) = \mathring{\pi}_{\mathcal{D}}(X) \cup \partial_{\mathcal{D}} X$, the pieces are already disjoint, so the ordinary union sign is enough. |
| $\mu : \mathcal{D} \to R$ | Surtea measure of the cells of one potential. It is then extended, with the same notation, to $\mu : [\mathcal{D}] \to R$. |
| $R$ | Value domain of Surtea's measure. It is not assumed to be $\mathbb{R}_{\geq 0}$. This matters because signs, directions, cancellations, or non-positive behaviour may be meaningful. |
| $\overline{\mu}(X)$ | External or total measure, $\overline{\mu}(X) = \mu(\overline{\pi}_{\mathcal{D}}(X))$. |
| $\mathring{\mu}(X)$ | Internal or proper measure, $\mathring{\mu}(X) = \mu(\mathring{\pi}_{\mathcal{D}}(X))$. |
| $\widetilde{\mu}(X)$ | Field measure or capacity of interaction, $\widetilde{\mu}(X) = \mu(\partial_{\mathcal{D}} X)$. |
| $\widehat{\mu}(X, Y)$ | Interaction measure for disjoint supports, $\widehat{\mu}(X, Y) = \mu(\overline{\pi}_{\mathcal{D}}(X) \cap \overline{\pi}_{\mathcal{D}}(Y))$, defined when $X \cap Y = \varnothing$. |
| $\rho : R \to \mathbb{R}_{\geq 0}$ | Optional positive readout used when one wants a ratio, graph, survival loss, or Pythagorean-style diagram. |
| $\rho_\mu(Y)$ | Composite positive support readout, $\rho_\mu(Y) = \rho(\mu(Y))$. In formulas this is the corrected meaning of the earlier shorthand for measured support size. |
| $\sigma_n$ | Full RSG structured recursive state. |
| $\varphi_n$ | Reduced phase/transport projection of $\sigma_n$. |
| $\mu_n^{\text{phys}}$ | Physical measures or attributes attached to the RSG state. The superscript prevents confusion with Surtea's measure $\mu$. |
| $S_n$ | Survival weight or represented persistence of the state/history. |
| $\Theta_n, \Pi_n$ | Position-like and motion-like phase coordinates in the reduced RSG model. |

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| **Symbol** | **Meaning** |
|---|---|
| $\ell$ | Scale factor putting $\Theta_n$ and $\Pi_n$ on comparable footing. |
| $\Omega^2$ | Curvature or restoring-flow coefficient shaping the reduced phase dynamics. |
| $R_\Omega$ | Curvature-shaped recursive update rule, $\sigma_{n+1} = R_\Omega(\sigma_n)$. |
| $F$ | A frame update map for a support history, used in the rational-closure section. |
| $q$ | Number of recursive frames in one closed cycle. |
| $\mathcal{A}_q$ | Apparent support object obtained by integrating $q$ sequential frames. |
| $\mathcal{W}_q$ | Support wake or boundary-warp record left by the sequential frames. |
| $\Delta t_{\text{upd}}$ | Time between recursive support updates. |
| $\Delta t_{\text{obs}}$ | Time span over which an observer or measuring process integrates several updates into one seen object. |
| $\rho = r/q$ | Rational closure step. It records that the update closes after $q$ frames without needing trigonometric angles. |
| $T_n = (e, a_n, b_n)$ | Etheron-centred three-point pathway: a central etheron $e$ with two other support points $a_n$ and $b_n$. |
| $\eta$ | Mixing parameter between the boundary of the seen object and the wake left by its sequential frames. |
| $J(\varphi_n)$ | RSG phase action norm, $J = \Theta_n^2 + \ell^2\Pi_n^2$. |
| $W(\varphi_n)$ | RSG phase exposure weight, $W = \Theta_n^2/J(\varphi_n)$. |
| $W_\Omega(\varphi_n)$ | Optional curvature-aware phase exposure weight. |
| $B_D^\rho(X_n)$ | Boundary exposure ratio obtained after applying the positive readout $\rho$ to Surtea's internal and field measures. When the readout is fixed, the shorter notation $B_D(X_n)$ is also used. |
| $E_s, p_s, m_s$ | Support energy, support momentum or flow, and effective support mass in the Surtea-Austin support triangle. |
| $\delta_{\text{Pyth}}$ | Pythagorean defect: the amount by which the readout support triangle misses ideal quadratic closure. |
| $\Delta_{\text{bd}}$ | Boundary defect: change in the $\mathcal{D}$-boundary layer of the support. |
| $\Delta_{\text{class}}$ | Surtea class defect: change in the topological class of the support. |
| $\Delta_{\text{int}}$ | Interaction defect: boundary or interaction-instability change. |
| $\Gamma(\sigma_n)$ | Survival-loss coefficient of the full structured state. |
| $\Lambda_n$ | Effective local loss rate, $\Lambda_n = \Gamma(\sigma_n)W(\varphi_n)$. |
| $\Lambda_\Omega$ | Curvature-aware effective loss rate. |

## Reading the Support Operators

The symbol $\pi$ is used because the operators act like projections from an arbitrary subset of $M$ to a better-organised topological subset. The decoration tells the reader which projection is meant:

$$\mathring{\pi}_{\mathcal{D}}(X) = \mathring{\pi}_{\mathcal{D}}(X) = X^{\circ} \qquad \text{means the } \mathcal{D}\text{-interior projection.} \tag{3}$$

$$\overline{\pi}_{\mathcal{D}}(X) = \overline{\pi}_{\mathcal{D}}(X) = \overline{X}^{\mathcal{D}} \qquad \text{means the } \mathcal{D}\text{-closure projection.} \tag{4}$$

Thus the bar in $\overline{\pi}_{\mathcal{D}}$ is not a hat and not an average. It means closure. In plain language, $\overline{\pi}_{\mathcal{D}}(X)$ is the support obtained by adding every $\mathcal{D}$-cell that touches $X$. The small circle in $\mathring{\pi}_{\mathcal{D}}$ means interior. $\mathring{\pi}_{\mathcal{D}}(X)$ is the support obtained by keeping only those $\mathcal{D}$-cells that sit wholly inside $X$.

The boundary is the difference between these two projections:

$$\partial_{\mathcal{D}} X = \overline{\pi}_{\mathcal{D}}(X) \setminus \mathring{\pi}_{\mathcal{D}}(X). \tag{5}$$

## Surtea's Geometry Comes Before Metric

Traian Surtea's point is that a partitioned object $(M, \mathcal{D})$ is already a geometric object in a very broad sense, before coordinates, metric, norm, parallelism, or curvature have been introduced. In this reading, a geometric space is a pair [1]

$$G = (M, \mathcal{G}), \tag{6}$$

where $M$ is a non-empty set and $\mathcal{G}$ is a non-empty family of non-empty subsets, called geometrical figures. A partitioned space $(M, \mathcal{D})$ is then a special case, because the cells of $\mathcal{D}$ are available as figures. Topological and measure spaces can also be read as special cases of this broader idea. Standard topology supplies one familiar special case [4].

At that level, any notion like congruence has to be introduced separately. For example, one may use a group such as $\mathrm{bsp}_M(F)$, the separating bijections of $M$ which leave a chosen figure $F \in \mathcal{G}$ invariant. That is still not the same thing as having coordinates or a metric.

This matters for the triangle analogy. At the Surtea level alone, there is no given norm for the sets

$$\overline{\pi}_{\mathcal{D}}(X), \qquad \mathring{\pi}_{\mathcal{D}}(X), \qquad \partial_{\mathcal{D}} X. \tag{7}$$

Therefore the Pythagorean formulas in this note must be read as a later positive readout, not as the bare Surtea geometry itself. Surtea's measurable study of a potential supplies a measure first, but its values live in $R$, not automatically in $\mathbb{R}_{\geq 0}$. The triangle ratio appears only after one declares how those $R$-values are to be read as positive exposure values.

For the same reason, the closure split will be written with ordinary union:

$$\overline{\pi}_{\mathcal{D}}(X) = \mathring{\pi}_{\mathcal{D}}(X) \cup \partial_{\mathcal{D}} X. \tag{8}$$

The pieces are already disjoint by definition, since $\partial_{\mathcal{D}} X = \overline{\pi}_{\mathcal{D}}(X) \setminus \mathring{\pi}_{\mathcal{D}}(X)$. The symbol $\cup$ therefore keeps the notation simple and avoids suggesting that an extra disjoint-union construction has been added.

## Surtea's Measurable Potential

For the measurable study of one potential, start with a function on the cells of the partition:

$$\mu : \mathcal{D} \to R. \tag{9}$$

This is then extended, with the same notation, to the topology generated by the partition:

$$\mu : [\mathcal{D}] \to R. \tag{10}$$

The value domain $R$ is not being assumed to be the positive real line:

$$R \not\equiv \mathbb{R}_{\geq 0}. \tag{11}$$

The point is that arbitrary subsets $X \subseteq M$ are not measured directly. They are first passed through the Surtea operators. This gives four basic measurable shadows of $X$:

$$\overline{\mu}, \mathring{\mu}, \widetilde{\mu} : \mathcal{P}(M) \to R. \tag{12}$$

$$\overline{\mu}(X) := \mu(\overline{\pi}_{\mathcal{D}}(X)), \tag{13}$$

$$\mathring{\mu}(X) := \mu(\mathring{\pi}_{\mathcal{D}}(X)), \tag{14}$$

$$\widetilde{\mu}(X) := \mu(\partial_{\mathcal{D}} X), \tag{15}$$

and, for disjoint $X$ and $Y$,

$$\widehat{\mu} : \{(X, Y) \in \mathcal{P}(M)^2 \mid X \cap Y = \varnothing\} \to R. \tag{16}$$

$$\widehat{\mu}(X, Y) := \mu(\overline{\pi}_{\mathcal{D}}(X) \cap \overline{\pi}_{\mathcal{D}}(Y)), \qquad X \cap Y = \varnothing. \tag{17}$$

The readings are:

| **Measure** | **Reading** |
|---|---|
| $\overline{\mu}(X)$ | External or total measure of the support. |
| $\mathring{\mu}(X)$ | Internal or proper measure of the support. |
| $\widetilde{\mu}(X)$ | Field measure, or capacity of interaction. |
| $\widehat{\mu}(X, Y)$ | Interaction measure of two disjoint supports. |

This is the Surtea-native measurable layer. The later triangle diagrams use a positive readout

$$\rho : R \to \mathbb{R}_{\geq 0} \tag{18}$$

and the composite notation

$$\rho_{\mu}(Y) := \rho(\mu(Y)). \tag{19}$$

Only after this readout is declared do expressions such as boundary ratios, Pythagorean support triangles, and monotone survival penalties become available. In plain English: Surtea first tells us what the measurable shadows are; the bridge then decides how to read those shadows as exposure.

# 3 Surtea Vocabulary and Binary Classification

Surtea's terminology is unusual on purpose. In this note, words such as "photon", "lighton", "spation", and "tempon" are not being used as ordinary physics words. They are formal labels for parts of a topology built from a partition. The safest way to read them is:

> First read the set-theoretic definition. Only then read the physical interpretation.

## 3.1 Photons, Etherons, and Gluons

The universe is

$$\mathbb{U} = (M, \mathcal{D}), \tag{20}$$

where $M$ is a non-empty set and $\mathcal{D}$ is a partition of $M$. A partition means that $M$ is cut into non-overlapping non-empty pieces:

$$D \neq \varnothing, \qquad D_i \cap D_j = \varnothing \quad (i \neq j), \qquad \bigcup_{D \in \mathcal{D}} D = M. \tag{21}$$

Each element

$$D \in \mathcal{D} \tag{22}$$

is called a $\mathcal{D}$-photon. In the present note, a $\mathcal{D}$-photon is a cell of the partition. It is not automatically a photon of electromagnetic physics. It is an indivisible topological cell relative to the chosen partition.

If a $\mathcal{D}$-photon contains exactly one material point,

$$\{a\} \in \mathcal{D}, \tag{23}$$

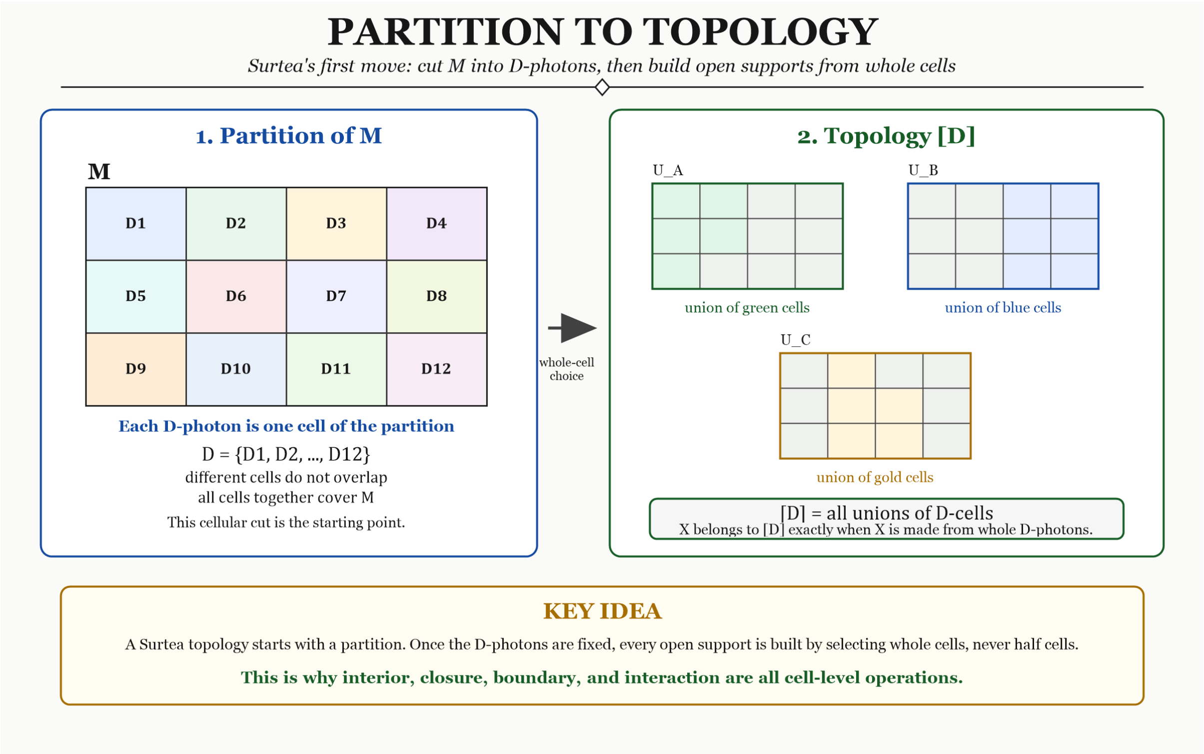
then it is called an absolute etheron. If a $\mathcal{D}$-photon contains exactly two material points,

$$G = \{g_1, g_2\} \in \mathcal{D}, \tag{24}$$

then it is called an absolute gluon.

For a high-school reader: imagine drawing a map on graph paper. Each square, hexagon, or tile is a cell. Surtea calls those basic cells $\mathcal{D}$-photons. A one-point cell is an etheron. A two-point cell is a gluon. These are names inside the formal construction, not claims that graph-paper tiles are ordinary particles.

This figure is the foundation for the rest of the note. Once $\mathcal{D}$ is fixed, interior, closure, boundary, lighton, undon, interaction, and refinement are all cell-level notions.



*Surtea's first move: cut M into D-photons, then build open supports from whole cells*

**Each D-photon is one cell of the partition**

D = {D1, D2, ..., D12}
different cells do not overlap
all cells together cover M
This cellular cut is the starting point.

[D] = all unions of D-cells
X belongs to [D] exactly when X is made from whole D-photons.

A Surtea topology starts with a partition. Once the D-photons are fixed, every open support is built by selecting whole cells, never half cells.

**This is why interior, closure, boundary, and interaction are all cell-level operations.**

Figure 1: Partition to topology. The universe $M$ is first cut into $\mathcal{D}$-photons. The topology $[\mathcal{D}]$ is then built from all unions of those whole cells.

## 3.2 Open-Closed Supports

The topology generated by $\mathcal{D}$ is

$$[\mathcal{D}] = \{\cup[\mathcal{A}] \mid \mathcal{A} \subseteq \mathcal{D}\}. \tag{25}$$

This means that a $\mathcal{D}$-open set is any union of $\mathcal{D}$-photons. Because the topology is closed-open, every element of $[\mathcal{D}]$ is both open and closed. Such sets are the cleanly cell-aligned supports.

A subset $X \subseteq M$ is sparse when it has empty interior:

$$X \text{ is sparse} \quad \Longleftrightarrow \quad X^\circ = \varnothing. \tag{26}$$

It is dense when its closure is all of $M$:

$$X \text{ is dense} \quad \Longleftrightarrow \quad \overline{X} = M. \tag{27}$$

These two yes-or-no properties help explain the names in the classification table below.

## 3.3 The Binary Matrix Behind the Names

Surtea classifies subsets by the chain

$$\varnothing \subseteq X^\circ \subseteq X \subseteq \overline{X} \subseteq M. \tag{28}$$

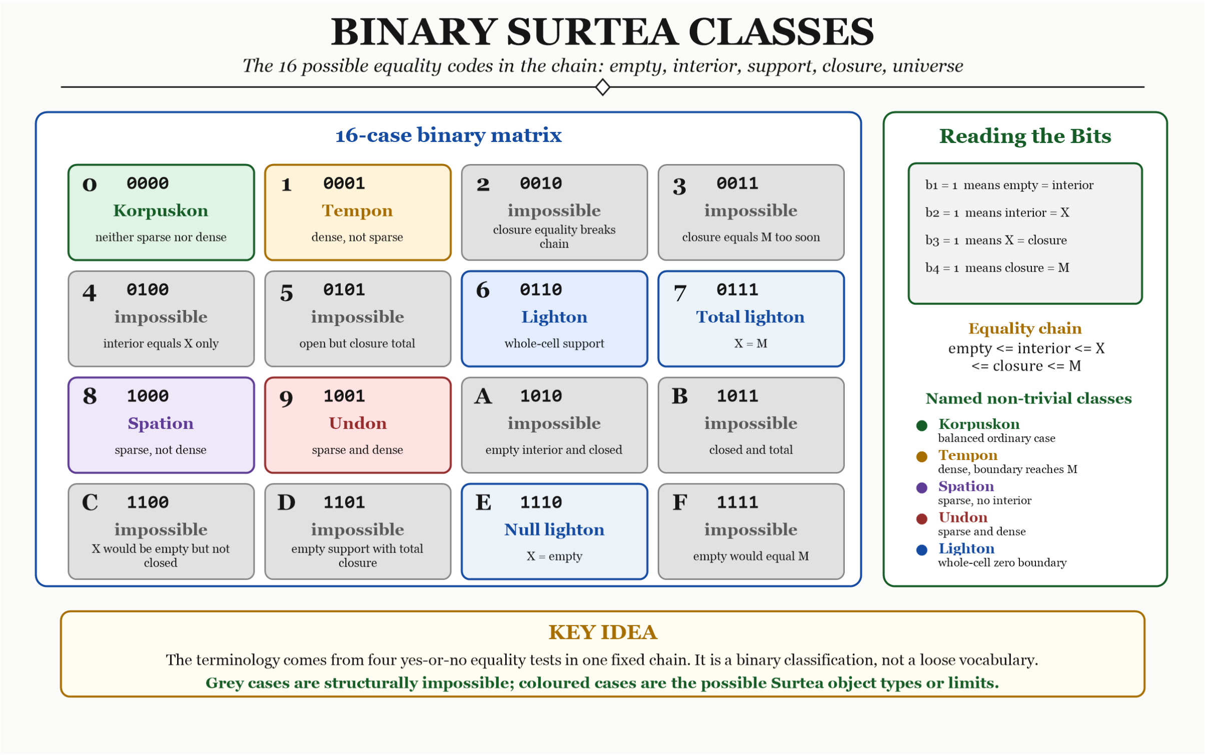
There are four possible places where equality might occur. The binary code $b_1b_2b_3b_4$ records equality by 1 and strict separation by 0:

$$\begin{aligned} b_1 = 1 &\iff \varnothing = X^\circ, \\ b_2 = 1 &\iff X^\circ = X, \\ b_3 = 1 &\iff X = \overline{X}, \\ b_4 = 1 &\iff \overline{X} = M. \end{aligned} \tag{29}$$

Thus 0000 means no equality occurs in the chain, while 1001 means $\varnothing = X^\circ$ and $\overline{X} = M$.

| **Hex** | **Binary** | **Structure** | **Topological character** | **Name** |
|---|---|---|---|---|
| 0 | 0000 | $\varnothing \neq X^\circ \neq X \neq \overline{X} \neq M$ | neither sparse nor dense | $\mathcal{D}$-korpuskon |
| 1 | 0001 | $\varnothing \neq X^\circ \neq X \neq \overline{X} = M$ | dense, not sparse | $\mathcal{D}$-tempon |
| 2 | 0010 | $\varnothing \neq X^\circ \neq X = \overline{X} \neq M$ | impossible | – |
| 3 | 0011 | $\varnothing \neq X^\circ \neq X = \overline{X} = M$ | impossible | – |
| 4 | 0100 | $\varnothing \neq X^\circ = X \neq \overline{X} \neq M$ | impossible | – |
| 5 | 0101 | $\varnothing \neq X^\circ = X \neq \overline{X} = M$ | impossible | – |
| 6 | 0110 | $\varnothing \neq X^\circ = X = \overline{X} \neq M$ | $X \in [\mathcal{D}]$, not sparse, not dense | $\mathcal{D}$-lighton |
| 7 | 0111 | $\varnothing \neq X^\circ = X = \overline{X} = M$ | $X = M$ | total lighton |
| 8 | 1000 | $\varnothing = X^\circ \neq X \neq \overline{X} \neq M$ | sparse, not dense | $\mathcal{D}$-spation |
| 9 | 1001 | $\varnothing = X^\circ \neq X \neq \overline{X} = M$ | sparse and dense | $\mathcal{D}$-undon |
| A | 1010 | $\varnothing = X^\circ \neq X = \overline{X} \neq M$ | impossible | – |
| B | 1011 | $\varnothing = X^\circ \neq X = \overline{X} = M$ | impossible | – |
| C | 1100 | $\varnothing = X^\circ = X \neq \overline{X} \neq M$ | impossible | – |
| D | 1101 | $\varnothing = X^\circ = X \neq \overline{X} = M$ | impossible | – |
| E | 1110 | $\varnothing = X^\circ = X = \overline{X} \neq M$ | $X = \varnothing$ | null lighton |
| F | 1111 | $\varnothing = X^\circ = X = \overline{X} = M$ | impossible | – |

The diagram above is the same classification as the table, but in a form that is easier to scan. It is useful because the terminology should feel forced by the binary structure, not invented after the fact.



**BINARY SURTEA CLASSES**

*The 16 possible equality codes in the chain: empty, interior, support, closure, universe*

**16-case binary matrix**

| | | | |
|---|---|---|---|
| **0** `0000`<br>**Korpuskon**<br>neither sparse nor dense | **1** `0001`<br>**Tempon**<br>dense, not sparse | **2** `0010`<br>**impossible**<br>closure equality breaks chain | **3** `0011`<br>**impossible**<br>closure equals M too soon |
| **4** `0100`<br>**impossible**<br>interior equals X only | **5** `0101`<br>**impossible**<br>open but closure total | **6** `0110`<br>**Lighton**<br>whole-cell support | **7** `0111`<br>**Total lighton**<br>X = M |
| **8** `1000`<br>**Spation**<br>sparse, not dense | **9** `1001`<br>**Undon**<br>sparse and dense | **A** `1010`<br>**impossible**<br>empty interior and closed | **B** `1011`<br>**impossible**<br>closed and total |
| **C** `1100`<br>**impossible**<br>X would be empty but not closed | **D** `1101`<br>**impossible**<br>empty support with total closure | **E** `1110`<br>**Null lighton**<br>X = empty | **F** `1111`<br>**impossible**<br>empty would equal M |

**Reading the Bits**

b1 = 1 means empty = interior
b2 = 1 means interior = X
b3 = 1 means X = closure
b4 = 1 means closure = M

**Equality chain**

empty <= interior <= X
<= closure <= M

**Named non-trivial classes**

- **Korpuskon** balanced ordinary case
- **Tempon** dense, boundary reaches M
- **Spation** sparse, no interior
- **Undon** sparse and dense
- **Lighton** whole-cell zero boundary

**KEY IDEA**

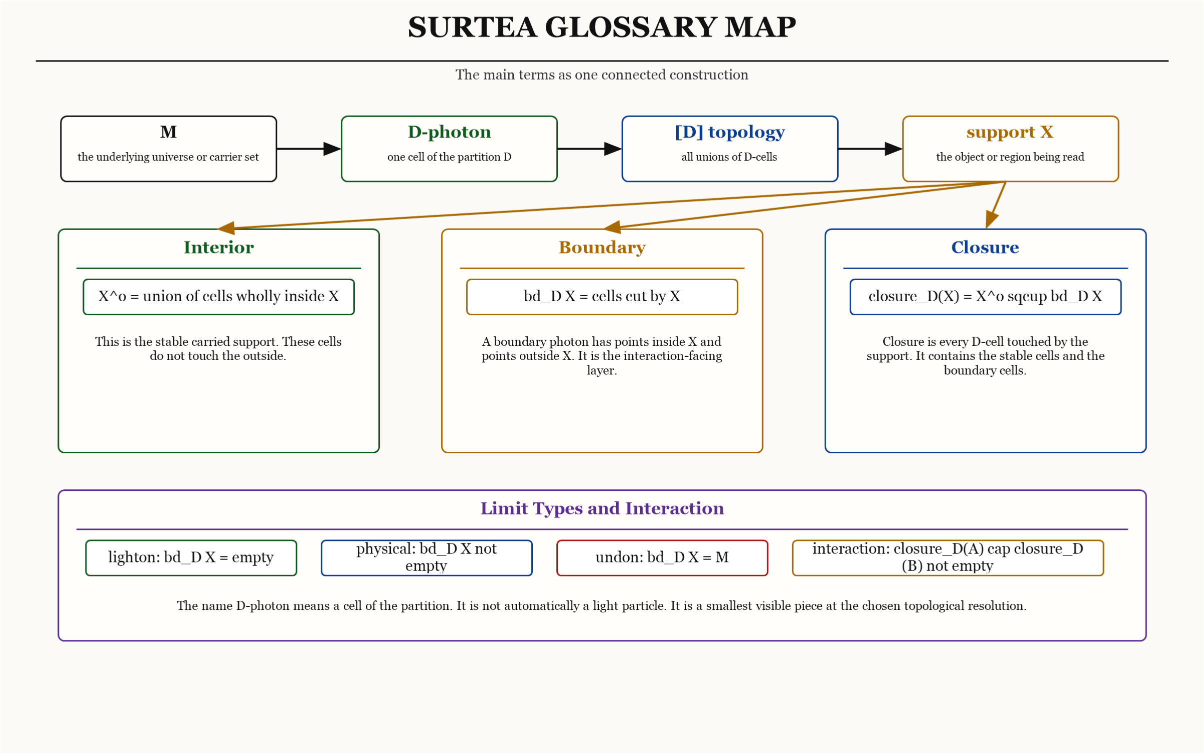
The terminology comes from four yes-or-no equality tests in one fixed chain. It is a binary classification, not a loose vocabulary.

**Grey cases are structurally impossible; coloured cases are the possible Surtea object types or limits.**

Figure 2: Binary Surtea classes. The names come from four equality tests in the chain $\varnothing \subseteq X^\circ \subseteq X \subseteq \overline{X} \subseteq M$. Coloured cases are possible classes or limits; grey cases are structurally impossible.

## 3.4 Plain-English Glossary

| **Term** | **Plain-English reading** |
|---|---|
| $\mathcal{D}$-photon | A basic cell of the partition $\mathcal{D}$. It is the smallest topological piece available at that resolution. |
| Etheron | A one-point $\mathcal{D}$-photon. It is a cell containing exactly one material point. |
| Gluon | A two-point $\mathcal{D}$-photon. It is a cell containing exactly two material points. |
| Lighton | A clean union of $\mathcal{D}$-photons. It is already open and closed in $[\mathcal{D}]$, so its boundary is empty. Proper lightons are topological objects, but in this note they are not interaction-bearing physical objects. |
| Spation | A sparse, non-dense support: it has empty interior but does not fill all of $M$ by closure. It behaves like a space-like sparse object in the naming scheme. |
| Tempon | A dense, non-sparse support: it has non-empty interior and closure $M$. It behaves like a time-like dense object in the naming scheme. |
| Korpuskon | A support with non-empty interior and non-total closure. It is neither sparse nor dense and is the most ordinary body-like class in the naming scheme. |
| Undon | A support that is both sparse and dense: empty interior but total closure. Its boundary is maximal. |



This is the stable carried support. These cells do not touch the outside.

A boundary photon has points inside X and points outside X. It is the interaction-facing layer.

Closure is every D-cell touched by the support. It contains the stable cells and the boundary cells.

The name D-photon means a cell of the partition. It is not automatically a light particle. It is a smallest visible piece at the chosen topological resolution.

Figure 3: Surtea glossary map. The construction starts with $M$, cuts it into $\mathcal{D}$-photons, forms the topology $[\mathcal{D}]$, and then reads a support $X$ through its interior, boundary, and closure.

This glossary map is included early because the words are doing a lot of work. A $\mathcal{D}$-photon is first of all a cell of the partition. It becomes part of the interior, boundary, or closure only after a support $X$ is chosen. In other words, the same cell may be harmless background for one support and a boundary photon for another.

The support triangle mainly concerns the non-trivial boundary-bearing cases: spations, tempons, korpuskons, and undons. Lightons are important because they show the limiting case of zero boundary. Undons show the opposite limiting case of maximal boundary.

This contrast is especially important for the word physical. Proper lightons remain topological objects, but they do not carry the boundary layer needed for non-trivial interaction. Undons show the opposite risk: the support is so boundary-exposed that every $\mathcal{D}$-photon belongs to the boundary.

# 4 Chart 1: The Surtea Support Triangle

# 5 Surtea Cells: The Triangle Is Only a Boundary Diagnostic

The most important point is this: the triangle is not the object. The object is the underlying support $X_n$, carried by the recursive state $\sigma_n$. In a Surtea topology, that support is understood through the $\mathcal{D}$-cells of the partition. The triangle is a compact way to measure how much of the support is interior and how much of it is boundary-facing.

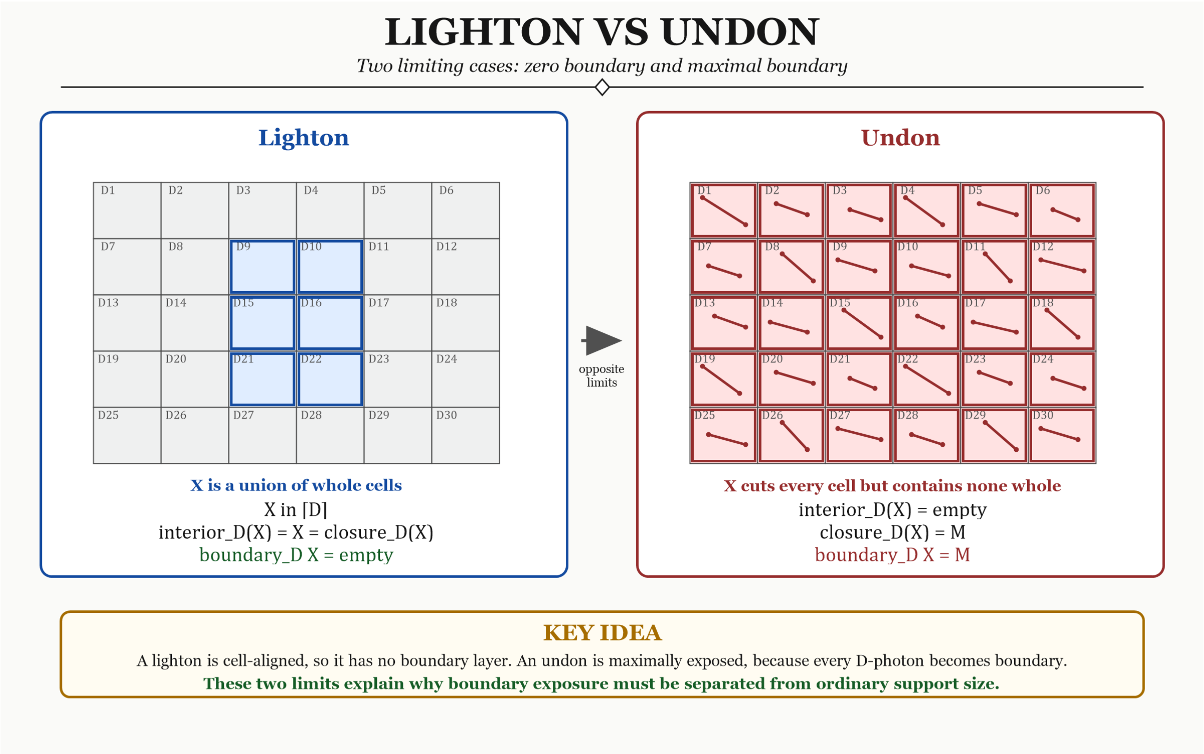


Figure 4: Lighton and undon as opposite boundary limits. A lighton is a clean union of $\mathcal{D}$-cells, so its boundary is empty. An undon cuts every cell without containing any cell whole, so its boundary is maximal.

For a high-school reader, imagine a map made of tiles. Each tile is a $\mathcal{D}$-cell. A support $X_n$ is a region made from some of those tiles, or from a shape that cuts across them. The cells fully inside the region make up the interior. The cells touched by the edge make up the boundary field. The closure is what you get after including all cells needed to cover the region.

This is the most important local picture. The smooth drawn region is only seen through the partition. Surtea's boundary is therefore a cellular band, not a thin geometric line.

## 5.1 The Cell Formulas

The $\mathcal{D}$-interior is the union of all $\mathcal{D}$-cells that sit wholly inside $X_n$:

$$\mathring{\pi}_{\mathcal{D}}(X_n) = \bigcup\{D \in \mathcal{D} \mid D \subseteq X_n\}. \tag{30}$$

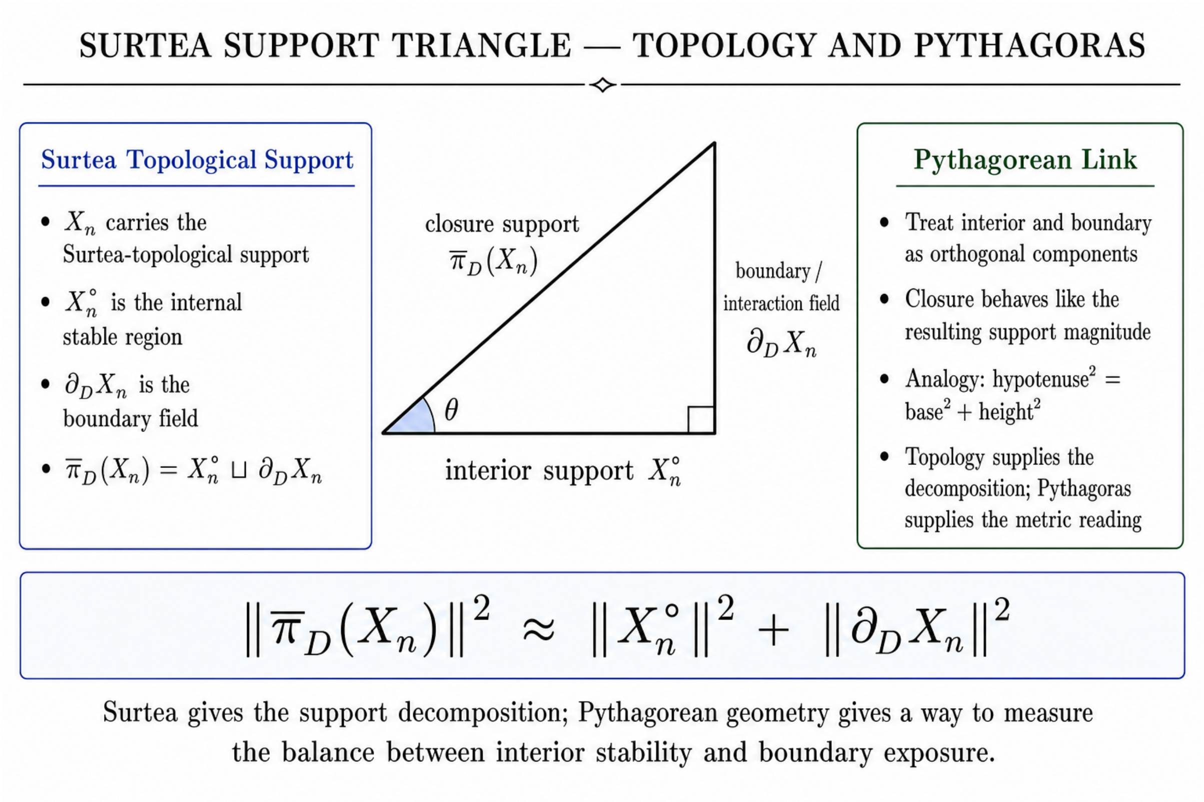
The $\mathcal{D}$-closure is the union of all $\mathcal{D}$-cells that touch $X_n$:

$$\overline{\pi}_{\mathcal{D}}(X_n) = \bigcup\{D \in \mathcal{D} \mid D \cap X_n \neq \varnothing\}. \tag{31}$$

The $\mathcal{D}$-boundary is the part of the closure that is not interior:

$$\partial_{\mathcal{D}} X_n = \overline{\pi}_{\mathcal{D}}(X_n) \setminus \mathring{\pi}_{\mathcal{D}}(X_n). \tag{32}$$

Equivalently, it is the union of all $\mathcal{D}$-cells that touch both $X_n$ and the outside of $X_n$:



**SURTEA SUPPORT TRIANGLE — TOPOLOGY AND PYTHAGORAS**

**Surtea Topological Support**

- $X_n$ carries the Surtea-topological support
- $X_n^\circ$ is the internal stable region
- $\partial_D X_n$ is the boundary field
- $\overline{\pi}_D(X_n) = X_n^\circ \sqcup \partial_D X_n$

**Pythagorean Link**

- Treat interior and boundary as orthogonal components
- Closure behaves like the resulting support magnitude
- Analogy: hypotenuse$^2$ = base$^2$ + height$^2$
- Topology supplies the decomposition; Pythagoras supplies the metric reading

$$\|\overline{\pi}_D(X_n)\|^2 \approx \|X_n^\circ\|^2 + \|\partial_D X_n\|^2$$

Surtea gives the support decomposition; Pythagorean geometry gives a way to measure the balance between interior stability and boundary exposure.

Figure 5: Surtea support triangle. The closure support is read as the whole support, with interior support and boundary field as two components.

$$\partial_{\mathcal{D}} X_n = \bigcup \{D \in \mathcal{D} \mid D \cap X_n \neq \varnothing \text{ and } D \cap (M \setminus X_n) \neq \varnothing\}. \tag{33}$$

That last formula is the cellular reason the boundary is an interaction field. A boundary cell is not purely inside and not purely outside. It is a contact cell. It sees both the support and its complement.

## 5.2 Boundary Photons and Interaction

For two disjoint supports $A$ and $B$, interaction is not modelled as the ordinary overlap $A \cap B$. The supports may be disjoint while their $\mathcal{D}$-closures still meet. In that case the interaction is mediated by the $\mathcal{D}$-photons that lie in both boundary layers.

For disjoint $A$ and $B$, this gives the exact boundary reading

$$\overline{\pi}_{\mathcal{D}}(A) \cap \overline{\pi}_{\mathcal{D}}(B) = \partial_{\mathcal{D}} A \cap \partial_{\mathcal{D}} B. \tag{34}$$

The measurable interaction channel is therefore

$$\widehat{\mu}(A, B) = \mu(\overline{\pi}_{\mathcal{D}}(A) \cap \overline{\pi}_{\mathcal{D}}(B)) = \mu(\partial_{\mathcal{D}} A \cap \partial_{\mathcal{D}} B), \qquad A \cap B = \varnothing. \tag{35}$$

The figure makes the formula concrete: the interaction lives in shared boundary cells, not in ordinary set overlap. In Surtea's measurable language, $\widehat{\mu}(A, B)$ measures that shared channel.

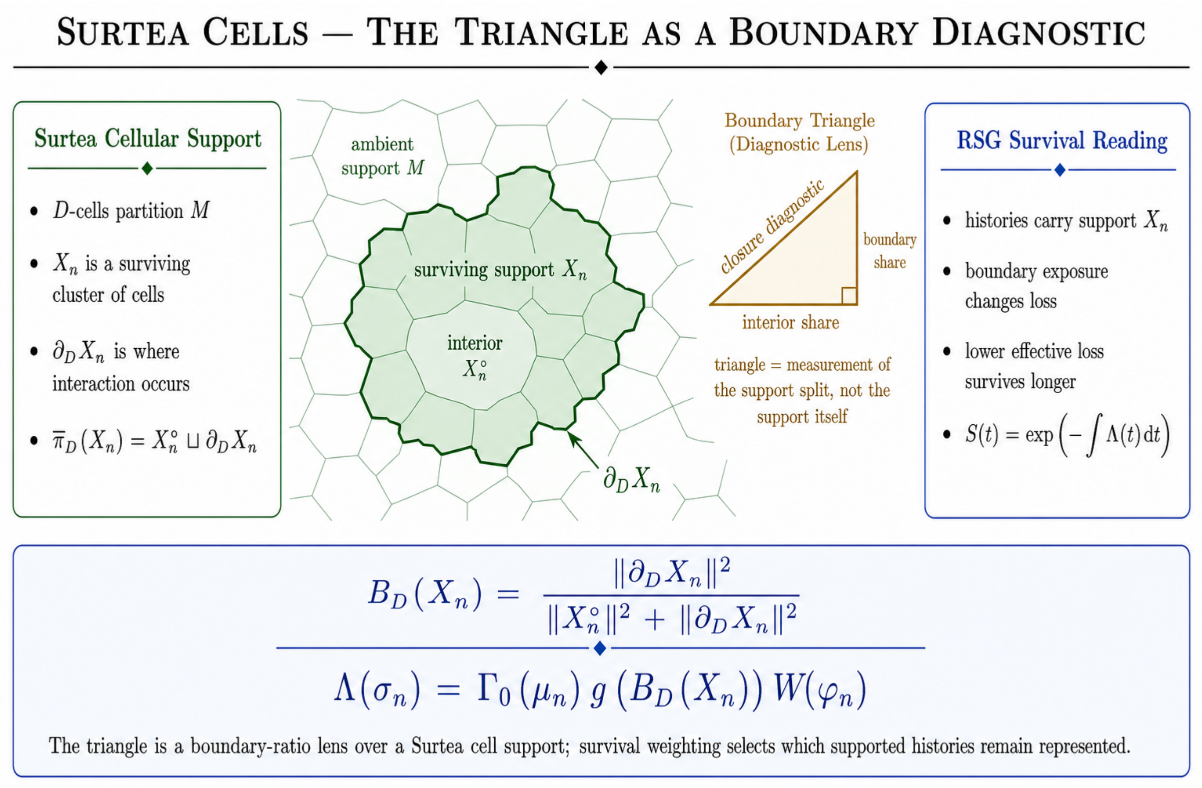


Figure 6: Surtea cellular support. The underlying object is the surviving cluster of $\mathcal{D}$-cells. The triangle is a diagnostic lens that measures the split between interior support and boundary exposure.

## 5.3 Why the Triangle Is Merely a Lens

The exact topological statement is the closure split

$$\overline{\pi}_{\mathcal{D}}(X_n) = X_n^\circ \cup \partial_{\mathcal{D}} X_n. \tag{36}$$

The two pieces are disjoint, but the ordinary union symbol is enough. This statement is about sets of cells. It is not yet a right triangle. The right triangle appears only after Surtea's measurable potential has been passed through a positive readout. Define

$$I_n^2 = \rho_\mu(X_n^\circ)\,, \qquad Q_n^2 = \rho_\mu(\partial_{\mathcal{D}} X_n)\,, \qquad C_n^2 = \rho_\mu(\overline{\pi}_{\mathcal{D}}(X_n))\,. \tag{37}$$

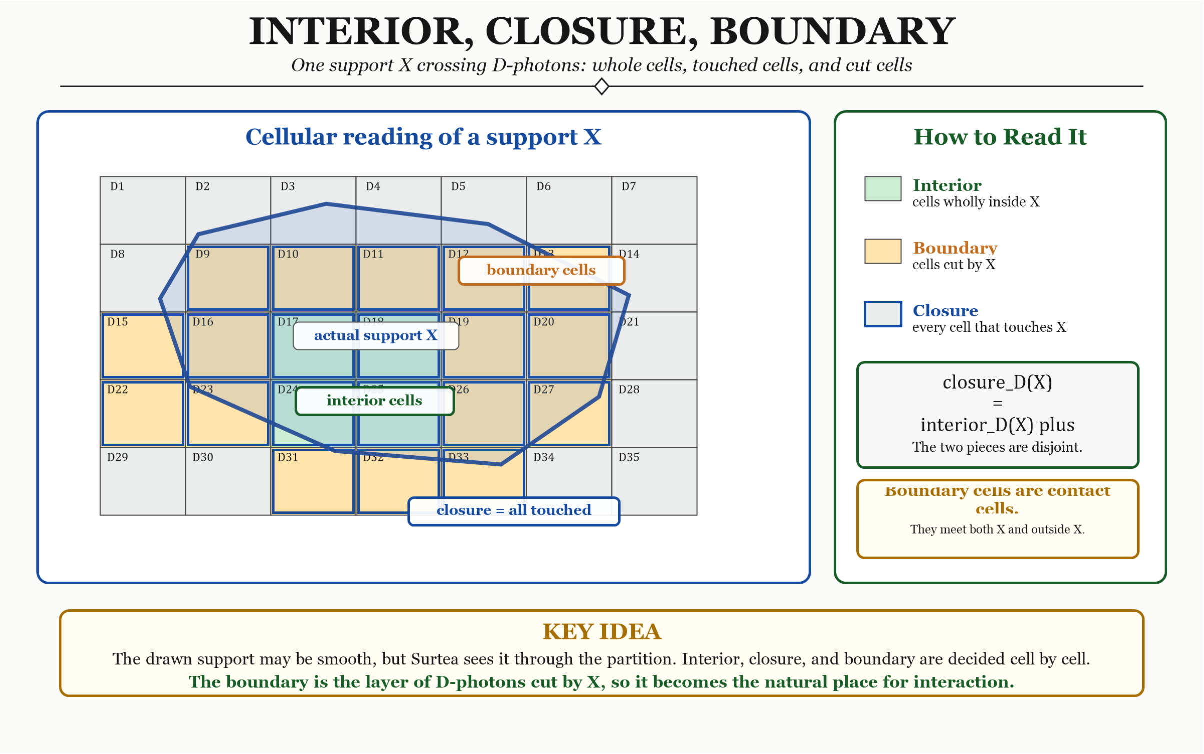
If the chosen readout is additive on the disjoint pieces used here, then

$$C_n^2 = I_n^2 + Q_n^2. \tag{38}$$

This is why the diagnostic triangle can be drawn. The base represents interior share. The height represents boundary share. The hypotenuse represents the measured closure support. But the real support is still the cell cluster. The triangle is like a speedometer: it tells you something important about the object, but it is not the object itself.

## 5.4 Counting Cells: The Simplest Positive Readout

The simplest positive readout is just a cell count. This is not the only possible reading of Surtea's $R$-valued measure, but it is the clearest toy case. Suppose the closure of a



The two pieces are disjoint.

They meet both X and outside X.

The drawn support may be smooth, but Surtea sees it through the partition. Interior, closure, and boundary are decided cell by cell.

**The boundary is the layer of D-photons cut by X, so it becomes the natural place for interaction.**

Figure 7: Interior, closure, and boundary. Interior cells sit wholly inside the support, closure cells are all cells touched by the support, and boundary cells are the cells cut by the support.

support contains 20 relevant $\mathcal{D}$-cells. Suppose 12 of them are interior cells and 8 are boundary cells. Then

$$C_n^2 = 20, \qquad I_n^2 = 12, \qquad Q_n^2 = 8. \tag{39}$$

The boundary exposure ratio is

$$B_D^\rho(X_n) = \frac{Q_n^2}{I_n^2 + Q_n^2} = \frac{8}{12+8} = 0.4. \tag{40}$$

In plain language, 40% of the readout support is boundary-facing. That does not mean 40% of the object disappears. It means 40% of the readout support is in the contact region where interaction, deformation, or loss can couple to the history.

## 5.5 How This Enters Survival

In RSG, a history does not survive because it has no boundary. It survives because its accumulated effective loss is lower than that of competing histories. The local loss rate is

$$\Lambda(\sigma_n) = \Gamma_0(\mu_n^{\text{phys}})\, g(B_D^\rho(X_n))\, W(\varphi_n). \tag{41}$$

The survival law is

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Lambda(\sigma)S. \tag{42}$$

The solution is

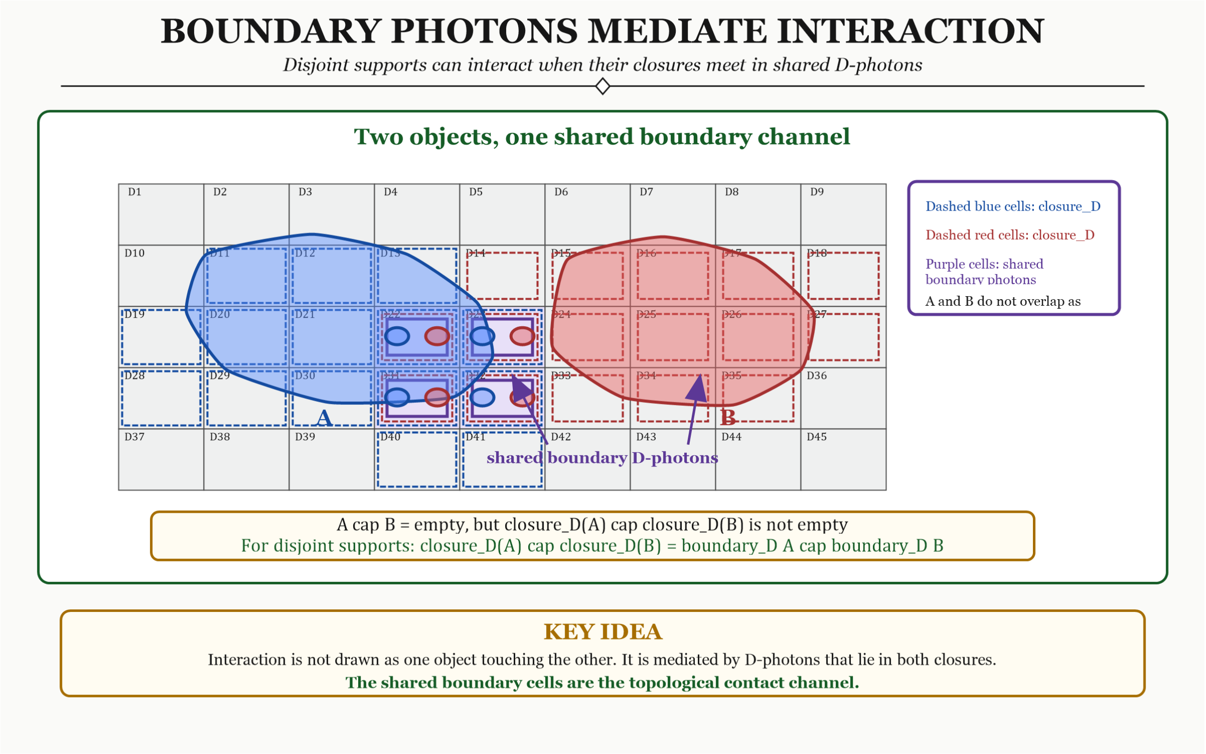


Figure 8: Boundary photons mediate interaction. The supports $A$ and $B$ are disjoint, but their closures meet in shared $\mathcal{D}$-photons. These shared boundary cells form the topological contact channel.

$$S(t) = S(0)\exp\left(-\int_0^t \Lambda(\sigma(\tau))\,\mathrm{d}\tau\right). \tag{43}$$

For a high-school reader, this says:

> Every history carries a score. Boundary exposure can make that score fall faster. A history with a smaller boundary penalty keeps more of its score. After many histories are compared, the ones with more score left are the ones that remain strongly represented.

## 5.6 The Support That Survives

The surviving thing is not the drawn triangle. What survives is a weighted history carrying support:

$$\gamma_i = \{\sigma_{i,0}, \sigma_{i,1}, \ldots, \sigma_{i,N}\}, \qquad \sigma_{i,k} = (X_{i,k}, \varphi_{i,k}, \mu_{i,k}^{\mathrm{phys}}, S_{i,k}). \tag{44}$$

At each step, the support may have a different boundary ratio:

$$B_D^{\rho}(X_{i,k}) = \frac{\rho_\mu(\partial_{\mathcal{D}} X_{i,k})}{\rho_\mu\left(X_{i,k}^{\circ}\right) + \rho_\mu(\partial_{\mathcal{D}} X_{i,k})}. \tag{45}$$

The history's total survival after $N$ steps is

$$S_i(N) = S_i(0)\exp\left(-\sum_{k=0}^{N-1}\Gamma_0(\mu_{i,k}^{\mathrm{phys}})g(B_D^{\rho}(X_{i,k}))W(\varphi_{i,k})\Delta t\right). \tag{46}$$

So the triangle is a repeated diagnostic applied to the support as the history evolves. The cell support is the carried structure. The boundary ratio is the positive readout of Surtea's field measure. Survival weighting decides how strongly that supported history remains represented.

## 5.7 One-Sentence Summary

> Surtea cells are the underlying support, Surtea's measurable potential gives the field measure, the positive readout forms the boundary ratio, and RSG survival weighting decides which support-carrying histories persist.

## 5.8 The Exact Topological Split

In Surtea's partition topology, every subset $X_n \subseteq M$ has an interior, a closure, and a boundary. The boundary is

$$\partial_{\mathcal{D}} X_n = \overline{\pi}_{\mathcal{D}}(X_n) \setminus \mathring{\pi}_{\mathcal{D}}(X_n). \tag{47}$$

Therefore the closure decomposes as an ordinary union of already disjoint pieces:

$$\overline{\pi}_{\mathcal{D}}(X_n) = \mathring{\pi}_{\mathcal{D}}(X_n) \cup \partial_{\mathcal{D}} X_n. \tag{48}$$

Using the shorter notation $X_n^\circ = \mathring{\pi}_{\mathcal{D}}(X_n)$, this becomes

$$\overline{\pi}_{\mathcal{D}}(X_n) = X_n^\circ \cup \partial_{\mathcal{D}} X_n. \tag{49}$$

This formula is the topological heart of the triangle. It says:

> The whole carried support is made from a stable inside plus an exposed boundary.

## 5.9 From Surtea Measure to a Readout Triangle

The triangle picture is not automatic. Surtea's geometry does not itself give a norm on support sets, and Surtea's measurable potential takes values in $R$, not automatically in $\mathbb{R}_{\geq 0}$. To draw a Pythagorean triangle, we must choose a positive readout

$$\rho : R \to \mathbb{R}_{\geq 0}. \tag{50}$$

For support sets $Y \in [\mathcal{D}]$, write

$$\rho_\mu(Y) = \rho(\mu(Y)). \tag{51}$$

For example, this readout may come from a cell count, a magnitude, or some later physical weighting. If $A \cap B = \varnothing$, additivity of the readout means

$$\rho_\mu(A \cup B) = \rho_\mu(A) + \rho_\mu(B). \tag{52}$$

Applying this to the Surtea split gives

$$\rho_\mu(\overline{\pi}_{\mathcal{D}}(X_n)) = \rho_\mu(X_n^\circ) + \rho_\mu(\partial_{\mathcal{D}} X_n). \tag{53}$$

This is the Pythagorean reading:

$$\text{closure}^2 = \text{interior}^2 + \text{boundary}^2. \tag{54}$$

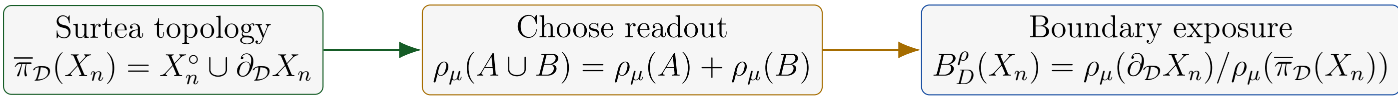
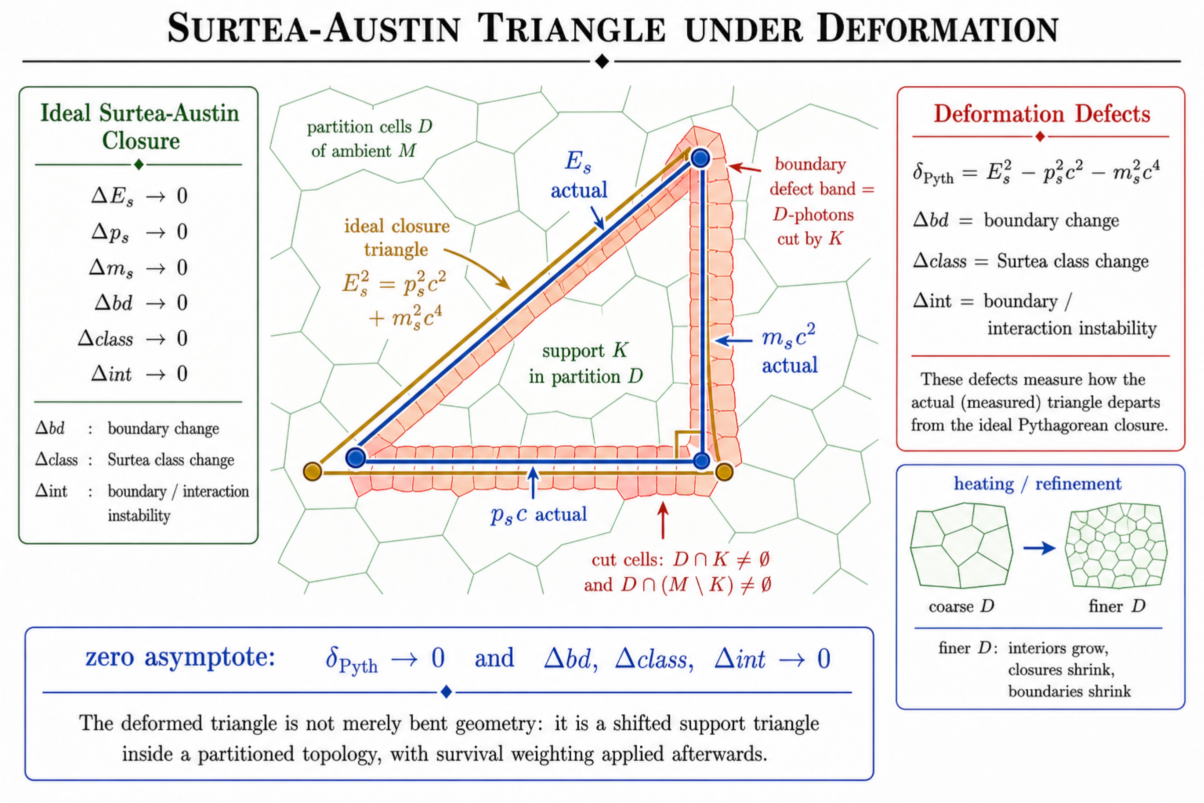


Figure 9: Intermediate bridge from Surtea decomposition to a measured boundary-exposure ratio.

# 6 Surtea-Austin Triangle Under Deformation



These defects measure how the actual (measured) triangle departs from the ideal Pythagorean closure.

The deformed triangle is not merely bent geometry: it is a shifted support triangle inside a partitioned topology, with survival weighting applied afterwards.

Figure 10: Surtea-Austin triangle under deformation. The ideal closure triangle is shown underneath, the readout support triangle is shifted, and the thick boundary defect band records the $\mathcal{D}$-cells cut by the support $K$.

A deformed Surtea-Austin triangle should not be pictured as a single bent Pythagorean triangle. The better picture is layered:

1. an ideal closure triangle, where the support closes cleanly;
2. a readout or deformed support triangle, where the support quantities have shifted;
3. a thick boundary-cell band, where the support cuts through $\mathcal{D}$-photons.

The third layer is the specifically Surtea part. In ordinary Euclidean geometry, the edge of a triangle is a thin line. In Surtea's partition topology, the boundary is not merely a line. It is a collection of $\mathcal{D}$-cells. A boundary cell is a cell that has some points inside the support and some points outside it.

## 6.1 The Ideal Support Triangle

The ideal support triangle has the Pythagorean form

$$E_s^2 = p_s^2 c^2 + m_s^2 c^4. \tag{55}$$

Here

$$E_s = \text{support energy}, \qquad p_s = \text{support momentum or flow}, \qquad m_s = \text{effective support mass}. \tag{56}$$

The ideal closure case is not only metric. It is also topological. In the ideal Surtea-Austin limit, the readout support approaches clean closure:

$$\begin{aligned} \Delta E_s &\to 0, \\ \Delta p_s &\to 0, \\ \Delta m_s &\to 0, \\ \Delta_{\text{bd}} &\to 0, \\ \Delta_{\text{class}} &\to 0, \\ \Delta_{\text{int}} &\to 0. \end{aligned} \tag{57}$$

For a high-school reader, this says: the ideal triangle is the target shape. The energy side, flow side, and mass side all fit together. At the same time, the support's boundary, topological type, and interaction behaviour are not changing unexpectedly.

## 6.2 The Measured Support Triangle

Under deformation, the actual readout support quantities are shifted away from their ideal values:

$$E_s = E_{s,0} + \Delta E_s, \qquad p_s = p_{s,0} + \Delta p_s, \qquad m_s = m_{s,0} + \Delta m_s. \tag{58}$$

The ideal quantities satisfy

$$E_{s,0}^2 = p_{s,0}^2 c^2 + m_{s,0}^2 c^4. \tag{59}$$

The readout quantities need not satisfy the same equation exactly. The Pythagorean defect is

$$\delta_{\text{Pyth}} = E_s^2 - p_s^2 c^2 - m_s^2 c^4. \tag{60}$$

If

$$\delta_{\text{Pyth}} = 0, \tag{61}$$

then the readout support triangle still lands exactly on the Pythagorean closure relation. If

$$\delta_{\text{Pyth}} \neq 0, \tag{62}$$

then the readout support triangle has a readout-level defect. Its sides no longer fit the ideal support relation exactly.

## 6.3 The Boundary Defect Band

Now comes the topological part. Let $K \subseteq M$ be the deformed support inside the partition $\mathcal{D}$. The $\mathcal{D}$-boundary is

$$\partial_{\mathcal{D}} K = \bigcup \{ D \in \mathcal{D} \mid D \cap K \neq \varnothing \text{ and } D \cap (M \setminus K) \neq \varnothing \}. \tag{63}$$

This is the boundary-cell band. It consists of exactly those $\mathcal{D}$-photons cut by the support $K$. These are not merely decorative cells on the drawing. They are the cells where the support is neither wholly inside nor wholly outside.

The boundary defect may be measured by comparing the actual boundary to an ideal boundary:

$$\Delta_{\mathrm{bd}} = \rho_\mu(\partial_{\mathcal{D}} K_{\mathrm{act}}) - \rho_\mu(\partial_{\mathcal{D}} K_0)\,. \tag{64}$$

Often one may use the absolute size

$$|\Delta_{\mathrm{bd}}| = |\rho_\mu(\partial_{\mathcal{D}} K_{\mathrm{act}}) - \rho_\mu(\partial_{\mathcal{D}} K_0)|\,. \tag{65}$$

Plain English:

> If the support cuts through more cells than it did before, the boundary band gets thicker. If it cuts through fewer cells, the boundary band shrinks.

## 6.4 Class and Interaction Defects

Surtea's classification depends on interior, closure, and boundary. Therefore deformation can change not only the metric triangle, but also the topological class of the support. We can write the support class as

$$\mathrm{Class}_{\mathcal{D}}(K) \in \{\mathrm{lighton}, \mathrm{spation}, \mathrm{tempon}, \mathrm{korpuskon}, \mathrm{undon}\}. \tag{66}$$

A simple class-change indicator is

$$\Delta_{\mathrm{class}} = \begin{cases} 0, & \mathrm{Class}_{\mathcal{D}}(K_{\mathrm{act}}) = \mathrm{Class}_{\mathcal{D}}(K_0), \\ 1, & \mathrm{Class}_{\mathcal{D}}(K_{\mathrm{act}}) \neq \mathrm{Class}_{\mathcal{D}}(K_0). \end{cases} \tag{67}$$

The interaction defect can be measured by the change in boundary exposure:

$$\Delta_{\mathrm{int}} = |B^\rho_D(K_{\mathrm{act}}) - B^\rho_D(K_0)|\,. \tag{68}$$

This works because $B^\rho_D(K)$ measures the boundary-facing share of the support after the positive readout:

$$B^\rho_D(K) = \frac{\rho_\mu(\partial_{\mathcal{D}} K)}{\rho_\mu(K^\circ) + \rho_\mu(\partial_{\mathcal{D}} K)}. \tag{69}$$

For a high-school reader: two triangles may look almost the same on paper, but if one cuts many more cells on the underlying grid, it is more exposed. That means its interaction and survival behaviour can be different even if the drawn triangle looks similar.

## 6.5 One Combined Deformation Vector

It is useful to collect the metric and topological defects into one diagnostic package:

$$\mathcal{D}_{\mathrm{def}}(K) = (\delta_{\mathrm{Pyth}}, \Delta_{\mathrm{bd}}, \Delta_{\mathrm{class}}, \Delta_{\mathrm{int}}) \,. \tag{70}$$

This vector says what kind of deformation has occurred. The first entry is metric. The other entries are topological and interaction-facing.

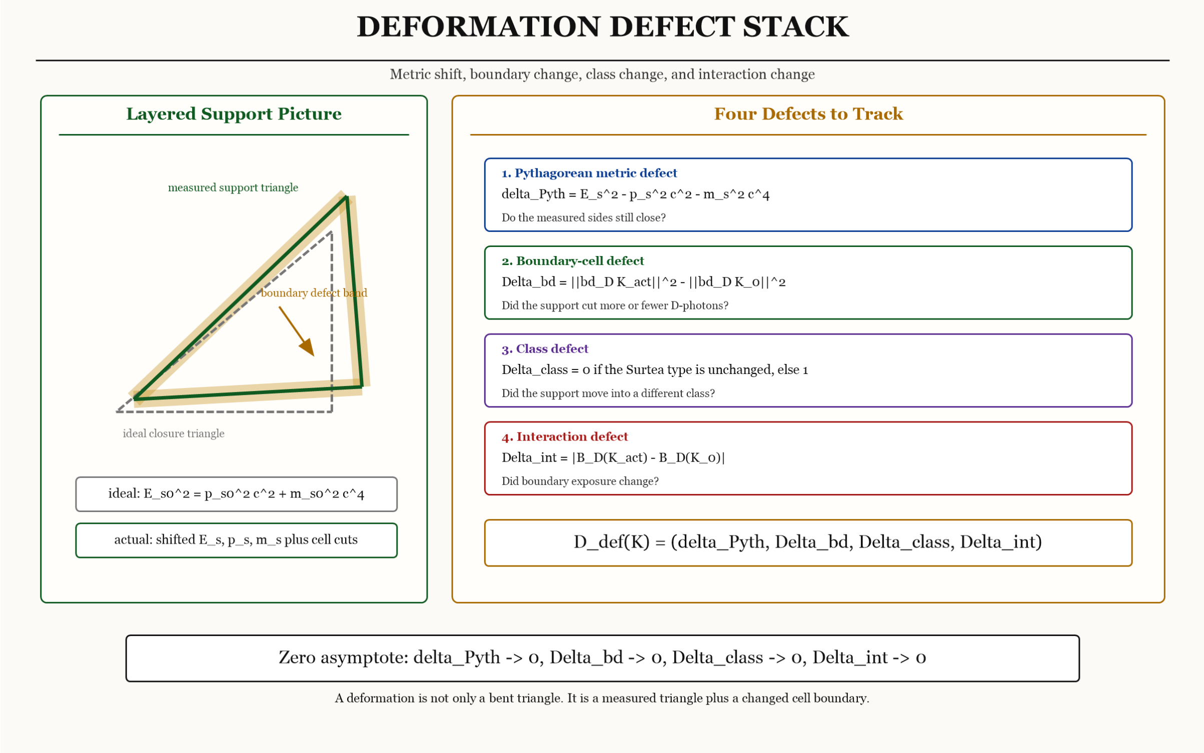


Figure 11: Deformation defect stack. A Surtea-Austin deformation records the readout-level failure of the triangle together with boundary change, class change, and interaction-exposure change.

The stack figure is useful because it prevents a common mistake. The deformation is not one number. The Pythagorean defect says whether the sides still close metrically, while the other entries say whether the cellular support has changed its boundary, its Surtea class, or its interaction exposure. These are related, but they are not the same diagnostic.

The zero asymptote is the limit

$$\delta_{\mathrm{Pyth}} \to 0, \qquad \Delta_{\mathrm{bd}} \to 0, \qquad \Delta_{\mathrm{class}} \to 0, \qquad \Delta_{\mathrm{int}} \to 0. \tag{71}$$

That is the clean Surtea-Austin closure limit. The support triangle closes metrically, and the underlying topological support stops changing its boundary, class, and interaction exposure.

## 6.6 Heating and Refinement

The boundary band also depends on the partition itself. Suppose $\mathcal{C}$ is a coarser partition and $\mathcal{H}$ is a finer partition, written

$$\mathcal{C} \preceq \mathcal{H}. \tag{72}$$

In Surtea's heating picture, passing from $\mathcal{C}$ to $\mathcal{H}$ means increasing resolution. For the same support $K$, the interior grows:

$$\mathring{\pi}_{\mathcal{C}}(K) \subseteq \mathring{\pi}_{\mathcal{H}}(K). \tag{73}$$

The closure shrinks:

$$\overline{\pi}_{\mathcal{H}}(K) \subseteq \overline{\pi}_{\mathcal{C}}(K). \tag{74}$$

The boundary shrinks:

$$\partial_{\mathcal{H}} K \subseteq \partial_{\mathcal{C}} K. \tag{75}$$

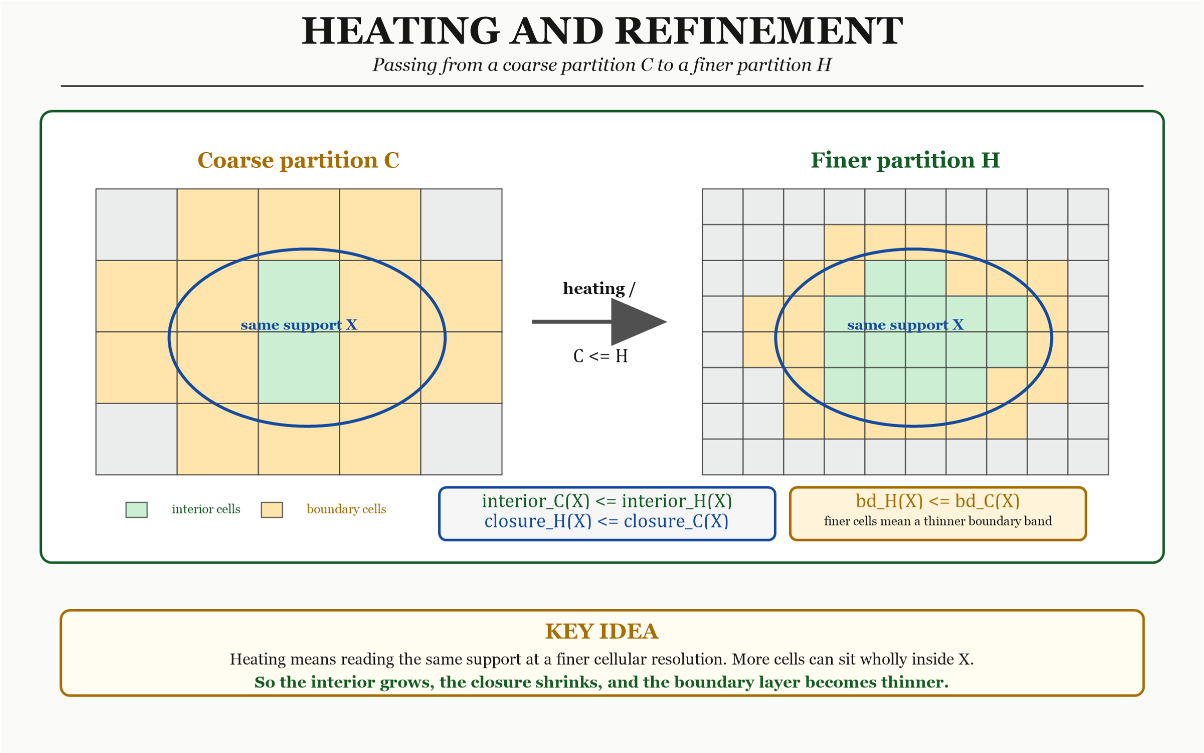


Figure 12: Heating and refinement. Passing from a coarse partition $\mathcal{C}$ to a finer partition $\mathcal{H}$ reads the same support at higher cellular resolution. The interior grows, while closure and boundary shrink.

In high-school language: a coarse grid makes the edge look fat because many large cells are cut by the object. A finer grid sees the shape more precisely, so fewer cells have to be counted as ambiguous boundary cells. The boundary band becomes thinner.

## 6.7 Survival After Deformation

The deformed support still enters the same survival structure. We use the actual support $K_{\text{act}}$, not only the ideal triangle:

$$\Lambda(K_{\text{act}}, \varphi) = \Gamma_0(\mu_{\text{phys}})\, g(B^{\rho}_{D}(K_{\text{act}}))\, W(\varphi). \tag{76}$$

If deformation increases the readout boundary exposure, then $B_D^\rho(K_{\mathrm{act}})$ increases. If $g$ is increasing, then the effective loss increases:

$$B_D^\rho(K_{\mathrm{act}}) \uparrow \implies g(B_D^\rho(K_{\mathrm{act}})) \uparrow \implies \Lambda \uparrow . \tag{77}$$

A larger $\Lambda$ means faster survival decay:

$$S(t) = S(0) \exp\left( - \int_0^t \Lambda(K_{\mathrm{act}}(\tau), \varphi(\tau))\, \mathrm{d}\tau \right) . \tag{78}$$

Thus the deformed Surtea-Austin triangle is not merely bent geometry. It is a shifted support triangle inside a partitioned topology, with survival weighting applied afterwards.

# 7 The Boundary Exposure Readout

The Surtea-native boundary quantity is the field measure

$$\widetilde{\mu}(X_n) = \mu(\partial_{\mathcal{D}} X_n). \tag{79}$$

To turn it into an ordinary positive ratio, choose the positive readout $\rho : R \to \mathbb{R}_{\geq 0}$. Then define three readout magnitudes:

$$I_n^2 = \rho_\mu(X_n^\circ) , \qquad Q_n^2 = \rho_\mu(\partial_{\mathcal{D}} X_n) , \qquad C_n^2 = \rho_\mu(\overline{\pi}_{\mathcal{D}}(X_n)) . \tag{80}$$

The Pythagorean support relation is

$$C_n^2 = I_n^2 + Q_n^2. \tag{81}$$

The boundary exposure ratio is

$$B_D^\rho(X_n) = \frac{Q_n^2}{C_n^2} = \frac{\rho_\mu(\partial_{\mathcal{D}} X_n)}{\rho_\mu(X_n^\circ) + \rho_\mu(\partial_{\mathcal{D}} X_n)}. \tag{82}$$

When $\rho$ has been fixed, the shorter notation $B_D(X_n)$ is used. The stable interior share is

$$A_D^\rho(X_n) = \frac{I_n^2}{C_n^2} = 1 - B_D^\rho(X_n). \tag{83}$$

## 7.1 Sensitivity Derivatives

The formula

$$B_D = \frac{Q^2}{I^2 + Q^2} \tag{84}$$

has the expected behaviour. If the boundary size $Q$ grows while the interior size $I$ is fixed, boundary exposure increases:

$$\frac{\partial B_D}{\partial Q} = \frac{2QI^2}{(I^2 + Q^2)^2} \geq 0. \tag{85}$$

If the interior size $I$ grows while the boundary size $Q$ is fixed, boundary exposure decreases:

$$\frac{\partial B_D}{\partial I} = -\frac{2IQ^2}{(I^2 + Q^2)^2} \leq 0. \tag{86}$$

Plain English:

> A bigger boundary makes the support more exposed. A bigger stable interior makes the same boundary matter less.

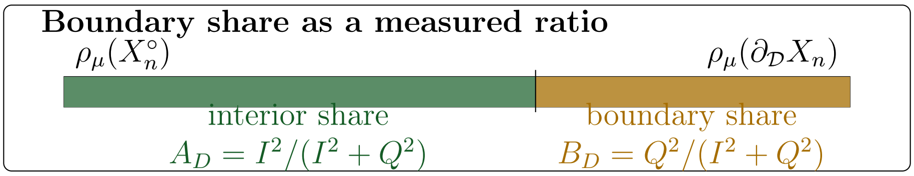
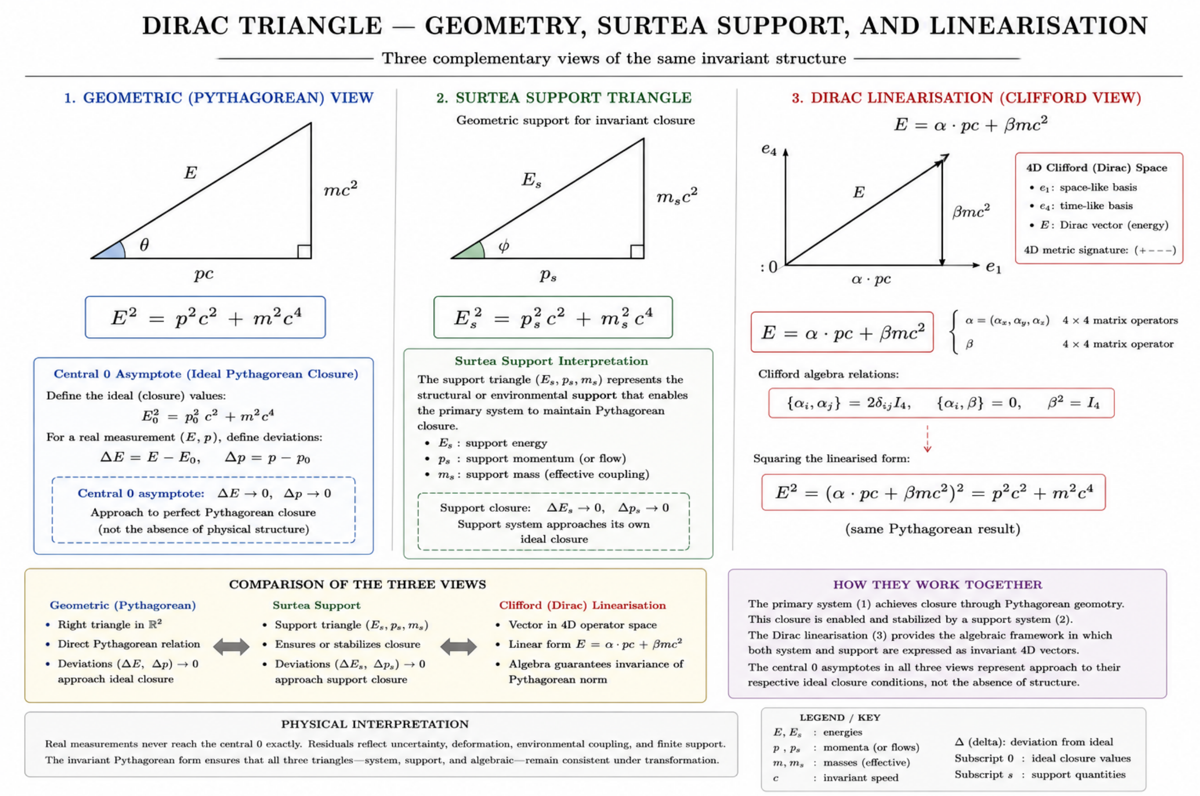


Figure 13: A ratio view of the support triangle. The boundary share is not the whole support; it is the exposed fraction of the whole readout support.

## 8 Chart 2: Pythagoras, Surtea, and Dirac



**DIRAC TRIANGLE — GEOMETRY, SURTEA SUPPORT, AND LINEARISATION**

Three complementary views of the same invariant structure

**1. GEOMETRIC (PYTHAGOREAN) VIEW**

$$E^2 = p^2c^2 + m^2c^4$$

**Central 0 Asymptote (Ideal Pythagorean Closure)**

Define the ideal (closure) values:

$$E_0^2 = p_0^2\, c^2 + m^2c^4$$

For a real measurement $(E, p)$, define deviations:

$$\Delta E = E - E_0, \quad \Delta p = p - p_0$$

**Central 0 asymptote:** $\Delta E \to 0, \ \Delta p \to 0$
Approach to perfect Pythagorean closure
(not the absence of physical structure)

**2. SURTEA SUPPORT TRIANGLE**

Geometric support for invariant closure

$$E_s^2 = p_s^2\, c^2 + m_s^2\, c^4$$

**Surtea Support Interpretation**

The support triangle $(E_s, p_s, m_s)$ represents the structural or environmental **support** that enables the primary system to maintain Pythagorean closure.

- $E_s$ : support energy
- $p_s$ : support momentum (or flow)
- $m_s$ : support mass (effective coupling)

Support closure: $\Delta E_s \to 0, \ \Delta p_s \to 0$
Support system approaches its own
ideal closure

**3. DIRAC LINEARISATION (CLIFFORD VIEW)**

$$E = \alpha \cdot pc + \beta mc^2$$

**4D Clifford (Dirac) Space**

- $e_1$: space-like basis
- $e_4$: time-like basis
- $E$: Dirac vector (energy)

4D metric signature: $(+---)$

$$E = \alpha \cdot pc + \beta mc^2 \quad \begin{cases} \alpha = (\alpha_x, \alpha_y, \alpha_z) & 4 \times 4 \text{ matrix operators} \\ \beta & 4 \times 4 \text{ matrix operator} \end{cases}$$

Clifford algebra relations:

$$\{\alpha_i, \alpha_j\} = 2\delta_{ij} I_4, \quad \{\alpha_i, \beta\} = 0, \quad \beta^2 = I_4$$

Squaring the linearised form:

$$E^2 = (\alpha \cdot pc + \beta mc^2)^2 = p^2c^2 + m^2c^4$$

(same Pythagorean result)

**COMPARISON OF THE THREE VIEWS**

**Geometric (Pythagorean)**
- Right triangle in $\mathbb{R}^2$
- Direct Pythagorean relation
- Deviations $(\Delta E, \ \Delta p) \to 0$ approach ideal closure

**Surtea Support**
- Support triangle $(E_s, p_s, m_s)$
- Ensures or stabilizes closure
- Deviations $(\Delta E_s, \ \Delta p_s) \to 0$ approach support closure

**Clifford (Dirac) Linearisation**
- Vector in 4D operator space
- Linear form $E = \alpha \cdot pc + \beta mc^2$
- Algebra guarantees invariance of Pythagorean norm

**HOW THEY WORK TOGETHER**

The primary system (1) achieves closure through Pythagorean geomotry.
This closure is enabled and stabilized by a support system (2).
The Dirac linearisation (3) provides the algebraic framework in which both system and support are expressed as invariant 4D vectors.
The central 0 asymptotes in all three views represent approach to their respective ideal closure conditions, not the absence of structure.

**PHYSICAL INTERPRETATION**

Real measurements never reach the central 0 exactly. Residuals reflect uncertainty, deformation, environmental coupling, and finite support. The invariant Pythagorean form ensures that all three triangles—system, support, and algebraic—remain consistent under transformation.

LEGEND / KEY

$E, E_s$ : energies
$p$ , $p_s$ : momenta (or flows)
$m, m_s$ : masses (effective)
$c$ : invariant speed
$\Delta$ (delta): deviation from ideal
Subscript 0 : ideal closure values
Subscript $s$ : support quantities

Figure 14: Three complementary views: Pythagorean geometry, Surtea support, and Dirac linearisation. The common feature is an invariant quadratic structure.

### 8.1 What the Dirac Comparison Does and Does Not Say

The ordinary Pythagorean energy relation is

$$E^2 = p^2c^2 + m^2c^4. \tag{87}$$

Dirac's linearisation replaces the square-root form by an operator-linear form,

$$E = \alpha \cdot pc + \beta mc^2, \tag{88}$$

with algebraic conditions on $\alpha$ and $\beta$ chosen so that squaring returns the same invariant:

$$E^2 = p^2c^2 + m^2c^4. \tag{89}$$

The Surtea support triangle is not the Dirac equation. The relation is by structural analogy:

| Pythagoras | Surtea support | Dirac |
|---|---|---|
| quadratic invariant | closure/interior/boundary split | linear operator form preserving invariant |

(90)

The useful lesson is this:

> First identify the invariant whole. Then identify the components. Then decide whether the situation needs a readout ratio, a survival weight, or an algebraic linearisation.

# 9 RSG Structured States: The Austin Side

In the RSG notation, a structured recursive state is

$$\sigma_n = (X_n, \varphi_n, \mu_n^{\text{phys}}, S_n). \tag{91}$$

The pieces are:

$$X_n \quad \text{topological support,} \tag{92}$$

$$\varphi_n = (\Theta_n, \Pi_n) \quad \text{phase/transport projection,} \tag{93}$$

$$\mu_n^{\text{phys}} \quad \text{physical measures,} \tag{94}$$

$$S_n \quad \text{survival weight.} \tag{95}$$

The reduced RSG phase norm is

$$J(\varphi_n) = \Theta_n^2 + \ell^2 \Pi_n^2. \tag{96}$$

The RSG phase exposure weight is

$$W(\varphi_n) = \frac{\Theta_n^2}{J(\varphi_n)} = \frac{\Theta_n^2}{\Theta_n^2 + \ell^2 \Pi_n^2}. \tag{97}$$

This is parallel to the Surtea boundary readout:

$$B_D^\rho(X_n) = \frac{\rho_\mu(\partial_{\mathcal{D}} X_n)}{\rho_\mu(X_n^\circ) + \rho_\mu(\partial_{\mathcal{D}} X_n)}. \tag{98}$$

The important distinction is:

| **Surtea ratio** | **RSG ratio** |
|---|---|
| $B_D^\rho(X_n)$ measures how much of the support is boundary-exposed after the readout $\rho$. | $W(\varphi_n)$ measures how much of the phase state is positionally exposed. |
| Topological/support side. | Dynamical/phase side. |
| Best placed inside $\Gamma(\sigma_n)$. | Already part of the RSG survival law. |

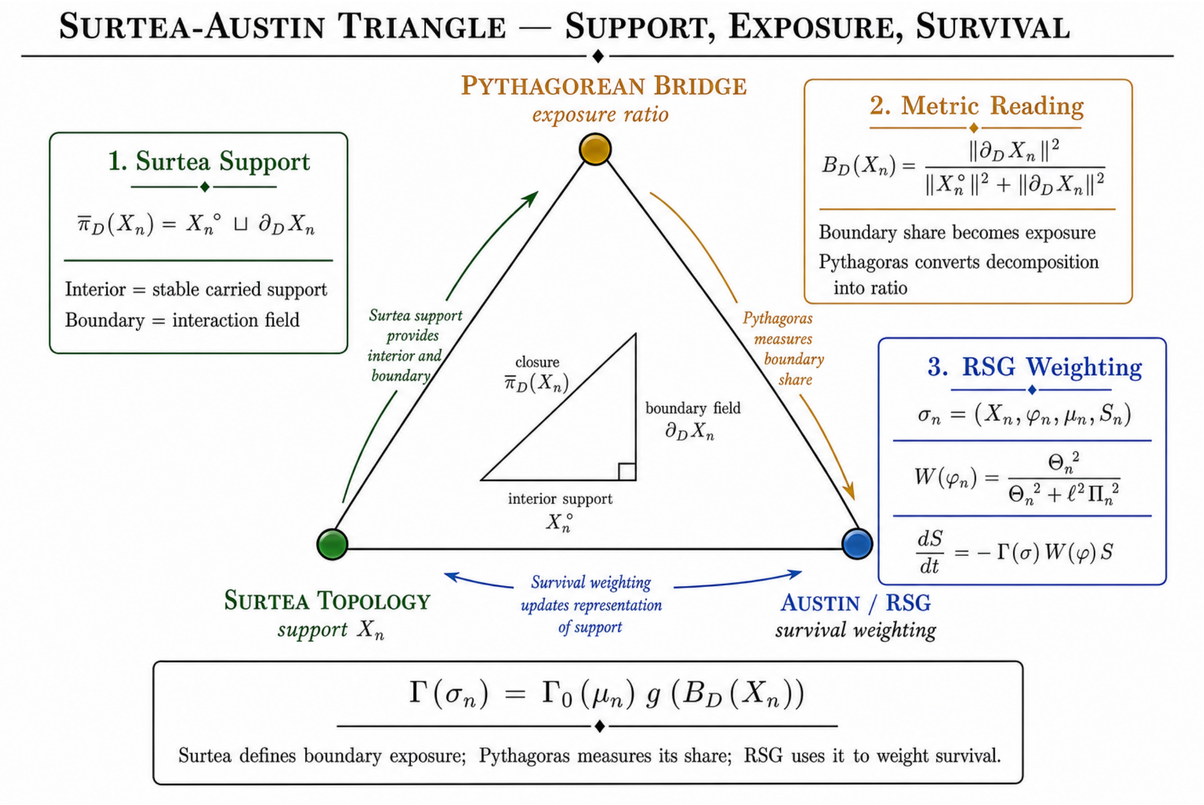


Figure 15: Surtea-Austin triangle. Surtea supplies the boundary split, the added positive readout measures the share, and RSG uses the result in survival weighting.

# 10 Chart 3: The Surtea-Austin Triangle

## 10.1 The Bridge Postulate

The cleanest bridge is not to replace $W(\varphi_n)$. Instead, the note postulates that the Surtea boundary-field readout shapes the state-dependent loss coefficient:

$$\Gamma(\sigma_n) = \Gamma_0(\mu_n^{\mathrm{phys}})\, g(B_D^\rho(X_n)). \tag{99}$$

Here:

- $\Gamma_0(\mu_n^{\mathrm{phys}})$ is the baseline loss coming from physical measures $\mu_n^{\mathrm{phys}}$;
- $B_D^\rho(X_n)$ is the positive readout of Surtea boundary-field exposure;
- $g$ is a non-negative response function saying how boundary exposure changes loss.

This is the central modelling move of the paper. It is not a theorem of Surtea topology. It becomes a testable bridge only after $\mathcal{D}$, $\mu$, $\rho$, $g$, $\Gamma_0$, $W$, and the relevant update rule have been fixed before comparison.

The RSG survival law is

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Gamma(\sigma)W(\varphi)S. \tag{100}$$

Substituting the Surtea-Austin bridge gives

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Gamma_0(\mu_{\mathrm{phys}})\, g(B_D^\rho(X))\, W(\varphi)\, S. \tag{101}$$

This is the main formula of the note, read as a formal bridge postulate inside the assumed RSG survival law.

## 10.2 The Effective Loss Rate

Define

$$\Lambda(\sigma) = \Gamma(\sigma) W(\varphi). \tag{102}$$

With the Surtea bridge,

$$\Lambda(\sigma) = \Gamma_0(\mu_{\text{phys}})\, g(B^{\rho}_{D}(X))\, W(\varphi). \tag{103}$$

Thus survival decreases according to

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Lambda(\sigma) S. \tag{104}$$

If $\Lambda$ is constant for a short interval, the solution is

$$S(t) = S(0) e^{-\Lambda t}. \tag{105}$$

If $\Lambda$ changes with time, the solution is

$$S(t) = S(0) \exp\left( - \int_0^t \Gamma_0(\mu_{\text{phys}}(\tau))\, g(B^{\rho}_{D}(X(\tau)))\, W(\varphi(\tau))\, \mathrm{d}\tau \right). \tag{106}$$

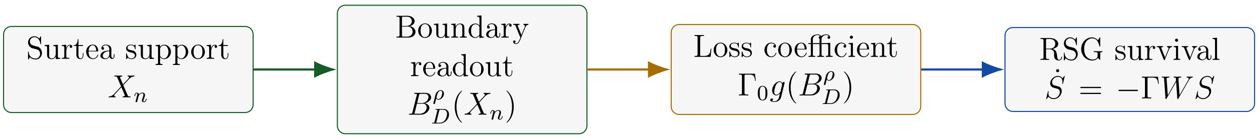


Figure 16: The operational bridge. Surtea boundary exposure enters RSG through the loss coefficient $\Gamma$, while $W(\varphi)$ remains the phase exposure weight.

# 11 Future Bridge I: Curvature-Aware Extension

The next figures are retained because they show how the bridge could be extended, but the extension is conditional. Curvature enters the Surtea-Austin triangle only after a curvature-shaped update rule has been specified. In the reduced RSG phase model, curvature is represented by the coefficient $\Omega^2$ in the phase-flow equations

$$\frac{\mathrm{d}\Theta}{\mathrm{d}t} = \Pi, \qquad \frac{\mathrm{d}\Pi}{\mathrm{d}t} = -\Omega^2 \Theta. \tag{107}$$

When $\Omega^2$ is locally constant and the motion is lossless, the corresponding phase-energy diagnostic is

$$E_{\Phi} = \frac{1}{2}\left(\Pi^2 + \Omega^2 \Theta^2\right). \tag{108}$$

This says that curvature shapes the possible phase histories. It does not, by itself, choose which histories survive. Survival selection still comes later through the loss law.

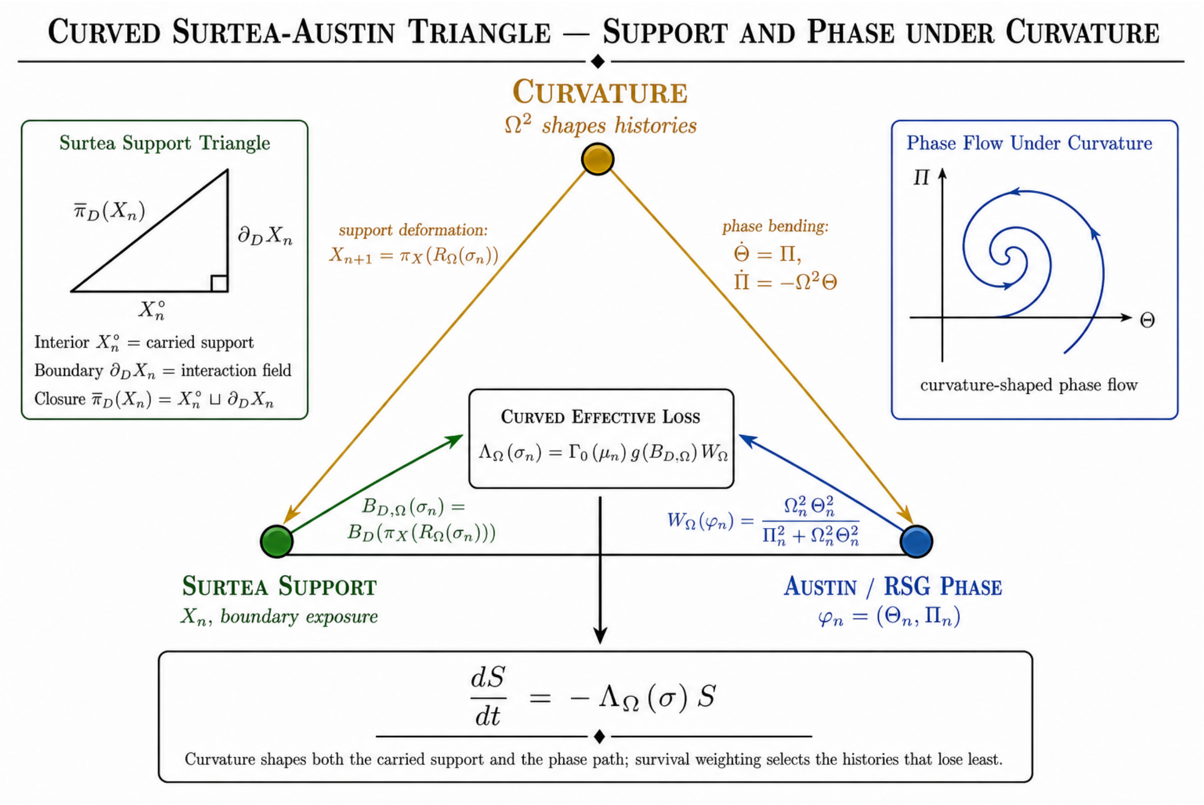


Figure 17: Curved Surtea-Austin triangle. Curvature acts in both directions: it deforms the carried Surtea support and bends the RSG phase path. Both effects meet in the curvature-aware effective loss $\Lambda_\Omega$.

## 11.1 Two Curvature Pathways

Under curvature, the recursive update may be written as

$$\sigma_{n+1} = R_\Omega(\sigma_n). \tag{109}$$

This update has two relevant projections:

$$\varphi_{n+1} = \pi_\Phi(R_\Omega(\sigma_n)), \qquad X_{n+1} = \pi_X(R_\Omega(\sigma_n)). \tag{110}$$

Thus curvature can affect survival by two routes:

1. It changes the phase trajectory $\varphi_n$, and therefore changes the phase exposure weight $W(\varphi_n)$.
2. It changes the carried support $X_n$, and therefore changes the Surtea boundary-field readout $B_D^\rho(X_n)$.

This is the practical curvature picture. Curvature first acts on the update rule. One projection gives the phase route, which controls phase exposure. The other projection gives the support route, which controls which $\mathcal{D}$-photons are cut by the support. Survival sees the result of both routes at once.

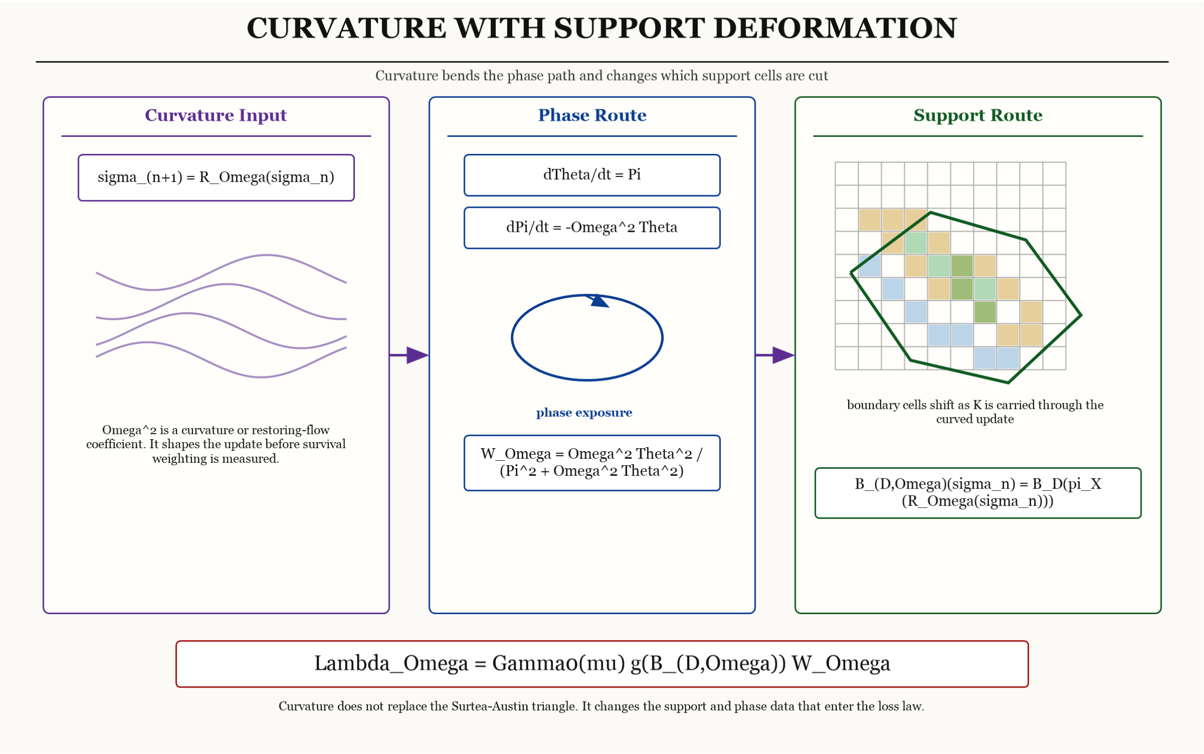


Figure 18: Curvature with support deformation. The same curvature-shaped update $R_\Omega$ changes the phase path and the carried support, so both $W_\Omega$ and $B^\rho_{D,\Omega}$ may change before survival weighting is applied.

## 11.2 Curvature-Aware Boundary Exposure

If the topology $\mathcal{D}$ and readout $\rho$ are fixed, curvature changes $B^\rho_D$ by changing the support $X_n$. The boundary ratio at the next step is

$$B^\rho_D(X_{n+1}) = \frac{\rho_\mu(\partial_{\mathcal{D}} X_{n+1})}{\rho_\mu(X^\circ_{n+1}) + \rho_\mu(\partial_{\mathcal{D}} X_{n+1})}. \tag{111}$$

Using the curvature-shaped update, this can be written as

$$B^\rho_{D,\Omega}(\sigma_n) = B^\rho_D(\pi_X(R_\Omega(\sigma_n)))\,. \tag{112}$$

This formula means: first let curvature shape the next support, then measure how much of that support is boundary-exposed.

## 11.3 Curvature-Aware Phase Exposure

The minimal RSG weight remains

$$W(\varphi_n) = \frac{\Theta_n^2}{\Theta_n^2 + \ell^2 \Pi_n^2}. \tag{113}$$

If the application wants the phase exposure to follow the local curvature energy split, one may use the curvature-aware specialisation

$$W_\Omega(\varphi_n) = \frac{\Omega_n^2 \Theta_n^2}{\Pi_n^2 + \Omega_n^2 \Theta_n^2}. \tag{114}$$

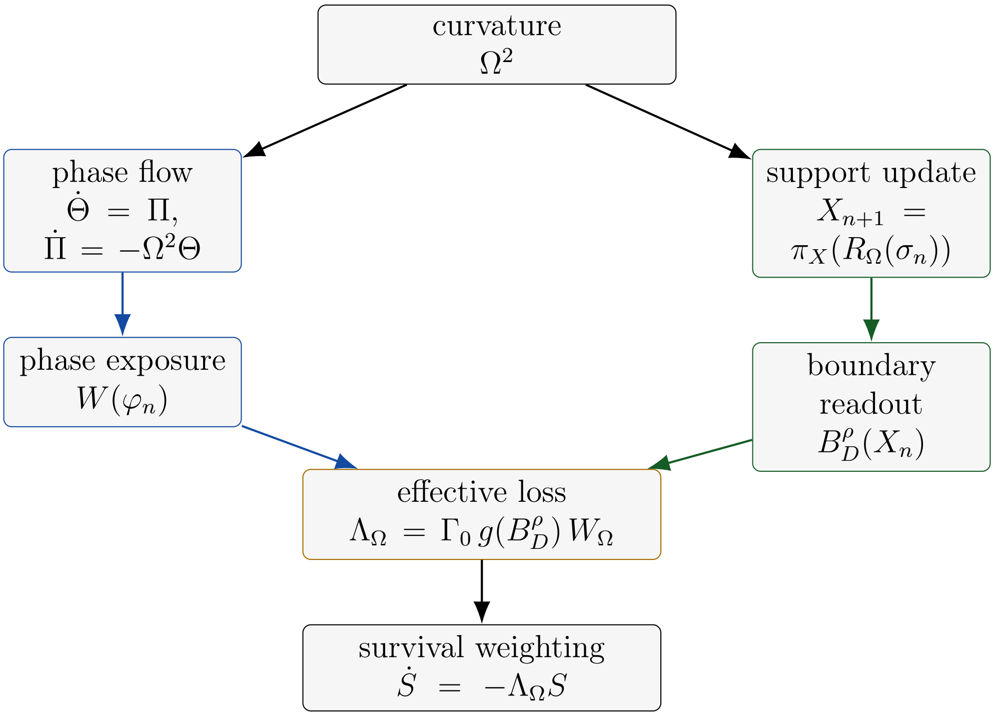


Figure 19: Curvature does not replace the Surtea-Austin triangle. It shapes the phase path and the support path before the survival filter is applied.

This is optional. The safe reading is that $W$ is the basic RSG exposure weight, while $W_\Omega$ is a special case for models where the curvature coefficient fixes the natural phase metric.

## 11.4 Curvature-Aware Survival Law

Combining the two pathways gives the curvature-aware effective loss rate

$$\Lambda_\Omega(\sigma_n) = \Gamma_0(\mu_n^{\text{phys}})\, g(B^\rho_{D,\Omega}(\sigma_n))\, W_\Omega(\varphi_n). \tag{115}$$

The corresponding survival equation is

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Lambda_\Omega(\sigma)S. \tag{116}$$

Equivalently,

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Gamma_0(\mu_{\text{phys}})\, g(B^\rho_{D,\Omega}(\sigma))\, W_\Omega(\varphi)\, S. \tag{117}$$

Plain English:

> Curvature bends the available histories. Some bends make the phase state more exposed; some bends make the support boundary larger. The survival law then weights histories according to the combined exposure.

# 12 Future Bridge II: Sequential Histories and Rational Closure

The next construction is speculative, but it can be stated without making it loose. A Surtea-Austin triangle need not be read only as one static geometric triangle. It may also be read as one frame in a short cyclic support history. If the cycle updates faster than the observer can separate its frames, the observer sees the whole cycle as one apparent object.

This is the intended meaning of an object made from $q/q$ frames. The object is not one frozen triangle. It is $q$ sequential support frames seen across one complete cycle.

## 12.1 No-Trig Recursive Closure

Let $K_n \subseteq M$ be the support at frame $n$. Let $F$ be the frame update rule:

$$K_{n+1} = F(K_n). \tag{118}$$

A rationally closed cycle of length $q$ is one for which

$$F^q(K_n) = K_n, \qquad F^s(K_n) \neq K_n \quad 1 \leq s < q. \tag{119}$$

If the update step is recorded as a rational closure fraction, write

$$\rho = \frac{r}{q}, \qquad \gcd(r, q) = 1. \tag{120}$$

This is the no-trig version of rotation. The cycle is defined by recursion and return, not by sine and cosine. The support visits a finite sequence of frames and then closes back onto itself.

The figure makes the phrase no-trig recursion concrete. Nothing in the definition requires a continuous angle. Each triangle starts at the central etheron $e$ and reaches out to two neighbouring boundary points. What matters is the exact return: after the chosen number of updates, the frame is back where it began, with no earlier return.

## 12.2 The Apparent Object

If the update time is much shorter than the observer's integration time, then several support frames are blended into one seen object:

$$\Delta t_{\text{upd}} \ll \Delta t_{\text{obs}}. \tag{121}$$

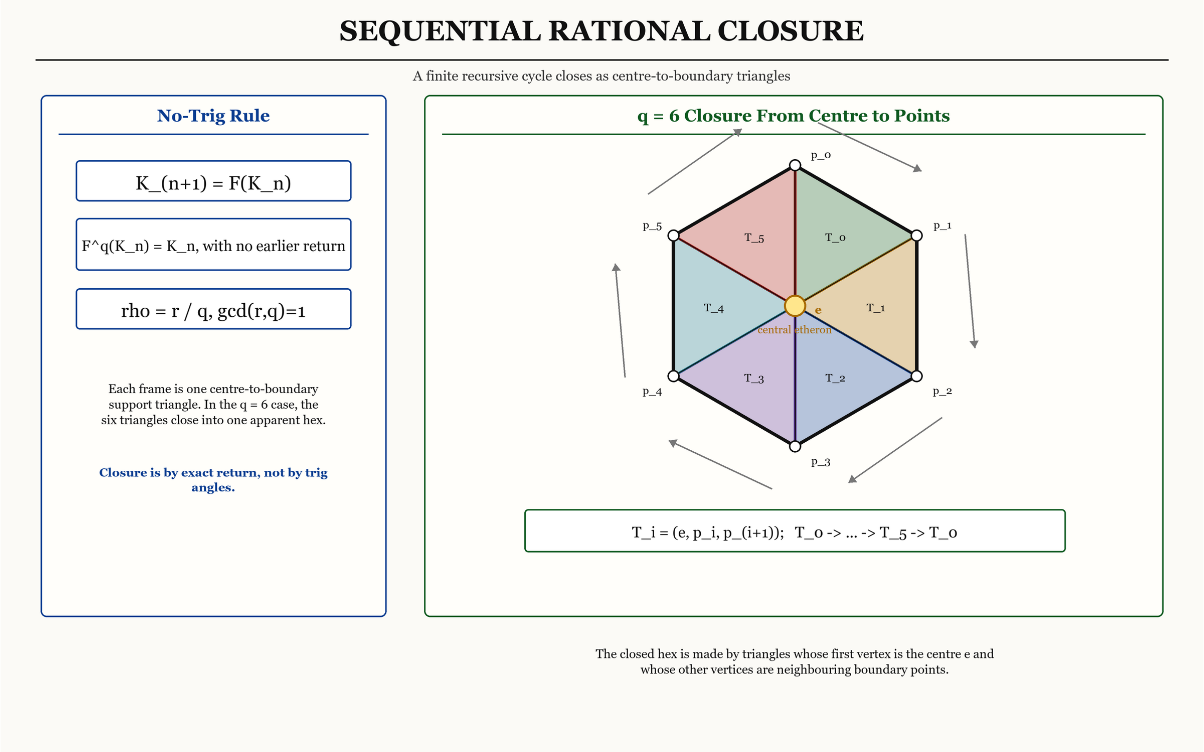
One full cycle is visible as one apparent support when

$$q\,\Delta t_{\text{upd}} \leq \Delta t_{\text{obs}}. \tag{122}$$

The apparent support is then the union of all frames in the cycle:

$$\mathcal{A}_q(K_n) = \bigcup_{j=0}^{q-1} F^j(K_n). \tag{123}$$

This explains why a rotating triangular support might not be seen as a rotating triangle. If the frames close through six or eight distinct boundary positions, the observer



SEQUENTIAL RATIONAL CLOSURE

A finite recursive cycle closes as centre-to-boundary triangles

**No-Trig Rule**

K_(n+1) = F(K_n)

F^q(K_n) = K_n, with no earlier return

rho = r / q, gcd(r,q)=1

Each frame is one centre-to-boundary support triangle. In the q = 6 case, the six triangles close into one apparent hex.

**Closure is by exact return, not by trig angles.**

**q = 6 Closure From Centre to Points**

T_i = (e, p_i, p_(i+1)); T_0 -> ... -> T_5 -> T_0

The closed hex is made by triangles whose first vertex is the centre e and whose other vertices are neighbouring boundary points.

Figure 20: Sequential rational closure. The support is updated through centre-to-boundary triangles $T_i = (e, p_i, p_{i+1})$, whose union forms a closed hex after $q = 6$ steps.

may see a hexagon-like or octagon-like support in the underlying substance. The apparent polygon is not the primitive moving object. It is the integrated record of a fast cyclic history.

This is the key visual correction: the hex is not added as a separate geometric object. It is the union of the triangular frames. The observer sees the union because the update is faster than the observer's ability to split the frames apart.

The readout boundary exposure of the seen object is

$$B_{\mathcal{D}}^{\rho,\text{seen}}(K_n) = \frac{\rho_\mu(\partial_{\mathcal{D}}\mathcal{A}_q(K_n))}{\rho_\mu(\mathring{\pi}_{\mathcal{D}}(\mathcal{A}_q(K_n))) + \rho_\mu(\partial_{\mathcal{D}}\mathcal{A}_q(K_n))}. \tag{124}$$

This is what a slow measuring process would assign to the integrated object.

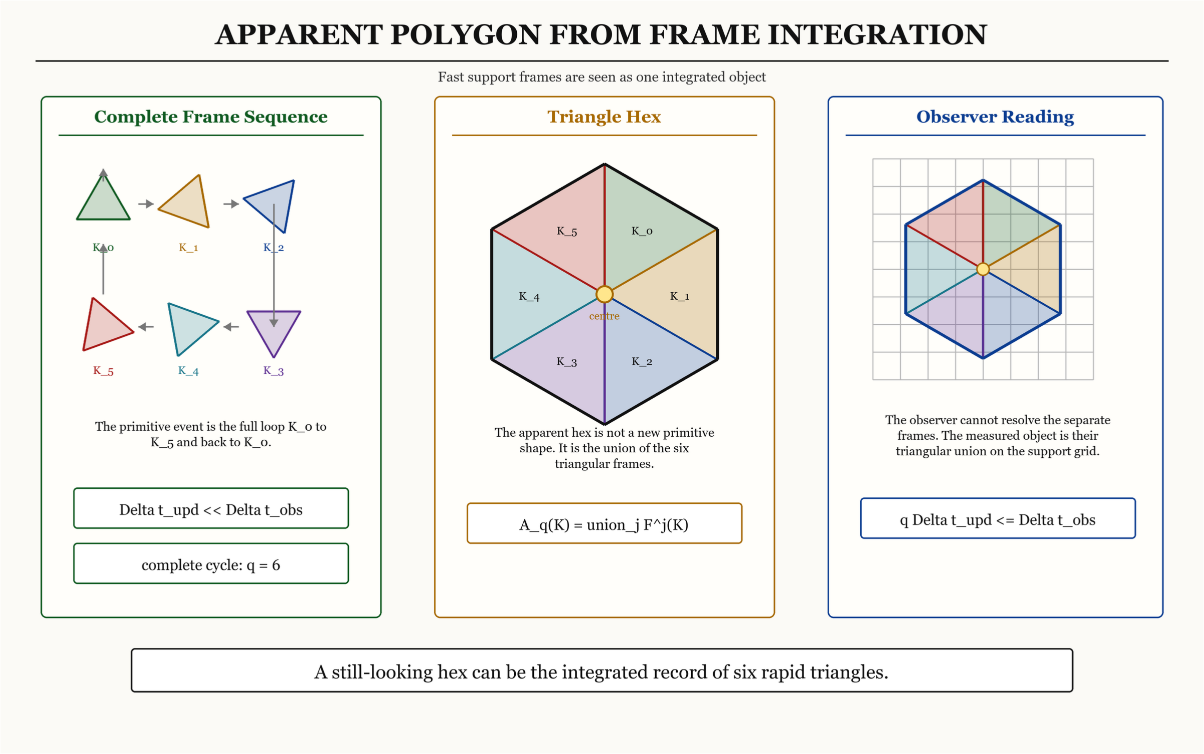
## 12.3 The Support Wake

The apparent object may look still while the support history is not still. Each frame can cut the partition cells differently, so each frame can leave a different boundary record. Define the support wake as the union of the boundary layers visited during one closed cycle:

$$\mathcal{W}_q(K_n) = \bigcup_{j=0}^{q-1} \partial_{\mathcal{D}}\big(F^j(K_n)\big)\,. \tag{125}$$

The seen boundary and the wake boundary need not agree:

$$\partial_{\mathcal{D}}\mathcal{A}_q(K_n) \neq \mathcal{W}_q(K_n) \quad \text{in general.} \tag{126}$$



The primitive event is the full loop K_0 to K_5 and back to K_0.

The apparent hex is not a new primitive shape. It is the union of the six triangular frames.

The observer cannot resolve the separate frames. The measured object is their triangular union on the support grid.

A still-looking hex can be the integrated record of six rapid triangles.

Figure 21: Apparent polygon from frame integration. In the $q = 6$ case, the seen hex is built from six triangular support frames meeting at one centre.

This is the important Surtea point. The object may appear as one still support, but the surrounding partition can still carry evidence of the sequential updates. In a later physical model, this is where one would look for support layer warping, boundary waves, or a gravity-like record. At this stage it should be called a support wake, not a derived gravitational wave.

The diagram separates the visible reading from the hidden record. The seen object uses $\partial_{\mathcal{D}}\mathcal{A}_q(K_n)$. The wake uses all the frame boundaries that were visited during the cycle. These can disagree, which is why $B_D^{\rho,\mathrm{eff}}$ is introduced rather than using only the visible boundary.

The wake exposure can be read by

$$B_D^{\rho,\mathrm{wake}}(K_n) = \frac{\rho_\mu(\mathcal{W}_q(K_n))}{\rho_\mu(\mathring{\pi}_{\mathcal{D}}(\mathcal{A}_q(K_n))) + \rho_\mu(\mathcal{W}_q(K_n))}. \tag{127}$$

A simple effective boundary exposure is then

$$B_D^{\rho,\mathrm{eff}}(K_n) = (1-\eta)\, B_D^{\rho,\mathrm{seen}}(K_n) + \eta\, B_D^{\rho,\mathrm{wake}}(K_n), \qquad 0 \le \eta \le 1. \tag{128}$$

Here $\eta$ says how strongly the model weights the hidden wake compared with the visible apparent support. If $\eta = 0$, only the seen object matters. If $\eta = 1$, the support wake carries the whole boundary penalty.

The corresponding cyclic-history loss rate is

$$\Lambda_q(\sigma_n) = \Gamma_0(\mu_n^{\mathrm{phys}})\, g(B_D^{\rho,\mathrm{eff}}(K_n))\, W(\varphi_n). \tag{129}$$

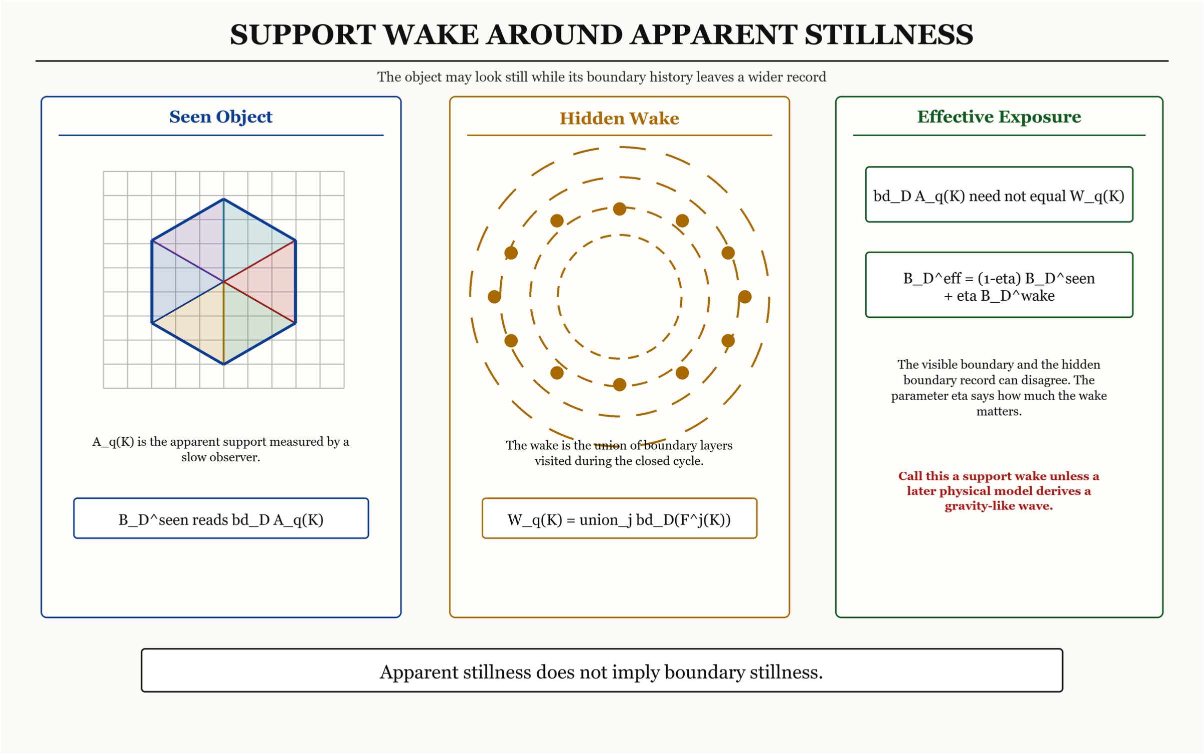


Figure 22: Support wake around apparent stillness. The seen support can be a single integrated hex, while the hidden wake records the boundary layers visited by the sequential frames.

## 12.4 Etheron-Centred Three-Point Pathways

The triangular support can also be treated as a three-point pathway around a central point. Let

$$T_n = (e, a_n, b_n), \tag{130}$$

where $e$ is a central etheron and $a_n, b_n$ are the two other support points at frame $n$. The frame rule is then

$$T_{n+1} = F_T(T_n), \tag{131}$$

with rational closure

$$F_T^q(T_n) = T_n. \tag{132}$$

The support at that frame is

$$K_n = \mathrm{supp}(T_n). \tag{133}$$

This gives a clean place to introduce three-body mechanics later. One may ask how $a_n$ and $b_n$ update around the central etheron $e$, and whether the resulting cycle has a stable closure. But this is only a modelling bridge until a precise interaction law is supplied. It should not yet be stated as a derivation of proton, neutron, and electron structure. The cautious claim is that it gives a particle-like bound pathway: several sequential support connections around one centre, seen as one stable apparent object.

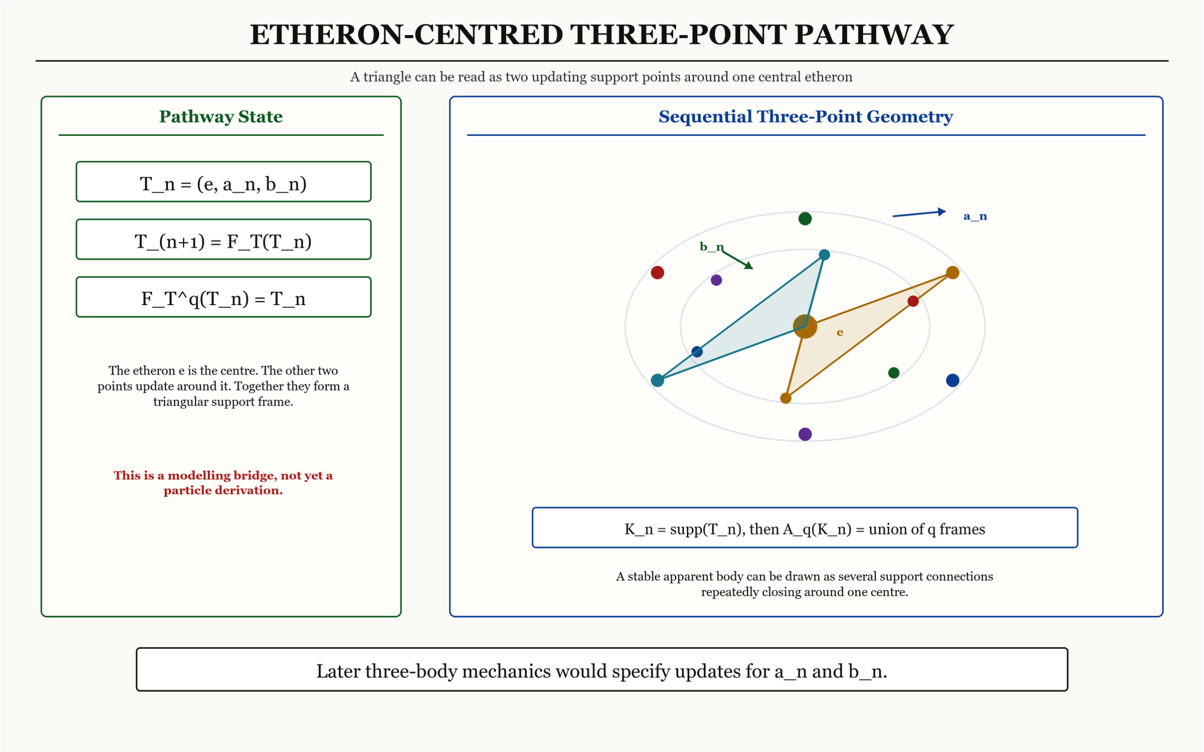


Figure 23: Etheron-centred three-point pathway. The support frame $T_n = (e, a_n, b_n)$ updates around a central etheron $e$, giving a cautious bridge to later three-body modelling.

This figure is deliberately labelled as a modelling bridge. It shows where a later mechanics could enter, but it does not claim that the named particles have already been derived. At this stage, the mathematical object is a three-point support pathway with rational closure.

## 12.5 Photon Energy and Gravitational Bookkeeping

The same caution applies to photons. In ordinary relativistic language, a photon has zero rest mass but non-zero energy. If a photon of energy $E_\gamma$ is absorbed by a black hole, the black-hole mass increases by

$$\Delta M_{\mathrm{BH}} = \frac{E_\gamma}{c^2}. \tag{134}$$

That statement does not make the photon a massive particle at rest. It says that captured energy contributes to gravitational mass [5]. The Surtea-Austin question is more specific: can a massless, fast support history leave a boundary wake that couples to the surrounding support? The answer is not yet a completed physical derivation, but the equations above give the right bookkeeping structure:

$$\text{fast cyclic support} \quad \longrightarrow \quad \mathcal{A}_q(K_n) \ \text{ and } \ \mathcal{W}_q(K_n) \quad \longrightarrow \quad B_D^{\mathrm{eff}}(K_n) \quad \longrightarrow \quad \Lambda_q. \tag{135}$$

The point of the figure is caution. It keeps two statements separate. First, ordinary relativistic accounting says captured photon energy contributes to a black hole's mass-energy budget. Second, the Surtea-Austin language asks whether a fast support history also leaves a boundary wake. The second statement needs its own physical model.

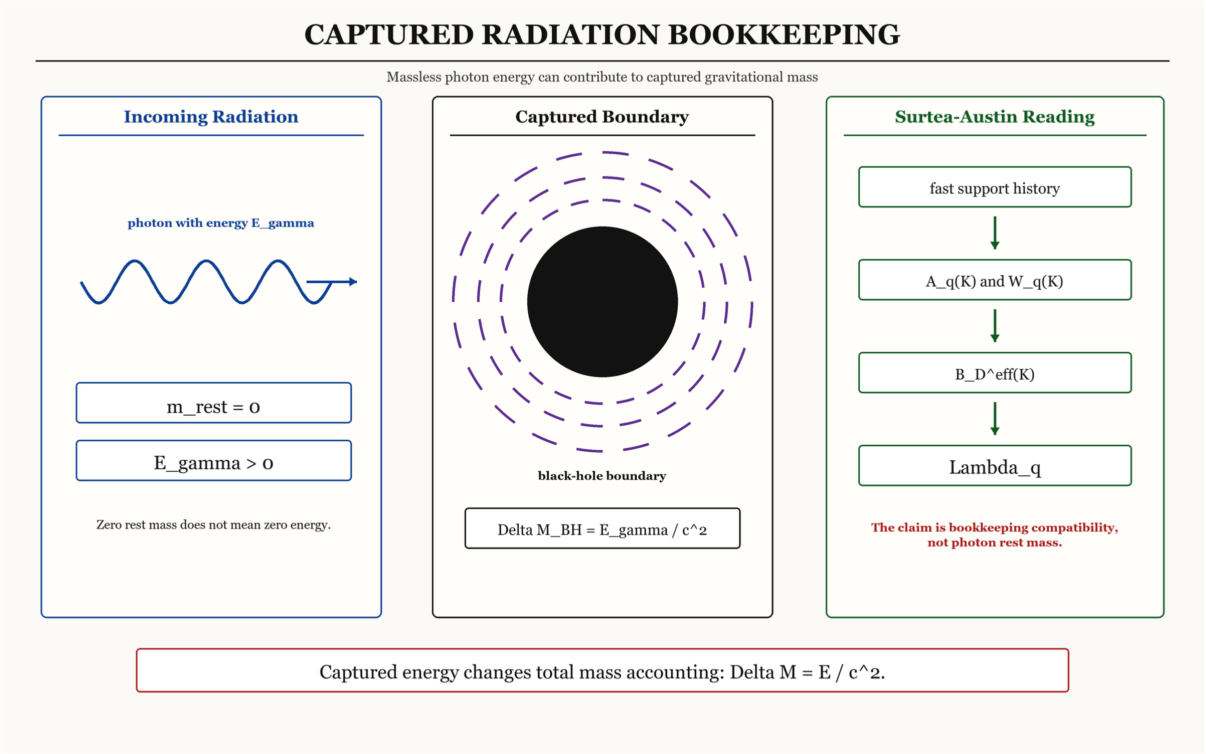


Figure 24: Captured radiation bookkeeping. A photon may have zero rest mass and still contribute captured energy $E_\gamma$, which changes total mass accounting by $E_\gamma/c^2$.

### 12.6 Plain English Reading

For a high-school reader, imagine a triangular stamp being placed round the same centre very quickly. If your eye is too slow to separate the stamps, you do not see one triangle moving. You see the whole pattern it has made. That pattern may look like a hexagon, an octagon, or another closed shape.

The Surtea part says that the real support is made from partition cells. The RSG part says that histories with lower effective loss survive more strongly. The new cyclic part says that a thing which appears still may actually be a fast closed pathway, and the surrounding support may remember that pathway through its boundary wake.

## 13 Solving the Assumed Survival Equation

Assume the local survival equation

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Lambda(t)S(t). \tag{136}$$

The calculation below solves that assumed equation. It does not derive the equation itself from Surtea topology.

Divide both sides by $S(t)$:

$$\frac{1}{S(t)}\frac{\mathrm{d}S}{\mathrm{d}t} = -\Lambda(t). \tag{137}$$

The left-hand side is the derivative of $\ln S(t)$, so

$$\frac{\mathrm{d}}{\mathrm{d}t}\ln S(t) = -\Lambda(t). \tag{138}$$

Integrate from 0 to $t$:

$$\ln S(t) - \ln S(0) = -\int_0^t \Lambda(\tau)\,\mathrm{d}\tau. \tag{139}$$

Exponentiating gives

$$S(t) = S(0)\exp\left(-\int_0^t \Lambda(\tau)\,\mathrm{d}\tau\right). \tag{140}$$

Substitute

$$\Lambda(\tau) = \Gamma_0(\mu_{\text{phys}}(\tau))g(B_D^\rho(X(\tau)))W(\varphi(\tau)). \tag{141}$$

Therefore

$$S(t) = S(0)\exp\left(-\int_0^t \Gamma_0(\mu_{\text{phys}}(\tau))g(B_D^\rho(X(\tau)))W(\varphi(\tau))\,\mathrm{d}\tau\right). \tag{142}$$

## 13.1 Discrete Recursive Version

For a history

$$\gamma_i = \{\sigma_{i,0}, \sigma_{i,1}, \ldots, \sigma_{i,N}\}, \tag{143}$$

the discrete survival weight is

$$S_i(N) = S_i(0)\exp\left(-\sum_{k=0}^{N-1} \Gamma_0(\mu_{i,k}^{\text{phys}})g(B_D^\rho(X_{i,k}))W(\varphi_{i,k})\Delta t\right). \tag{144}$$

The represented probability or normalised weight is

$$p_i(N) = \frac{S_i(N)}{\sum_j S_j(N)}. \tag{145}$$

For two histories $i$ and $j$,

$$\frac{p_i}{p_j} = \frac{S_i}{S_j} = \exp\left(-(A_i - A_j)\right), \tag{146}$$

where

$$A_i = \sum_k \Gamma_0(\mu_{i,k}^{\text{phys}})g(B_D^\rho(X_{i,k}))W(\varphi_{i,k})\Delta t \tag{147}$$

is the accumulated loss of history $i$.

The figure should be read from left to right. A candidate history is a chain of support states. Each state has its own boundary exposure and phase exposure. The loss is summed along the chain, then the remaining survival scores are normalised against one another. This is why RSG weighting is a comparison between histories, not a single absolute label put on one object.

# 14 Numerical Example

This example uses simple numbers to show how the pieces connect.

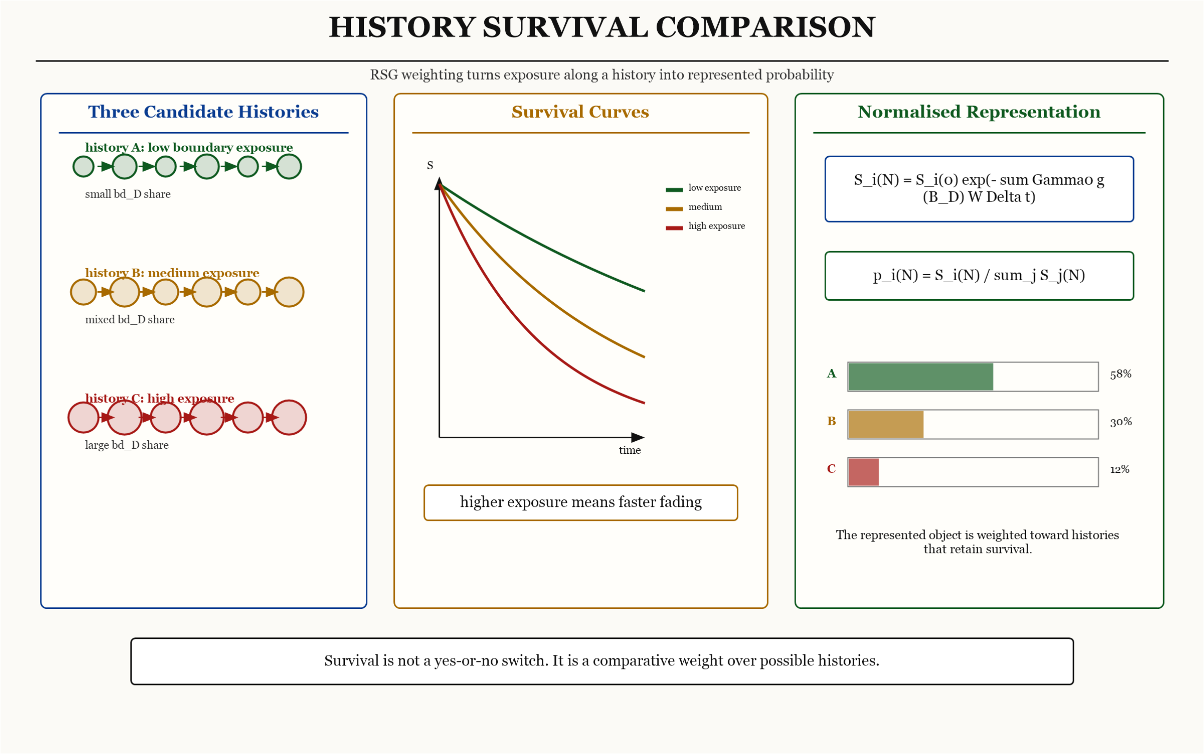


Figure 25: History survival comparison. Histories with larger boundary exposure accumulate loss more quickly, so their normalised representation becomes smaller after the survival weights are compared.

## 14.1 One Support State

Assume the chosen positive readout gives

$$I = 3, \qquad Q = 4, \qquad I^2 = \rho_\mu(X_n^\circ)\,, \qquad Q^2 = \rho_\mu(\partial_{\mathcal{D}} X_n)\,. \tag{148}$$

Then

$$C^2 = I^2 + Q^2 = 3^2 + 4^2 = 9 + 16 = 25, \tag{149}$$

so

$$C = 5. \tag{150}$$

This is the familiar 3-4-5 triangle.

The boundary exposure ratio is

$$B_{\mathcal{D}}^{\rho}(X_n) = \frac{Q^2}{I^2 + Q^2} = \frac{16}{25} = 0.64. \tag{151}$$

So 64% of the readout support is boundary-exposed.

## 14.2 RSG Phase Weight

Now assume the RSG phase coordinates are

$$\Theta_n = 2, \qquad \Pi_n = 1, \qquad \ell = 2. \tag{152}$$

Then

$$J(\varphi_n) = \Theta_n^2 + \ell^2 \Pi_n^2 = 2^2 + 2^2 \cdot 1^2 = 4 + 4 = 8. \tag{153}$$

The RSG exposure weight is

$$W(\varphi_n) = \frac{\Theta_n^2}{J(\varphi_n)} = \frac{4}{8} = 0.5. \tag{154}$$

## 14.3 Coupling Boundary Exposure into Loss

Choose a simple response function

$$g(B) = 1 + 2B. \tag{155}$$

Let the baseline physical loss be

$$\Gamma_0(\mu_n^{\text{phys}}) = 0.10. \tag{156}$$

Since $B_D^\rho(X_n) = 0.64$,

$$g(B_D) = 1 + 2(0.64) = 2.28. \tag{157}$$

Therefore

$$\Gamma(\sigma_n) = \Gamma_0 g(B_D) = 0.10 \cdot 2.28 = 0.228. \tag{158}$$

The effective RSG loss rate is

$$\Lambda = \Gamma W = 0.228 \cdot 0.5 = 0.114. \tag{159}$$

With $S(0) = 1$, survival is

$$S(t) = e^{-0.114t}. \tag{160}$$

| **Time** $t$ | **Survival** $S(t) = e^{-0.114t}$ |
|---|---|
| 0 | 1.000 |
| 1 | 0.892 |
| 2 | 0.796 |
| 5 | 0.565 |
| 10 | 0.320 |

## 14.4 Comparison with a More Interior-Stable Support

Now compare a second support with

$$I = 4, \qquad Q = 1. \tag{161}$$

Then

$$B_D = \frac{1^2}{4^2 + 1^2} = \frac{1}{17} \approx 0.059. \tag{162}$$

Using the same $g(B) = 1 + 2B$,

$$g(B_D) = 1 + 2(0.059) \approx 1.118. \tag{163}$$

Then

$$\Gamma = 0.10 \cdot 1.118 = 0.1118, \tag{164}$$

and with the same $W = 0.5$,

$$\Lambda = 0.1118 \cdot 0.5 = 0.0559. \tag{165}$$

So

$$S(t) = e^{-0.0559t}. \tag{166}$$

At $t = 10$,

$$S(10) = e^{-0.559} \approx 0.572. \tag{167}$$

The boundary-heavy support had $S(10) \approx 0.320$. The interior-stable support has $S(10) \approx 0.572$. The same phase exposure $W$ survives better when the Surtea boundary exposure is smaller.

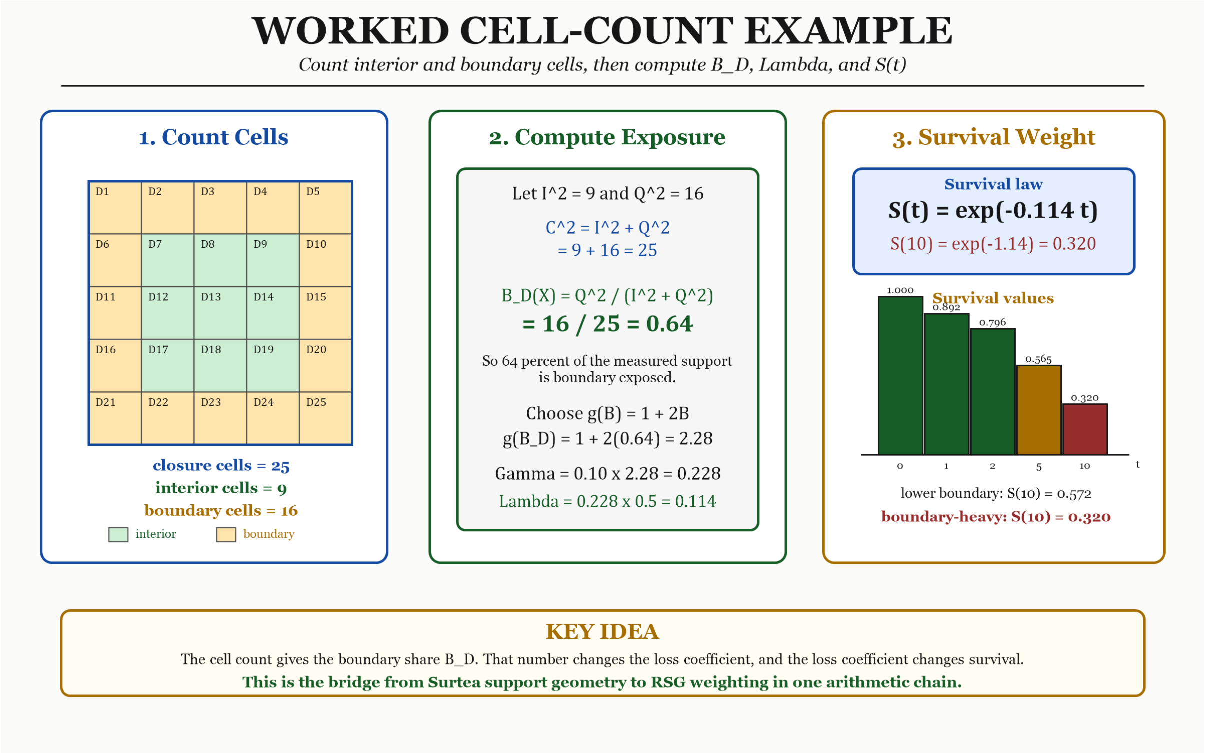


Figure 26: Worked cell-count example. A $5 \times 5$ support has 9 interior cells and 16 boundary cells, giving $B_D = 16/25 = 0.64$. That boundary share then changes $\Gamma$, $\Lambda$, and $S(t)$.

The PNG figure is the same calculation in a single visual chain: count cells, compute $B_D$, pass it through $g(B)$, and read the resulting survival decay.

# 15 Operational Toy Protocol and Falsifier

The numerical example is illustrative. To turn the bridge into a reproducible toy protocol, the choices must be fixed first.

1. Choose a finite grid universe $M$ and a partition $\mathcal{D}$ into cells.
2. Choose support states $X_1, \ldots, X_m \subseteq M$.

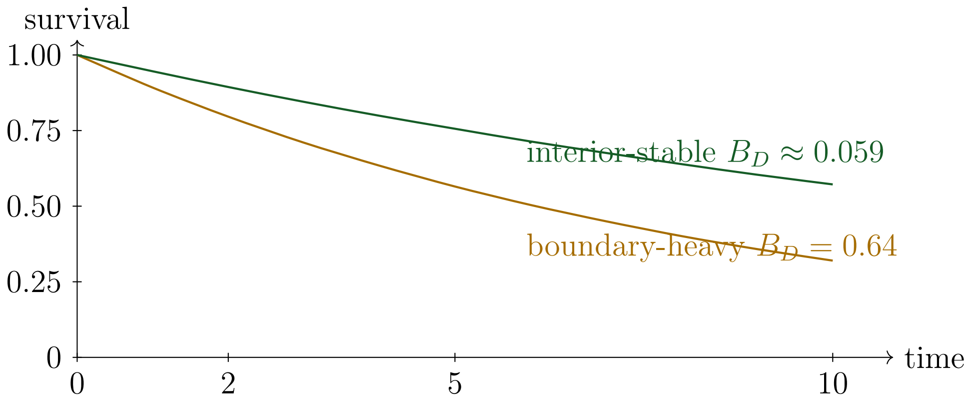


Figure 27: Numerical example. With the same phase exposure $W = 0.5$, the boundary-heavy support loses survival weight faster because its Surtea boundary exposure increases $\Gamma$.

3. Choose the Surtea measure $\mu : \mathcal{D} \to R$, extend it to $[\mathcal{D}]$, and choose the positive readout $\rho : R \to \mathbb{R}_{\geq 0}$. In the simplest toy model, $\rho_\mu(Y)$ is the number of cells assigned to $Y$.
4. Compute every exposure ratio:

$$B_D^\rho(X_i) = \frac{\rho_\mu(\partial_{\mathcal{D}} X_i)}{\rho_\mu(X_i^\circ) + \rho_\mu(\partial_{\mathcal{D}} X_i)}. \tag{168}$$

5. Fix the response function, for example

$$g(B) = 1 + \alpha B, \qquad \alpha \geq 0. \tag{169}$$

6. Fix $\Gamma_0$, $W$, $\Delta t$, and the number of steps $N$.
7. Evolve each survival weight by

$$S_i(N) = S_i(0) \exp\left(-N\, \Gamma_0\, g(B_D^\rho(X_i))\, W\, \Delta t\right). \tag{170}$$

If all other inputs are equal and $g$ is increasing, the pre-declared prediction is

$$B_D^\rho(X_i) > B_D^\rho(X_j) \quad \Longrightarrow \quad S_i(N) < S_j(N). \tag{171}$$

That gives a clean failure condition:

> Once $\mathcal{D}$, $\mu$, $\rho$, $g$, $\Gamma_0$, $W$, and the update rule are fixed independently, the Surtea-Austin bridge fails for that toy model class if larger readout boundary exposure does not produce the pre-declared larger loss within the stated tolerance.

For a high-school reader: decide the grid, decide how to count cells, decide the loss rule, and only then run the comparison. If the exposed shapes do not fade faster under the rule you promised in advance, the bridge has failed in that test.

# 16 Plain English Explanation

Imagine the support $X_n$ as a territory.

- The interior $X_n^\circ$ is the safe inside of the territory.
- The boundary $\partial_{\mathcal{D}} X_n$ is the edge where contact, stress, or interaction happens.
- The closure $\overline{\pi}_{\mathcal{D}}(X_n)$ is the whole territory once its edge is included.

The positive Pythagorean readout gives a simple way to measure how much of the whole is inside and how much is edge. If the boundary is large compared with the interior, the support is exposed. If the interior is large compared with the boundary, the support is more stable.

RSG then asks: which histories keep surviving as the recursive system evolves? The answer is controlled by a survival score $S$. If the loss rate is high, the score drops quickly. If the loss rate is low, the score drops slowly.

The Surtea-Austin bridge says:

> Boundary exposure should affect the loss rate, because exposed supports are more available to interaction, deformation, or dissipation.

The final formula is

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Gamma_0(\mu_{\mathrm{phys}})\, g(B_D^\rho(X))\, W(\varphi)\, S. \tag{172}$$

For a high-school reading, translate it as:

> The survival score goes down at a rate determined by three things: the ordinary physical loss, how exposed the support boundary is, and how exposed the phase motion is. Multiply those together, and you get the speed at which the history fades from the represented measure.

# 17 The Ultimate Formulas

The bridge can be summarised as a Surtea topological split, a Surtea measurable potential, a positive readout, an RSG loss rule, and then optional curvature and cyclic-history extensions.

## 1. Surtea support split

$$\overline{\pi}_{\mathcal{D}}(X_n) = X_n^\circ \cup \partial_{\mathcal{D}} X_n. \tag{173}$$

## 2. Surtea measurable potential

$$\mu : \mathcal{D} \to R, \qquad \mu : [\mathcal{D}] \to R. \tag{174}$$

$$\overline{\mu}(X) = \mu(\overline{\pi}_{\mathcal{D}}(X)), \qquad \mathring{\mu}(X) = \mu(\mathring{\pi}_{\mathcal{D}}(X)), \qquad \widetilde{\mu}(X) = \mu(\partial_{\mathcal{D}} X). \tag{175}$$

$$\widehat{\mu}(X, Y) = \mu(\overline{\pi}_{\mathcal{D}}(X) \cap \overline{\pi}_{\mathcal{D}}(Y)), \qquad X \cap Y = \varnothing. \tag{176}$$

## 3. Positive Pythagorean readout

$$\rho_\mu(\overline{\pi}_{\mathcal{D}}(X_n)) = \rho_\mu(X_n^\circ) + \rho_\mu(\partial_{\mathcal{D}} X_n)\,. \tag{177}$$

## 4. Boundary exposure ratio

$$B_D^\rho(X_n) = \frac{\rho_\mu(\partial_{\mathcal{D}} X_n)}{\rho_\mu(X_n^\circ) + \rho_\mu(\partial_{\mathcal{D}} X_n)}. \tag{178}$$

## 5. RSG phase exposure

$$W(\varphi_n) = \frac{\Theta_n^2}{\Theta_n^2 + \ell^2 \Pi_n^2}. \tag{179}$$

## 6. Surtea-Austin loss coefficient

$$\Gamma(\sigma_n) = \Gamma_0(\mu_n^{\mathrm{phys}})\, g(B_D^\rho(X_n)). \tag{180}$$

## 7. Survival law

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Gamma_0(\mu_{\mathrm{phys}})\, g(B_D^\rho(X))\, W(\varphi)\, S. \tag{181}$$

## 8. Curvature-aware extension

$$\frac{\mathrm{d}S}{\mathrm{d}t} = -\Gamma_0(\mu_{\mathrm{phys}})\, g(B_{D,\Omega}^\rho(\sigma))\, W_\Omega(\varphi)\, S. \tag{182}$$

## 9. Deformation diagnostic

$$\mathcal{D}_{\mathrm{def}}(K) = (\delta_{\mathrm{Pyth}}, \Delta_{\mathrm{bd}}, \Delta_{\mathrm{class}}, \Delta_{\mathrm{int}}) \to (0,0,0,0). \tag{183}$$

## 10. Cyclic-history exposure

$$\mathcal{A}_q(K_n) = \bigcup_{j=0}^{q-1} F^j(K_n), \qquad \mathcal{W}_q(K_n) = \bigcup_{j=0}^{q-1} \partial_{\mathcal{D}}(F^j(K_n)). \tag{184}$$

$$\Lambda_q(\sigma_n) = \Gamma_0(\mu_n^{\mathrm{phys}})\, g(B_D^{\rho,\mathrm{eff}}(K_n))\, W(\varphi_n). \tag{185}$$

The shortest verbal form is:

> Surtea defines the support boundary; Surtea's measurable potential gives the field measure; the positive readout gives the boundary share; RSG uses that share to weight survival.

This final chart is deliberately repetitive. By the end of the note, the reader should be able to follow the whole chain without needing to remember the surrounding prose: cells give boundary, boundary gives exposure, exposure changes loss, and loss changes which histories remain represented.

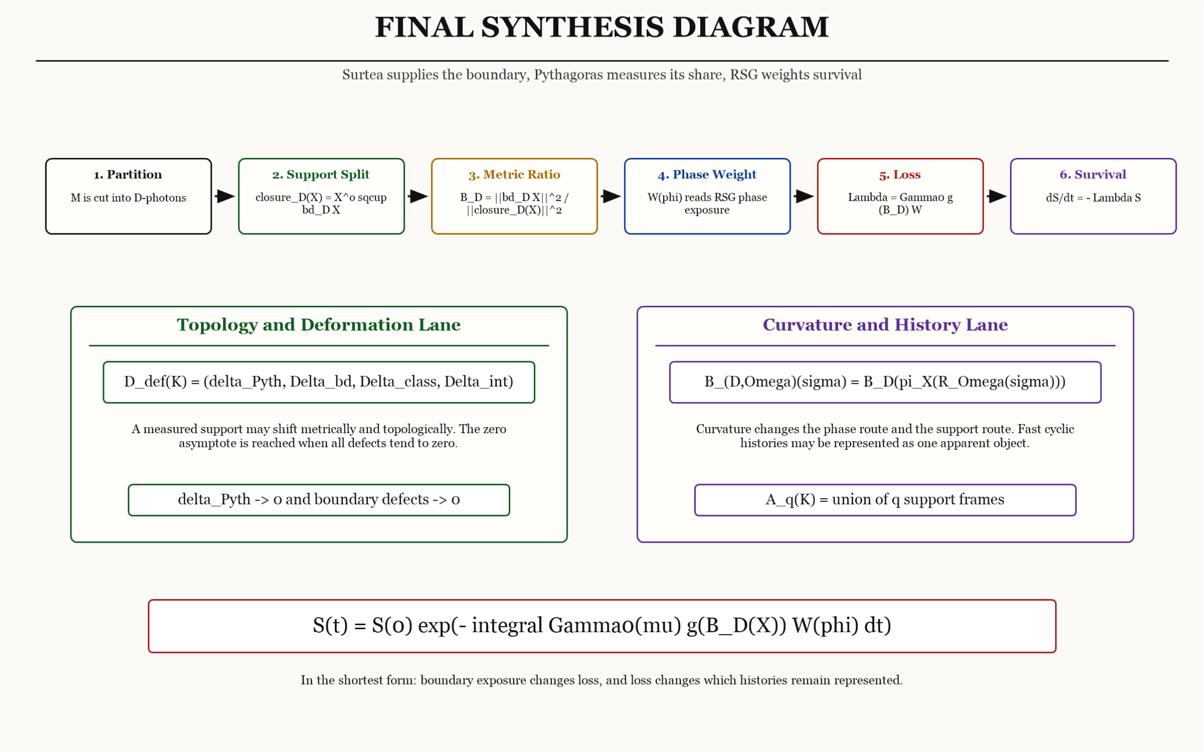


Figure 28: Final synthesis diagram. The bridge runs from partition cells, to Surtea support splitting, to Pythagorean boundary ratio, to RSG phase weighting, to survival and represented histories.

## 18 Figure Strategy

The figures are kept in the body of the paper because they are not decoration. They do different jobs in the argument. The foundation figures introduce partition cells, interior, closure, boundary, and the Surtea classes. The central triangle figures then build the Surtea-Austin bridge. The deformation, curvature, and sequential-history figures are marked as future bridges, so the reader can see the proposed direction without mistaking it for a completed physical derivation.

The main rule is simple: figures that support the formal bridge stay in the main line; figures that support curvature, wakes, rational closure, and three-point pathways stay with their corresponding future-bridge sections. This keeps all visual material available while making the claim status clear.

## 19 Cautions and Next Steps

1. The topological identity
$$\overline{\pi}_{\mathcal{D}}(X_n) = X_n^{\circ} \cup \partial_{\mathcal{D}} X_n \tag{186}$$
is exact in the Surtea setting. The pieces are already disjoint, so the ordinary union symbol is enough.
2. The Pythagorean readout formula requires Surtea's measurable potential $\mu$ and an added positive readout $\rho$. Surtea's bare partition geometry does not already

include a norm on $\overline{\pi}_{\mathcal{D}}(X)$, $\mathring{\pi}_{\mathcal{D}}(X)$, or $\partial_{\mathcal{D}}X$. Different applications may choose different readouts.

3. $B^{\rho}_{D}(X_n)$ should not replace $W(\varphi_n)$. They measure different kinds of exposure.

4. The response function $g$ must be fixed before fitting data. If it is chosen freely after the fact, the framework becomes too flexible.

5. The curvature-aware formula requires a specified curvature rule $R_{\Omega}$ or a specified field $\Omega^2$. Without that rule, curvature remains a schematic organiser rather than a predictive input.

6. The deformation diagnostic separates readout-level defect from topological defect. A small $\delta_{\mathrm{Pyth}}$ does not guarantee a small boundary or class defect, because the support may cut the partition cells differently.

7. The sequential-history construction requires a specified update rule $F$, a cycle length $q$, and a time-scale relation between $\Delta t_{\mathrm{upd}}$ and $\Delta t_{\mathrm{obs}}$. Without those, apparent stillness and support wakes remain schematic diagnostics.

8. The etheron-centred three-point pathway is a modelling bridge only. It should not be described as a derivation of proton, neutron, electron, or photon structure until an interaction law and empirical fit are given.

9. The Dirac comparison is a structural analogy about preserving an invariant quadratic form. It should not be overstated as a derivation of Dirac theory.

# References

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