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Temporal Dynamics: A Unified Baseline-Consistency Framework for Gravity, Electromagnetism, and Wave Transport

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Temporal Dynamics: A Unified Baseline-Consistency Framework for Gravity, Electromagnetism, and Wave Transport

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Abstract

This paper presents a unified Temporal Dynamics (TD) formulation of gravity, electromagnetism, wave propagation, and annihilation using a single baseline-relay framework. In TD, the baseline relay speed is fixed at $S \equiv c$, while local physical departures from the reference state are encoded by a lag field $\Delta T(x, t)$ and a signed texture-load $\chi \equiv q\Delta T$. Gravity is modeled as the baseline curvature response to gradients in ΔT, while electric interaction is derived as signed texture-resolution of the same textured carrier-curve. Magnetism emerges as a motion-induced transverse warp-leftover generated when direct texture stretching is forbidden by baseline consistency. Radiation is interpreted not as a separate substance but as transported field-state difference generated by source-state transitions. The paper extends the signed-ΔT structure to annihilation, treating radiative output as the collapse of static carrier-texture disagreement into propagating baseline difference-content. A prediction section identifies testable signatures, including timing–difference transport separation, electric boundary saturation behavior, and strong-curvature magnetic amplification. The framework is presented as an operational and falsifiable platform intended for mathematical refinement, numerical simulation, and empirical comparison.

Keywords: Temporal Dynamics; baseline consistency; gravitational time lag; signed texture-load; gravity–electromagnetism unification; magnetism as warp-leftover; wave transport; signed ΔT structure; matter–antimatter annihilation

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1. TD Baseline

This section defines the baseline language of Temporal Dynamics (TD) in its simplest usable form. The purpose is not to re-derive all later results here, but to establish one operational picture that can carry gravity, electromagnetism, waves, and annihilation without switching conceptual frameworks.

TD begins from a single claim:

> Physical effects are baseline correction phenomena. The baseline must remain internally consistent, so whenever a local state changes, the system responds by curve redistribution, texture reorganization, or propagated difference.

In this framework, gravity and electromagnetism are not introduced as unrelated mechanisms. They are different correction channels of the same baseline process.

1.1. Space and Time as Operational Quantities

TD treats space and time as operational quantities.

- **Time** is the count of baseline update steps.
- **Distance** is the amount of baseline relay completed during those steps.

The unperturbed baseline relay speed is fixed and identified with

$$S \equiv c. \tag{1}$$

So in the reference baseline state,

$$d\ell_0 = c\, dt_0. \tag{2}$$

Equation (2) is the operational anchor of TD: one baseline time-step corresponds to a fixed relay distance. Every later effect is described as a local correction to this baseline bookkeeping.

1.2. Extra Space on the Baseline and Why Lag Appears

TD models mass as *extra space* (and later, signed variants including less-space structures). The key point is that this extra space is still part of the same baseline and must update under the same baseline relay rule.

That is the origin of lag.

If a region contains extra space, the baseline does not get a faster local clock to compensate. The baseline still relays at the same fundamental rate c. Therefore, the local update must cover more baseline content within the same relay rule, and a local update lag appears.

This lag is the TD gravitational quantity.

Define the local TD lag fraction by

$$\Delta T(x, t), \tag{3}$$

with the interpretation:

- $\Delta T = 0$: no local lag relative to the reference baseline,
- larger ΔT: stronger local lag (stronger mass-curve state),
- spatial variation in ΔT: source of gravitational response.

A useful operational form is to define the local lag as a fraction of a baseline crossing time. For a source region with characteristic diameter D, define the baseline crossing time

$$\tau_D \equiv \frac{D}{c}. \tag{4}$$

Then TD writes the lag fraction as

$$\Delta T = \frac{\Delta t_{\text{lag}}}{\tau_D}, \qquad \text{so} \qquad \Delta t_{\text{lag}} = \Delta T\, \tau_D. \tag{5}$$

This gives the central physical meaning immediately:

> ΔT is the straight-path baseline lag caused by extra space that still has to complete the same baseline tick.

1.3. From Straight-Path Lag to Curvature Geometry

The TD picture is not only that lag occurs; it is that the baseline must remain consistent while lag occurs.

When the extra-space region completes its delayed update, the baseline has effectively generated additional path content. TD describes the geometric response to this as curvature (the mass curve): the baseline redistributes the path into a curved geometry rather than violating the baseline relay rule.

This is the crucial distinction:

- the *straight-path lag* is encoded by ΔT,
- the *curved path geometry* is the consistency response produced by the baseline.

Using (5), the lag-time can be converted directly into a length:

$$\Delta \ell_{\text{lag}} = c\, \Delta t_{\text{lag}} = c(\Delta T\, \tau_D) = c\left(\Delta T\, \frac{D}{c}\right) = \Delta T\, D. \tag{6}$$

Equation (6) is one of the most important baseline checks in TD. It shows that the curvature-length budget can be computed directly from the straight-path lag fraction ΔT and a source scale D.

In other words:

The baseline lag (ΔT) is the primary physical quantity, and the curvature length is the geometry the baseline produces to remain consistent with that lag.

This gives a direct TD route from the scalar lag description to geometric curvature, without changing language or introducing a separate mechanism.

1.4. Dynamic Baseline Picture (Not a Static Curve)

The mass curve in TD is not a static object. It is part of the baseline relay itself.

Because the baseline relays at c, any change in the local ΔT field does not stop the relay. Instead, the baseline updates by changing the *direction* of the curve it takes while continuing to relay at the same baseline speed.

This is the TD dynamic picture:

- the baseline always relays at c,
- ΔT changes the local lag state,
- the mass-curve geometry redirects to preserve consistency,
- but that redirection does not automatically change the intrinsic carrier structure.

This matters later for the gravity–EM bridge: ordinary gravitational re-direction changes path/geometry, but does not by itself rewrite the local EM-defining structure.

1.5. Carrier Curve and Texture Are One Structured Object

A central TD point is that texture is *not* something riding on top of the mass curve.

The texture is the structure of the mass curve itself.

If the texture is removed, the mass curve is removed. There is no separate "carrier first, texture added later" picture in TD. The carrier is a *textured carrier-curve*.

This is the correct TD hierarchy:

1. extra space (or signed space-imbalance) produces a local lag state ΔT,
2. the baseline resolves that lag into a curved carrier geometry,
3. the internal signed arrangement of that same carrier geometry is its texture.

So the mass curve and texture are not two independent things. They are two descriptions of one baseline structure:

- **carrier magnitude / lag state** (ΔT),
- **carrier texture orientation / sign structure** (signed texture organization).

To prepare the EM bridge, define the compact signed texture-load quantity

$$\chi \equiv q\,\Delta T, \tag{7}$$

where q is the local sign/orientation marker of the texture.

Equation (7) is not yet the full EM law. It is the first bridge variable showing that EM can be expressed using the same baseline quantity (ΔT) that defines gravity.

1.6. Why Gradients Matter (and Uniform Background Does Not Force Motion)

A uniform ΔT background changes the local baseline relay condition, but by itself does not define a force.

What produces motion/response is a *gradient* in the lag field:

$$\nabla \Delta T \neq 0.$$

This is why TD gravity is fundamentally a gradient theory in practice:

- ΔT sets the local baseline state,

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- $\nabla\Delta T$ sets the direction and strength of the gravitational correction response.

The same logic later extends to the textured carrier state:

- local signed texture structure defines EM interaction rules,
- changes/rearrangements in that structure produce EM forces and radiation channels.

1.7. Operational Bridge Quantities

For later sections, two additional baseline forms are useful as operational checks:

$$N^2 = 1 - \Delta T, \tag{8}$$

and

$$n(x) = \frac{1}{\sqrt{1 - \Delta T(x)}} = \frac{1}{N(x)}. \tag{9}$$

These are bookkeeping forms of the same TD lag state:

- N tracks the local relay reduction relative to the reference baseline,
- n is the equivalent relay/stretch index form.

They are included here only as a compact dictionary. The primary TD quantity remains ΔT.

1.8. Baseline Consistency Statement

All later derivations use one consistency rule:

The baseline cannot lose or gain physical content by bookkeeping alone. If a local state changes, the system must compensate by curve redistribution, texture reorganization, or transported difference, while preserving baseline consistency.

This is the unifying statement behind the whole paper:

- **Gravity** is the baseline curvature response to the lag-state field ΔT.
- **Electromagnetism** is the signed texture-resolution behavior of that same textured carrier-curve.
- **Radiation/waves** are propagated differences between old and new baseline states.

1.9. Minimal TD Toolbox for the Next Sections

The minimal baseline toolbox used in the next sections is:

$$S \equiv c, \tag{10}$$

$$\Delta T(x,t) \quad \text{(local baseline lag fraction)}, \tag{11}$$

$$\tau_D = \frac{D}{c}, \tag{12}$$

$$\Delta t_{\text{lag}} = \Delta T\,\tau_D, \tag{13}$$

$$\Delta \ell_{\text{lag}} = c\,\Delta t_{\text{lag}} = \Delta T\,D, \tag{14}$$

$$N^2 = 1 - \Delta T, \tag{15}$$

$$n = \frac{1}{\sqrt{1-\Delta T}}, \tag{16}$$

$$\chi \equiv q\Delta T. \tag{17}$$

The next section (§2) states the TD postulates in compact form. Section 3 then develops gravity as the baseline curvature response from ΔT, and Section 4 develops electromagnetism as signed texture-resolution of the same textured carrier-curve.

1.10. Section Summary

TD starts from a fixed operational relay baseline (c) and describes mass as extra-space-induced lag in that baseline. The lag fraction ΔT encodes the straight-path delay; the mass curve is the geometry the baseline creates to remain consistent with that lag. The texture is not an added feature riding on the mass curve; it is the structure of the mass curve itself. This is why the same baseline quantity (ΔT) can support both gravity and electromagnetism in one framework.

2. TD Postulates

This section states the TD postulates in a form that follows directly from the baseline established in Section 1. The postulates do not introduce a second framework. They fix the allowed moves inside TD, so later derivations remain consistent and do not drift into analogy.

The baseline quantities from Section 1 remain the starting point:

$$S \equiv c, \qquad \Delta T, \qquad \chi = q\Delta T.$$

The lapse/index forms introduced earlier may still be used as compact checks, but the primary TD variable in this section is ΔT.

2.1. Why Postulates Are Needed

TD is designed as a derivation framework, not a collection of interpretations. The postulates below define what is physically allowed in TD:

- what can change locally,
- what must be conserved,
- how changes propagate,
- and which descriptions are physically equivalent.

2.2. Postulate 1: Baseline Relay

Postulate 1 (Baseline relay). Physical propagation and field communication occur through the baseline relay process, and the baseline relay speed is

$$S \equiv c. \tag{18}$$

Operational meaning. All propagated differences (signals, field-updates, radiative content) are transported by the same baseline relay process.

Immediate consequence. No physical difference-content propagates faster than the baseline relay. A source change generated at time t' influences a point a distance r away only at the retarded time

$$t = t' + \frac{r}{c}. \tag{19}$$

This is the TD causality lock used later for waves, source interaction, and history effects.

2.3. Postulate 2: Local Baseline State Is the Lag Field ΔT

Postulate 2 (Local lag field). The local baseline state is encoded by the lag field

$$\Delta T(x, t). \tag{20}$$

Operational meaning. ΔT is the local straight-path lag fraction produced when extra-space content must still complete the same baseline tick. It is the primary TD quantity for gravity.

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Immediate consequence. A uniform ΔT background changes local relay condition but does not by itself produce a directional response. Directional response requires a gradient:

$$\nabla \Delta T \neq 0. \tag{21}$$

In the bridge form used in this paper, the TD gravity response is written directly in terms of ΔT:

$$\mathbf{g} = -\frac{c^2}{2} \nabla \Delta T. \tag{22}$$

Equation (22) is the minimal TD gravity law used in later sections: gravity is the baseline response to spatial variation of the lag field.

2.4. Postulate 3: The Carrier Curve Is the Baseline Geometry of ΔT

Postulate 3 (Carrier-curve response). The mass curve is the baseline geometry generated to remain consistent with the local lag field ΔT. It is not a separate object added afterward.

Operational meaning. ΔT is the primary local lag (straight-path) quantity; curvature is the geometric consistency response the baseline produces from that lag.

For a source region with characteristic diameter D, define the baseline crossing time

$$\tau_D = \frac{D}{c}. \tag{23}$$

Then the lag time and equivalent lag-length budget are

$$\Delta t_{\text{lag}} = \Delta T \, \tau_D, \qquad \Delta \ell_{\text{lag}} = c \, \Delta t_{\text{lag}} = \Delta T \, D. \tag{24}$$

Immediate consequence. The curvature-length budget is computed directly from ΔT. This is the TD bridge from local lag to geometry.

Dynamic form of the same postulate.

The carrier curve is not static. It is part of the baseline relay itself. When the ΔT field changes, the carrier curve updates by changing the direction it takes while the baseline continues relaying at c. The relay speed is unchanged; the local curve geometry is what updates.

This is the TD picture used later for gravity–EM consistency:

- ΔT changes the local lag state,
- the carrier geometry redirects to preserve the baseline,
- the baseline relay remains at c.

2.5. Postulate 4: Texture Is the Structure of the Carrier Curve

Postulate 4 (Carrier-texture unity). The texture is the structure of the carrier curve itself. It is not a separate layer riding on an already-complete mass curve.

Operational meaning. In TD, the mass curve and its texture are one structured baseline object described in two ways:

- **carrier magnitude / lag state**: ΔT,
- **carrier texture orientation / sign structure**: the signed organization of that same ΔT-defined curve.

A compact signed texture-load variable is introduced as

$$\chi \equiv q \, \Delta T, \tag{25}$$

where q is the local sign/orientation marker.

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Immediate consequence. Because texture is the structure of the carrier curve, it cannot appear or disappear arbitrarily. Any local texture change is a baseline-structural change and must obey TD conservation and transport rules.

This postulate is the conceptual bridge for EM: the EM channel is built from the same ΔT-defined carrier structure that defines gravity.

2.6. Postulate 5: Baseline Substance Is Conserved

Postulate 5 (Baseline substance conservation). Extra-space content, carrier curvature, and carrier texture are states of the baseline itself. They are not created or destroyed by notation or relabeling.

Operational meaning. TD permits only three types of change:

1. redistribution of baseline structure,
2. local re-resolution into a new configuration,
3. conversion between bound structure and propagated difference.

Immediate consequence. TD conservation laws are redistribution laws. Local changes must be balanced by transport or by conversion into propagated difference-content.

This is the foundation for:

- local texture continuity,
- radiation as transported change,
- annihilation as release of structured baseline difference.

2.7. Postulate 6: Electromagnetism Is the Signed Texture-Resolution Channel

Postulate 6 (EM channel). Electromagnetism is the baseline correction channel that appears when signed carrier-textures interact and must resolve while preserving the ΔT-defined carrier consistency.

Operational meaning. EM is not introduced as an unrelated field. It is the signed texture-resolution behavior of the same textured carrier curve already defined by ΔT.

This postulate gives the TD bridge statement:

- gravity is the response to $\nabla \Delta T$ (carrier-lag gradient),
- EM is the response to signed texture-resolution built from $\chi = q\Delta T$.

Immediate consequence. The electric and magnetic channels are not separate ontologies in TD; they are two ways the baseline preserves the same structured carrier under interaction and motion.

(The explicit electric-share and magnetic-leftover forms are developed in Sections 4 and 5.)

2.8. Postulate 7: Signed Texture-Load Is Locally Conserved Under Redistribution

Postulate 7 (Texture continuity). Signed texture-load is locally conserved under baseline redistribution. Local change in signed texture-load must be matched by transport.

Operational meaning. Since texture is the structure of the carrier curve itself, it cannot appear or disappear on its own. Local changes are allowed only if a transport current accounts for them.

Define:

- $\rho_\chi(x,t)$: signed texture-load density,
- $\mathbf{J}_\chi(x,t)$: signed texture-load current.

Then the local TD continuity law is

$$\frac{\partial \rho_\chi}{\partial t} + \nabla \cdot \mathbf{J}_\chi = 0. \tag{26}$$

Immediate consequence. No local signed texture can be created or deleted without a flow term. This is the TD conservation lock behind charge continuity.

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2.9. Postulate 8: Motion/Stretch Generates Leftover; Radiation Is Change in Leftover

Postulate 8 (Leftover and radiation). Motion or reconfiguration of a textured carrier can generate a mismatch (leftover) relative to its previous local expression. Radiation is generated only when that leftover changes.

Operational meaning. TD distinguishes:

- a persistent field structure (which may have a nonzero leftover),
- a radiative wave (which requires a time-varying leftover).

Define the motion factor

$$\rho_v = \sqrt{1 - \frac{v^2}{c^2}}, \tag{27}$$

and the TD leftover (bridge form)

$$\delta\chi \equiv \delta(q\Delta T) = \chi\left(\frac{1}{\rho_v} - 1\right). \tag{28}$$

Radiative source content is then generated by change in leftover:

$$\Delta(\delta\chi) = \delta\chi_{\text{new}} - \delta\chi_{\text{old}}. \tag{29}$$

Immediate consequence. A system can sustain a strong local magnetic/warp structure without radiating continuously if its leftover is steady. Radiation requires

$$\Delta(\delta\chi) \neq 0. \tag{30}$$

2.10. Postulate 9: Propagated Difference-Content Has Finite-Speed Identity

Postulate 9 (Difference transport and identity). Once generated, a field-difference is propagated by the baseline relay at speed c. During propagation, its local representation may change, but its source-generated difference identity is preserved.

Operational meaning. TD treats waves as transported difference-content (old state → new state). Path curvature, delay, and local decomposition may alter appearance, but not the physical identity of the propagated difference.

In vacuum, the retarded transport form is

$$\Delta(\delta\chi)(r,t) = \Delta(\delta\chi)\Big(0, t - \frac{r}{c}\Big). \tag{31}$$

In a nonuniform $\Delta T(x)$ background, the travel time is path-dependent:

$$t_{\text{travel}} = \frac{1}{c}\int n(x)\,dl, \qquad n(x) = \frac{1}{\sqrt{1-\Delta T(x)}}. \tag{32}$$

Immediate consequence. The observed waveform may be delayed, redshifted, or geometrically redirected by the background, while still carrying the same source-born difference-content.

2.11. Postulate 10: Bookkeeping Invariance

Postulate 10 (Bookkeeping invariance). Different valid TD bookkeeping choices may change intermediate expressions, but they must not change measurable outcomes.

Operational meaning. TD permits multiple descriptions of the same baseline process (for example, lag-first, curve-length-first, or propagated-difference-first descriptions), provided they agree on observables.

If $\mathcal{B}_1$ and $\mathcal{B}_2$ are two valid TD descriptions of the same process and $\mathcal{O}[\cdot]$ is a measurable outcome, TD requires

$$\mathcal{O}[\mathcal{B}_1] = \mathcal{O}[\mathcal{B}_2]. \tag{33}$$

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Immediate consequence. TD is not reduced to notation. The invariant core is the baseline correction process itself, not any one preferred decomposition.

2.12. Derivation Flow for the Rest of the Paper

The postulates above produce the working derivation chain used in the rest of the paper:

1. Fix the baseline relay: $S \equiv c$.
2. Define the local carrier-lag state: $\Delta T(x, t)$.
3. Build gravity from the lag gradient:
$$\mathbf{g} = -\frac{c^2}{2}\nabla\Delta T.$$
4. Encode signed carrier-texture with $\chi = q\Delta T$.
5. Enforce local conservation using
$$\partial_t \rho_\chi + \nabla \cdot \mathbf{J}_\chi = 0.$$
6. Generate motion/stretch leftover using $\delta\chi$.
7. Generate radiation only when $\delta\chi$ changes.
8. Propagate the resulting difference-content at finite speed through the baseline.
9. Require bookkeeping-equivalent descriptions to produce the same observables.

This gives a single TD language for gravity, EM, waves, and annihilation.

2.13. Section Summary

The TD postulates fix the framework at the level of principle. The baseline relay remains at c, the local gravitational state is the lag field ΔT, the carrier curve is the geometry generated from that lag, and the texture is the structure of that carrier curve itself. Because texture is baseline structure, it is locally conserved under redistribution. Motion and reconfiguration generate leftover; radiation is the change in leftover; and all propagated difference-content travels at finite speed with preserved identity. Different TD bookkeeping choices are allowed, but measurable outcomes must remain invariant.

Section 3 develops gravity directly from the ΔT field and its gradients. Section 4 then develops the EM channel as signed texture-resolution of the same textured carrier curve.

3. Gravity as Baseline Curvature Response

In Temporal Dynamics (TD), gravity is the baseline response to extra space-content. It is not introduced as a separate field placed on top of reality. The baseline relay rule remains fixed, and the local geometry adjusts to keep that rule consistent.

The gravity channel begins from one statement:

> Mass is extra space on normal space. Because that extra space is still part of the baseline, it must complete the same baseline tick. The resulting lag is the gravitational load, and the geometric expression of that load is the mass curve.

A second point is equally important for everything that follows in this paper:

> The mass curve is not a bare curve with a texture added later. The texture is the local structure of the mass curve itself. If the texture is removed, the mass curve is removed.

In the gravity section, the net external effect is written with the gravitational lag field ΔT_g. The electromagnetic (signed texture) structure is developed in the next section.

3.1. Baseline Relay and the TD Conversion Constant

TD uses one operational relay baseline:

$$c = 299{,}792{,}458\ \mathrm{m\,s^{-1}}. \tag{34}$$

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It is convenient to define the TD baseline conversion constant

$$U_C \equiv \frac{1}{c} = 3.335640951\ldots \times 10^{-9}\ \mathrm{s\,m^{-1}}. \quad (35)$$

For any straight baseline distance d, the baseline transit time is

$$t_0(d) = d\,U_C = \frac{d}{c}. \quad (36)$$

Equation (36) is the reference timing rule. TD does not let gravity change this baseline rule. Gravity must therefore appear as a *lag-and-geometry correction* relative to the same fixed relay.

3.2. Mass as Extra Space and Why Lag Appears

A mass region contains extra space relative to the same baseline extent. The extra space is not external to the baseline; it is a local baseline configuration. Because it is still baseline space, it does not get a second clock.

This immediately forces a lag:

- the baseline tick rule remains the same,
- the local region contains more space-content to complete under that same rule,
- the local completion therefore lags the reference baseline.

That lag is the gravitational time-load in TD.

The observable gravity channel is the net lag field ΔT_g. Internally, the mass curve is already a textured baseline configuration, but in neutral matter the signed texture is locally arranged so that the net external effect at this stage is the gravity lag field and its curvature response.

3.3. TD Gravity Constant and the Lag Field ΔT_g

TD uses the mass conversion constant (diameter form)

$$K_M = 2.970330587876230031748161313565 \times 10^{-27}\ \mathrm{m\,kg^{-1}}. \quad (37)$$

For a source mass M, define its TD gravity length scale

$$D_M \equiv K_M M. \quad (38)$$

The gravitational lag field in diameter form is

$$\Delta T_g(d) = \frac{D_M}{d} = \frac{K_M M}{d}. \quad (39)$$

A radius form is also useful. With $d = 2r$, define

$$k_m \equiv \frac{K_M}{2}, \qquad r_M \equiv k_m M, \quad (40)$$

so that

$$\Delta T_g(r) = \frac{r_M}{r} = \frac{k_m M}{r}. \quad (41)$$

This is the core gravity relation in TD:

- more mass $\Rightarrow$ more lag,
- greater distance $\Rightarrow$ the same source lag is spread across more baseline extent, so the lag decreases.

3.4. Straight-Path Lag and Curved-Path Geometry

Equation (39) is the *straight-path* bookkeeping statement. It tells how much local baseline lag is present relative to the reference baseline across a baseline separation d.

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The baseline cannot implement this by changing c. The relay rule stays fixed.

The allowed correction is geometric: the lag is expressed as a curved relay path (the mass curve). In TD language,

> The straight-path ΔT_g drives the correction. The mass curve is the geometry that carries that lag while preserving the baseline rule.

This is the gravity mechanism:

1. extra space produces a local lag field ΔT_g,
2. the baseline relay remains fixed,
3. the lag is therefore realized as curvature (mass curve),
4. the curve continuously carries the lag through the baseline relay.

The mass curve is therefore not a static picture. It is a moving baseline path-state maintained by the same relay rule.

3.5. Converting ΔT_g Directly into Curvature Length

The lag field can be converted directly into a geometric excess length using only the TD baseline conversion.

Let L be a chosen reference segment (for example, the source diameter, or any local baseline segment used in a calculation). Its baseline transit time is

$$t_0(L) = L\,U_C. \tag{42}$$

If the local lag fraction is ΔT_g, the corresponding lag time attached to that segment is

$$\tau_g(L) = \Delta T_g\, t_0(L) = \Delta T_g\, L\, U_C. \tag{43}$$

Converting that lag time back into distance with the same baseline relay gives the curvature-length excess

$$L_{\mathrm{curv}}(L) = c\,\tau_g(L) = \Delta T_g\, L. \tag{44}$$

This is the direct TD evidence chain:

$$\Delta T_g \longrightarrow \tau_g \longrightarrow L_{\mathrm{curv}}. \tag{45}$$

The lag is therefore not only a timing statement. It also produces a geometric curve-length through the same TD conversion rule.

3.6. Gravity Acceleration from Baseline Share

Gravity in TD is generated by the straight-path lag ΔT_g, but the lag is carried by the arriving curve-state. A remote point does not respond to a source relabeling instantly; it responds when the updated curve-state arrives through the baseline relay.

To write the acceleration law directly in TD form, define the local baseline-share factor

$$S_g(d) \equiv \frac{d\,U_C}{(d\,U_C) + \tau_g(d)}. \tag{46}$$

Using $\tau_g(d) = \Delta T_g(d)\, d\, U_C$, this becomes

$$S_g(d) = \frac{1}{1 + \Delta T_g(d)}. \tag{47}$$

The TD gravity acceleration is then generated from the baseline-to-local relay difference through the TD acceleration form

$$a_g(d) = \frac{c^2}{2d}\left[1 - S_g(d)^2\right]. \tag{48}$$

Substituting Equation (47) gives an explicit TD gravity law in terms of the lag field:

$$a_g(d) = \frac{c^2}{2d}\left[1 - \frac{1}{\left(1 + \Delta T_g(d)\right)^2}\right]. \tag{49}$$

This form is fully TD:

- ΔT_g comes from extra space,
- S_g is the baseline-share after lag,
- a_g is generated from the baseline/local relay difference.

Weak-field form.

For $\Delta T_g \ll 1$,

$$\frac{1}{(1 + \Delta T_g)^2} \approx 1 - 2\Delta T_g, \tag{50}$$

so Equation (49) reduces to

$$a_g(d) \approx \frac{c^2}{d}\,\Delta T_g(d). \tag{51}$$

Using $\Delta T_g(d) = K_M M/d$,

$$a_g(d) \approx \frac{c^2 K_M M}{d^2}. \tag{52}$$

This is the TD inverse-square behavior in diameter form. The distance weakening is not imposed as a separate force law; it is the direct result of how the lag share ΔT_g spreads with distance.

3.7. Equivalent Gradient Form (Bridge Form)

The same gravity channel can be written as a gradient law (useful as a compact bridge form). In radius form, $\Delta T_g(r) = k_m M/r$, so the weak-field acceleration is equivalently

$$\mathbf{g}(\mathbf{x}) \;=\; -\frac{c^2}{2}\,\nabla \Delta T_g(\mathbf{x}), \tag{53}$$

with the direction always toward increasing ΔT_g (toward the source).

This is the same gravity channel as Equation (49); it is the gradient version of the straight-path lag rule in the weak-field/bridge regime.

3.8. The Curve Is Dynamic And Propagates at c

The mass curve is a baseline relay structure, so it is continuously maintained by the relay. It is not a frozen geometric object.

When a source is static, the curve is stationary in form. When the source changes, the lag field changes, and the curve-state updates. That update propagates through the baseline at the relay speed c.

In operational form, the remote gravity field is evaluated from the *arrived* lag profile:

$$\Delta T_g(\mathbf{x}, t) \;=\; \Delta T_g^{(\text{source})}\!\left(t - \frac{R}{c}\right) \quad \text{(vacuum relay, schematic form)}, \tag{54}$$

where R is the source-to-field-point separation along the propagation path.

This locks the gravity picture to the same baseline transport rule used later for electromagnetic waves:

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- the straight-path lag defines the correction,
- the curve carries that correction,
- the correction is felt when the updated curve-state arrives.

3.9. Curve Resolution for Multiple Masses

When multiple sources are present, the baseline cannot support incompatible curve requirements in the same region. The lag fields must resolve into a single cumulative curve-state.

In the weak/bridge regime, the lag fields combine approximately as

$$\Delta T_{g,\mathrm{tot}}(\mathbf{x},t) \approx \sum_i \Delta T_{g,i}(\mathbf{x},t), \tag{55}$$

and the gravity response follows from the same TD rule:

$$\mathbf{g}_{\mathrm{tot}}(\mathbf{x},t) = -\frac{c^2}{2}\nabla\Delta T_{g,\mathrm{tot}}(\mathbf{x},t) \quad \text{(bridge form)}. \tag{56}$$

This is not a separate force postulate. It is the baseline consistency condition for overlapping mass curves.

3.10. Wall Condition and the Black-Boundary

A special TD limit appears when the gravitational lag reaches the wall value

$$\Delta T_g = 1. \tag{57}$$

Using Equation (39),

$$1 = \frac{K_M M}{D_h} \quad \Longrightarrow \quad D_h = K_M M. \tag{58}$$

Equivalently, in radius form,

$$r_h = k_m M. \tag{59}$$

The black-boundary is therefore not inserted separately. It is the $\Delta T_g = 1$ limit of the same gravity lag field used everywhere else in TD.

3.11. Section Summary

The TD gravity channel is fully built from the baseline lag field ΔT_g:

1. Mass is extra space on normal space.
2. Extra space remains part of the baseline and must complete the same baseline tick.
3. This produces a gravitational lag field ΔT_g.
4. The baseline relay rule stays fixed, so the lag is expressed geometrically as the mass curve.
5. The lag converts directly into curvature length through the TD baseline conversion rule.
6. Gravity acceleration is generated from the baseline-share reduction:

$$a_g(d) = \frac{c^2}{2d}\left[1 - S_g(d)^2\right], \qquad S_g(d) = \frac{1}{1+\Delta T_g(d)}.$$

7. The curve is a dynamic relay structure; source changes propagate as curve-state updates at c.

A full gravity-only derivation (including strong-field spin corrections and detailed horizon dynamics in TD) is deferred to the companion gravity paper [1].

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3.12. Single Checksum Link

As a checksum only (not as a starting point), the TD constants satisfy

$$k_m = \frac{2G}{c^2}, \qquad K_M = \frac{4G}{c^2}. \tag{60}$$

With $d = 2r$, the weak-field TD law in Equation (52) becomes

$$a_g(r) = \frac{GM}{r^2}, \tag{61}$$

and the wall condition in Equation (58) becomes

$$D_h = \frac{4GM}{c^2}, \tag{62}$$

which matches the standard Schwarzschild diameter (equivalently $r_s = 2GM/c^2$).

3.13. Operational Measurement of the TD Gravity Variable

TD is not only geometric language; it is operational.
From

$$N^2 = 1 - \Delta T,$$

and using the local clock-rate ratio $N = d\tau/dt$ (local proper time over baseline reference time), we get:

$$\Delta T = 1 - \left(\frac{d\tau}{dt}\right)^2. \tag{63}$$

This is important because it tells us ΔT can be obtained directly from clock comparisons [2]. Once $\Delta T(x)$ is known (or inferred), the TD gravitational acceleration follows immediately from the gradient law:

$$\mathbf{a}_g = \frac{c^2}{2}\nabla\Delta T.$$

So the TD gravity pipeline is operationally closed:

$$\text{clock-rate map} \rightarrow \Delta T(x) \text{ map} \rightarrow \text{gradient} \rightarrow \text{gravitational response}.$$

4. EM as Signed Local Texture-Resolution (Electric Channel)

In Temporal Dynamics (TD), electromagnetism is not introduced as a separate field system independent of gravity. It appears from the same baseline mechanism, at a deeper layer of the same mass-curve construction.

The key point is structural:

> The mass curve is not an empty carrier with texture added on top of it. The signed texture is part of what *makes* the mass curve. If the texture is removed, the curve structure that depends on it is removed.

Gravity (Section 3) described the net lag of mass-space as the scalar field ΔT_m. This section goes one level deeper and introduces the *signed* sub-structure inside mass-space. That signed sub-structure produces the electric channel. An earlier version of TD electromagnetism was developed in [3]

4.1. From Mass-Space to Signed Texture-Space

Section 3 established the gravity picture:

- mass is extra space on normal space,
- the extra space must complete the baseline tick,
- this creates a lag field ΔT_m,

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- the lag is realized geometrically as the mass curve.

EM begins inside that same construction.

TD treats the mass region as containing *signed local extra-space structure* (curve-type / stretch-type sub-structure) inside the mass extra-space. These signed local contributions are not a second substance. They are the internal geometry of the same baseline configuration.

Two distinct quantities are then separated:

1. **Net mass lag** ΔT_m: the scalar lag that sets the local mass-curve (gravity channel).
2. **Signed texture lag** $q\Delta T$: the signed local texture contribution that sets the electric channel.

The same baseline logic applies to both:

- mass-space must complete the baseline tick $\Rightarrow \Delta T_m$,
- signed texture-space inside it must also complete the baseline tick $\Rightarrow q\Delta T$.

This is why the EM channel in TD is not foreign to gravity. It is a finer signed layer of the same baseline correction process.

4.2. How Signed Texture Is Generated

The generation mechanism is the same as gravity, but applied to the signed internal structure.

Step 1: Signed sub-space creates a signed local lag.

Inside the mass region, the signed texture-space contributes a local signed lag. TD denotes this by

$$q\Delta T, \tag{64}$$

where the sign encodes the local texture orientation.

Step 2: The mass-space still must complete its baseline tick.

The carrier mass-space (the ΔT_m structure) still has to complete its baseline update under the same rule $S \equiv c$. It cannot change the baseline relay constant.

Step 3: The signed lag must be realized geometrically.

Because the baseline rule cannot change, the signed local lag $q\Delta T$ is also expressed geometrically. This geometric expression is the *texture of the mass curve*.

That is the correct TD picture:

> ΔT_m sets the carrier mass-curve scale. $q\Delta T$ sets the signed texture geometry within that mass-curve. The texture is not separate from the curve; it is part of the curve's internal structure.

Step 4: Why texture cannot freely re-curve at fixed mass.

If the signed texture were allowed to change its own curve-length arbitrarily while the total mass-state ΔT_m is unchanged, the mass curve would no longer complete the same baseline tick consistently. That would rewrite the baseline bookkeeping without changing the actual mass-state, which TD forbids.

So the signed texture must obey a strict rule:

$$\text{texture may resolve, but not by rewriting the carrier mass-curve at fixed } \Delta T_m. \tag{65}$$

This restriction is exactly what generates the electric response.

4.3. The Electric Problem in TD: Texture-Resolution Without Carrier Rewrite

When two charged structures come into interaction range, their signed textures must resolve into a new cumulative local texture state. This is the same baseline requirement used in gravity (curve resolution), but now the issue is *signed texture resolution*.

The problem is:

1. A new cumulative $q\Delta T$ texture state is required locally.
2. Directly changing the texture curve-length would change the carrier mass-curve, even when the mass-state ΔT_m has not changed.
3. TD forbids that carrier rewrite.

So the baseline needs a legal way to resolve the interaction.

The legal correction is **radial geometry adjustment** (separation adjustment), not carrier-texture rewrite.

This is the electric channel in TD.

4.4. Why Like Charges Repel and Unlike Charges Attract in TD

The electric response is geometric and baseline-constrained, not an added force primitive.

Like-signed texture (repulsion).

For like textures, the local texture mismatch cannot cancel. If the baseline tried to force direct local texture re-resolution at the same separation, it would demand a texture-curve change that rewrites the carrier mass-curve.

That is not allowed.

The baseline instead resolves the conflict by *increasing separation geometry*. In TD language, the baseline delays the forced local texture re-resolution by increasing the distance available to the interaction.

This appears as electric repulsion.

$$\text{Like texture mismatch} \implies \text{radial separation increase.} \tag{66}$$

Opposite-signed texture (attraction).

For opposite textures, local signed cancellation is available. The baseline can reduce the mismatch by reducing the separation geometry because the signed textures resolve toward each other instead of demanding a carrier rewrite.

This appears as electric attraction.

$$\text{Opposite texture mismatch} \implies \text{radial separation decrease.} \tag{67}$$

Important TD interpretation.

Nothing is "pulling" or "pushing" in a separate-field sense. The baseline is enforcing consistency:

- it does not allow texture re-resolution to rewrite the carrier curve at fixed ΔT_m,
- so it resolves the mismatch through a change in distance instead.

The electric acceleration law below is the quantitative form of that baseline correction.

4.5. Charge-to-$q\Delta T$ Conversion

To compute electric effects, physical charge (in Coulombs) must be mapped into the TD signed texture-lag quantity $q\Delta T$.

Let:

- Q_1, Q_2 be the interacting charges (C),
- d be their separation (diameter-form distance used consistently with earlier sections),

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- k_q be the TD charge conversion constant.

  TD uses the geometric spreading form

$$q\Delta T_0(d) = k_q \frac{|Q_1 Q_2|}{d^2}, \tag{68}$$

and the signed form

$$q\Delta T(d) = \mathrm{sgn}(Q_1 Q_2)\, q\Delta T_0(d). \tag{69}$$

Equation (68) is the TD charge-texture map:

- $1/d^2$ is the geometric spreading law of the interaction share,
- k_q converts Coulomb charge product into a dimensionless TD lag quantity,
- the sign is carried separately by $\mathrm{sgn}(Q_1 Q_2)$.

Why the d^2 form appears.

This is the charge-texture analog of geometric spreading. A signed texture mismatch sourced at one location is shared over area-like spreading, so the local contribution at separation d scales as $1/d^2$. TD then converts that geometric share into a local signed lag fraction $q\Delta T$.

4.6. The Charge Constant k_q and Why It Is Linked to the Mass Constant

The TD charge constant is not introduced as an arbitrary parameter. It is tied to the TD mass constant k_m and the baseline relay c.

Using the locked TD constants from the gravity section and the standard Coulomb constant only as a calibration checksum, the TD charge constant is

$$k_q = \frac{2 k_e k_m}{c^2}. \tag{70}$$

Since $K_M = 2k_m$, this can also be written as

$$k_q = \frac{k_e K_M}{c^2}. \tag{71}$$

This is the direct gravity–EM constant bridge in TD.

Units check (important).

$$[k_e] = \mathrm{N\,m^2\,C^{-2}} = \mathrm{kg\,m^3\,s^{-2}\,C^{-2}}, \qquad [k_m] = \mathrm{m\,kg^{-1}}.$$

Therefore

$$[k_e k_m] = \mathrm{m^4\,s^{-2}\,C^{-2}}, \qquad \left[\frac{k_e k_m}{c^2}\right] = \mathrm{m^2\,C^{-2}}.$$

So

$$\left[k_q \frac{Q_1 Q_2}{d^2}\right] = \left[\mathrm{m^2\,C^{-2}}\right]\left[\mathrm{C^2}\right]\left[\mathrm{m^{-2}}\right] = 1,$$

which confirms that $q\Delta T$ is dimensionless, exactly as required for a TD lag quantity.

Numerical value (using the locked TD constants).

With

$$k_e = 8.9875517923 \times 10^9\ \mathrm{N\,m^2\,C^{-2}}, \qquad k_m = \frac{2G}{c^2},$$

the TD charge constant is

$$k_q \approx 2.9703305895 \times 10^{-34}\ \mathrm{m^2\,C^{-2}}. \tag{72}$$

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This makes the EM texture quantity $q\Delta T$ a fully defined TD object with the same baseline meaning as ΔT_m: a local lag-share in the baseline bookkeeping.

4.7. Electric Acceleration from the TD Share Law

The electric response uses the same TD acceleration template used elsewhere in the framework: a baseline correction acceleration is generated by a *share* of the local time-budget mismatch.

Let $\Delta T_m(d)$ be the local carrier mass-lag involved in the interaction (from Section 3), and let $q\Delta T(d)$ be the signed texture-lag from Equation (69).

Define the electric share factor

$$S_E(d) = \frac{q\Delta T(d)}{\Delta T_m(d) + |q\Delta T(d)|}. \tag{73}$$

Then the TD electric acceleration is

$$\mathbf{a}_E(d) = \frac{c^2}{2d}\, S_E(d)\, \hat{\mathbf{r}}, \tag{74}$$

where $\hat{\mathbf{r}}$ is the radial unit vector from source to test body.

This is the electric channel in TD form.

Interpretation of Equation (74).

- $\frac{c^2}{2d}$ is the TD baseline acceleration scale at distance d,
- S_E is the signed share of the local baseline mismatch that must be resolved through radial geometry correction,
- the sign of $q\Delta T$ determines repulsion $(+)$ or attraction $(-)$.

Why this is the same TD logic as gravity.

Gravity used the lag field ΔT_m to generate curvature response. Electricity uses the signed texture-lag $q\Delta T$, but the correction is constrained by the same carrier mass-lag ΔT_m. The baseline does not run two unrelated laws; it resolves two layers of the same law.

4.8. Explicit Connection to the Carrier Mass Curve

The electric share law only makes sense because the texture is tied to the carrier mass curve.

At fixed total mass-state:

$$\Delta T_m \text{ fixed} \quad \Longrightarrow \quad \text{carrier mass-curve scale fixed.} \tag{75}$$

If a local texture interaction tries to change the signed texture curve-length directly, it would alter the carrier curve bookkeeping while ΔT_m is unchanged. TD forbids that.

So the baseline redirects the correction into the only legal channel:

$$\text{texture mismatch} \longrightarrow \text{radial distance correction} \longrightarrow \mathbf{a}_E. \tag{76}$$

This is why the electric response is naturally radial in the static case, and why the sign of the texture mismatch determines attraction vs. repulsion.

4.9. Limit Behavior (TD Prediction Knob Built into the Electric Law)

The TD share law has an internal limit structure:

$$|S_E(d)| < 1 \quad \Longrightarrow \quad |\mathbf{a}_E(d)| < \frac{c^2}{2d}. \tag{77}$$

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So the electric channel is *share-limited* by construction. This is not inserted afterward; it is already present in the TD bookkeeping form.

That makes the electric law useful for TD stress tests:

- weak-share regime ($|q\Delta T| \ll \Delta T_m$),
- comparable-share regime,
- near-limit regime ($|S_E| \to 1$).

The framework therefore contains a built-in nontrivial limit behavior without changing the baseline rule $S \equiv c$.

4.10. Dynamic Statement (Preparing the Magnetic and Wave Sections)

The electric picture above is often drawn statically, but the TD picture is never truly static.

- The mass curve is a baseline relay geometry, continuously maintained.
- The texture is the signed internal structure of that curve.
- If the source charge configuration changes, the local texture-state changes.
- The updated texture/mass-curve state is then relayed through the baseline at c.

So the electric channel is already dynamic at its foundation:

$$\text{change in } q\Delta T \implies \text{updated curve-texture state} \implies \text{finite-speed relay.} \tag{78}$$

This is the bridge to magnetism and wave propagation, where motion and time-varying texture-state produce the transverse warp and transported field-difference structure.

4.11. Neutral Bodies and EM Selectivity

If a body has no signed texture content ($Q = 0$), then

$$\tau = 0, \qquad q\Delta T(d) = 0, \qquad \Theta(d) = 0. \tag{79}$$

So in TD:

- the body still has a mass curve ΔT_m (gravity remains),
- but there is no signed local texture-resolution channel (no electric response).

This is the clean bridge statement:

Gravity acts through Level-1 carrier curvature. EM acts only when Level-2 signed texture is present on that carrier.

4.12. Electric-Channel Checksum (Coulomb Limit)

As a checksum only (not as a TD starting point), the weak-share limit of the TD electric law reproduces the Coulomb acceleration form.

For $|q\Delta T| \ll \Delta T_m$,

$$S_E \approx \frac{q\Delta T}{\Delta T_m}. \tag{80}$$

Using

$$q\Delta T = k_q \frac{Q_1 Q_2}{d^2}, \qquad \Delta T_m = k_m \frac{M_{\text{eff}}}{d},$$

in Equation (74) gives

$$a_E \approx \frac{c^2}{2d}\left(\frac{k_q (Q_1 Q_2)/d^2}{k_m M_{\text{eff}}/d}\right) = \frac{c^2}{2}\frac{k_q}{k_m}\frac{Q_1 Q_2}{M_{\text{eff}} d^2}. \tag{81}$$

Substituting $k_q = 2k_e k_m / c^2$ from Equation (70) yields

$$a_E \approx k_e \frac{Q_1 Q_2}{M_{\text{eff}} d^2}, \tag{82}$$

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which is the standard Coulomb acceleration form (for the chosen effective responding mass M_{eff}).

This checksum confirms the intended TD bridge:

> The electric law is generated inside TD from baseline texture-resolution, while its weak-share limit matches the standard measured form.

4.13. Summary

The electric channel in TD is the baseline-consistent resolution of signed texture mismatch inside the mass curve:

1. The same mechanism that generates mass-space also contains signed sub-space structure.
2. That signed structure creates a local signed lag $q\Delta T$.
3. $q\Delta T$ is the texture of the mass curve, not an added field riding on it.
4. Texture cannot freely re-curve at fixed ΔT_m without rewriting the carrier mass-curve.
5. The baseline therefore resolves texture mismatch by changing separation geometry (repulsion/attraction).
6. Physical charge maps into $q\Delta T$ through the TD charge constant k_q.
7. Electric acceleration follows from the TD share law:

$$\mathbf{a}_E(d) = \frac{c^2}{2d} S_E(d)\,\hat{\mathbf{r}}.$$

The next subsection/section develops the magnetic channel, where motion drags the curve-texture geometry and the baseline resolves the resulting mismatch as transverse warp rather than radial correction.

4.14. Magnetism as Directional Warp of a Moving Texture

Magnetism in TD is not a new field added after gravity and electricity. It is the next baseline-consistency response of the *same* carrier structure.

The key point from the previous subsections remains unchanged:

> The signed texture is not something riding on the mass curve. The signed texture $\chi = q\Delta T$ is what makes up the carrier (mass) curve itself.

Because of this, a moving source cannot simply "stretch" the texture in the forward direction. A forward stretch of χ would change the carrier curve magnitude without a corresponding change in the underlying ΔT-defined mass content, which would break baseline consistency. TD forbids that. The baseline resolves the motion by *warping* the moving texture directionally instead. That directional warp is the magnetic channel.

4.14.1. Moving Source Picture in TD

A source in motion drags its carrier curve with it. Since the carrier curve is built from signed texture, the motion also attempts to drag (stretch) the local texture pattern in the direction of motion.

That creates a consistency problem:

1. The source motion requires a directional update of the carrier curve.
2. A naive forward stretch of the texture would alter $\chi = q\Delta T$ in the direction of motion.
3. But altering χ that way would alter the carrier curve magnitude without changing the underlying mass-defined ΔT content.
4. The baseline cannot allow that mismatch.

The allowed TD resolution is therefore:

> The forbidden forward texture-stretch is redirected into a transverse directional warp that preserves the carrier-curve magnitude.

This transverse directional warp is the magnetic structure.

4.14.2. TD Motion Mismatch Factor

Let the source speed relative to the local baseline frame be v. Define the usual TD motion factor (baseline-normalized speed factor)

$$\rho_v \equiv \sqrt{1-\frac{v^2}{c^2}}. \tag{83}$$

Two closely related TD motion mismatch measures are useful:

$$\lambda_v \equiv 1-\rho_v, \tag{84}$$

$$\eta_v \equiv \frac{1}{\rho_v}-1. \tag{85}$$

λ_v is the baseline leftover fraction in the direct relay picture, while η_v is the stretch-mismatch factor in the texture picture. They are linked by

$$\eta_v = \frac{\lambda_v}{\rho_v}. \tag{86}$$

For $v \ll c$,

$$\lambda_v \approx \frac{v^2}{2c^2}, \qquad \eta_v \approx \frac{v^2}{2c^2}. \tag{87}$$

4.14.3. Magnetic Warp from Forbidden Forward Stretch

Let

$$\chi(\mathbf{x},t) \equiv q\Delta T(\mathbf{x},t) \tag{88}$$

denote the signed texture field defined in the electricity subsection.

If the source moves, the motion attempts to produce a stretched texture magnitude in the direction of motion:

$$\chi^\star = \frac{\chi}{\rho_v}. \tag{89}$$

The forward stretch excess is therefore

$$\delta\chi_\parallel = \chi^\star - \chi = \chi\left(\frac{1}{\rho_v}-1\right) = \chi\,\eta_v. \tag{90}$$

In TD, this forward excess is not allowed to remain as a forward texture change (it would alter the carrier-curve magnitude). The baseline preserves the carrier by redirecting the same excess into a transverse warp:

$$\delta\chi_B \equiv \delta\chi_\perp = \chi\,\eta_v. \tag{91}$$

Equation (91) is the magnetic source statement in TD:

Magnetism is the transverse warp content generated when motion creates a texture-stretch demand that the baseline cannot permit as a forward change.

The sign/orientation of the warp is fixed by:

- the sign of the source texture ($+$ or $-$),
- the direction of source motion,
- and the local carrier-curve orientation.

No new primitive is introduced. The magnetic channel is a directional re-expression of the same texture content.

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4.14.4. Warp Leftover Length

To make the magnetic warp geometric (and measurable in TD terms), define the local magnetic leftover length as the transverse warp carried by the local carrier radius r:

$$L_B(r) \equiv r\,\delta\chi_B(r) = r\,\chi(r)\left(\frac{1}{\rho_v} - 1\right). \tag{92}$$

This is the TD "leftover" or warp-length quantity.

It is a direct geometric measure of how much transverse re-routing the baseline had to generate to preserve the carrier curve during motion. In this form:

- $\chi(r)$ supplies the source texture content,
- $\eta_v = (1/\rho_v - 1)$ supplies the motion mismatch,
- r converts the dimensionless warp content into a local geometric leftover length.

Equation (92) is the clean TD bridge between motion and magnetism.

4.14.5. Magnetic Acceleration as the Same TD Share Law

The magnetic channel uses the same TD acceleration logic as gravity and electricity: a baseline mismatch converted into acceleration through the local share.

The only change is the source term. For gravity, the source term is ΔT. For electricity, the source term is $\chi = q\Delta T$. For magnetism, the source term is the *motion-generated warp excess* $\delta\chi_B$.

A TD magnetic acceleration form is therefore

$$\mathbf{a}_B = \mathrm{sgn}(\text{local orientation})\,\frac{c^2}{2r}\,\frac{\delta\chi_B(r)}{\Delta T_m(r) + \chi(r)}\,\hat{\perp}, \tag{93}$$

where:

- ΔT_m is the local carrier (mass-curve) lag share,
- χ is the local signed texture share,
- $\delta\chi_B$ is the motion-generated magnetic warp share,
- $\hat{\perp}$ is the transverse warp direction selected by the baseline geometry.

Using Equation (91),

$$\mathbf{a}_B = \mathrm{sgn}(\text{local orientation})\,\eta_v\,\frac{c^2}{2r}\,\frac{\chi(r)}{\Delta T_m(r) + \chi(r)}\,\hat{\perp}. \tag{94}$$

This makes the TD hierarchy explicit:

- electric response is the direct texture-resolution channel,
- magnetic response is the *motion-modulated* texture-resolution channel.

In the low-speed limit ($v \ll c$),

$$\mathbf{a}_B \propto \frac{v^2}{2c^2} \times (\text{electric-share acceleration scale}), \tag{95}$$

which is exactly the expected TD behavior: magnetism emerges as a weaker motion-dependent correction to the same baseline mechanism.

4.14.6. Dynamic Update and Finite-Speed Propagation

The magnetic warp is not a static shape. It is a moving baseline update, exactly like the carrier curve itself.

When the source velocity changes, ρ_v, η_v, and therefore $\delta\chi_B$ change. The carrier curve and its magnetic warp update together. That update propagates through the baseline relay at c.

So in TD language:

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- the source correction is local and immediate at the source (the carrier re-balances instantly),
- the remote magnetic change is not felt until the updated carrier/warp state arrives through the baseline relay.

This will be used directly in the wave/radiation section, where changing warp content becomes propagated difference-content.

4.14.7. Direct Conversion Between Warp Leftover Length and B (Checksum Bridge)

The TD quantity is the warp leftover length L_B, not B as a primitive. However, for comparison with standard measurements, L_B can be converted directly to the conventional magnetic field B.

Let κ_χ be the *source texture-profile calibration constant* for the local radial texture profile in the magnetism checksum bridge (distinct from the TD pair-interaction constant k_q^{TD} defined in the electricity subsection). Let the local electric texture profile be written in the same TD form used earlier:

$$\chi(r) = q\Delta T(r) = \frac{\kappa_\chi q}{r}. \tag{96}$$

Then Equation (92) gives

$$L_B(r) = \kappa_\chi q \left(\frac{1}{\rho_v} - 1 \right) = \kappa_\chi q \, \eta_v. \tag{97}$$

For a charge circulating with speed v at radius r, the equivalent current is

$$I = \frac{qv}{2\pi r}. \tag{98}$$

Using the standard magnetic field of a circular current loop as a checksum relation in SI form [4,5],

$$B(r) = \frac{2k_e}{c^2} \frac{I}{r} = \frac{k_e q v}{\pi c^2 r^2}, \tag{99}$$

and defining the magnetic checksum constant

$$\kappa_B \equiv \frac{k_e}{c^2}, \tag{100}$$

this becomes

$$B(r) = \frac{\kappa_B q v}{\pi r^2}. \tag{101}$$

To preserve a direct TD checksum conversion, choose the SI bridge calibration

$$\kappa_\chi = \kappa_B. \tag{102}$$

Using the TD pair-interaction constant from the electricity subsection,

$$k_q^{\mathrm{TD}} \equiv \frac{2k_e k_m}{c^2}, \tag{103}$$

we also have

$$\kappa_B = \frac{k_q^{\mathrm{TD}}}{2k_m}, \tag{104}$$

so that

$$B(r) = \frac{k_q^{\mathrm{TD}}}{2k_m} \frac{q v}{\pi r^2}. \tag{105}$$

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Substituting Equation (97) into Equation (101), together with Equation (102), gives the direct TD conversion:

$$\boxed{B(r) = \frac{v}{\pi r^2}\,\frac{L_B(r)}{\eta_v}} \qquad \left(\eta_v = \frac{1}{\rho_v} - 1,\ \rho_v = \sqrt{1 - \frac{v^2}{c^2}}\right). \tag{106}$$

The inverse conversion is equally direct:

$$\boxed{L_B(r) = \frac{\pi r^2}{v}\,\eta_v\,B(r)}. \tag{107}$$

These two equations are the practical checksum bridge:

Given the TD leftover length L_B, the conventional B-field can be recovered directly; given B, the TD warp leftover length can be reconstructed directly.

How to read TD constants.

This paper uses two kinds of constants in the electromagnetism sections. First, *TD-native constants* (for example k_q^{TD}) are internal to the TD formulation and define texture/coupling relations at the level of TD variables. Second, *SI bridge/checksum constants* (for example $\kappa_B \equiv k_e/c^2$) are introduced only when writing comparison formulas in standard measurable SI form. In other words, TD-native constants define the model internally, while SI bridge constants are used to connect TD quantities to standard electromagnetic observables.

4.14.8. Magnetism Section Summary

Magnetism in TD is the transverse warp response of a moving texture-defined carrier curve:

1. The signed texture $\chi = q\Delta T$ makes up the carrier curve.
2. Motion attempts to stretch the texture forward by a factor $1/\rho_v$.
3. TD forbids that forward stretch because it would change the carrier-curve magnitude without changing the underlying ΔT content.
4. The baseline preserves consistency by redirecting the excess into a transverse warp:

$$\delta\chi_B = \chi\left(\frac{1}{\rho_v} - 1\right).$$

5. The corresponding geometric magnetic leftover length is

$$L_B(r) = r\,\delta\chi_B(r).$$

6. Magnetic acceleration follows from the same TD share-acceleration law, now driven by $\delta\chi_B$ instead of ΔT or χ.
7. The conventional magnetic field B is a checksum re-expression of the TD leftover length L_B, not a separate primitive.

This keeps gravity, electricity, and magnetism in one mechanism: baseline consistency, expressed through different forms of the same carrier/texture structure.

Sign and magnitude summary (the "moving picture").

The magnetic warp leftover becomes larger when:

- the source texture magnitude $|q\Delta T|$ is larger (stronger charge texture),
- the source motion is stronger (larger v, hence smaller ρ_v),
- the source state changes faster (larger acceleration or faster field reconfiguration).

Its orientation flips with source sign and/or motion reversal because the wrap direction flips. This gives the observed directional behavior without introducing a separate ontology.

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5. Transport, Waves, and Radiation in TD

This section extends the TD electricity and magnetism construction into propagation and radiation. The same baseline rules remain in force:

- the baseline relay is fixed $(S \equiv c)$,
- the signed texture-load $q\Delta T$ is the texture of the carrier ΔT-curve itself (not something separate riding on it),
- and any allowed evolution must preserve baseline consistency.

In this framework, an electromagnetic wave is not a separate substance. It is a *transported field-state difference* generated when a source changes its local electric/magnetic field state.

5.1. Field-State Language in TD

From the TD electricity and magnetism sections:

- the **electric channel** is the signed texture-state of the carrier curve (built from $q\Delta T$),
- the **magnetic channel** is the directional warp-leftover produced when motion tries to stretch that texture but direct texture stretching is forbidden.

To describe propagation cleanly, define the local EM field-state as

$$\mathcal{F}(x,t) \equiv \big(\chi_E(x,t),\ \delta\chi_B(x,t)\big), \tag{108}$$

where

- χ_E is the directional electric texture-state (the oriented form of $q\Delta T$),
- $\delta\chi_B$ is the directional magnetic warp-leftover state.

The bold notation records direction. The scalar $q\Delta T$ remains the core texture magnitude.

5.2. What a Wave Is in TD: Source-Defined Old/New States and Transported Difference

A TD wave is generated only when a *source* changes from one field-state to another.
At the source, define

$$\mathcal{F}_{\text{old}} = \big(\chi_{E,\text{old}},\ \delta\chi_{B,\text{old}}\big), \qquad \mathcal{F}_{\text{new}} = \big(\chi_{E,\text{new}},\ \delta\chi_{B,\text{new}}\big). \tag{109}$$

The emitted wave-content is the field-state difference

$$\Delta\mathcal{F} \equiv \mathcal{F}_{\text{new}} - \mathcal{F}_{\text{old}} = \big(\Delta\chi_E,\ \Delta\delta\chi_B\big), \tag{110}$$

with

$$\Delta\chi_E \equiv \chi_{E,\text{new}} - \chi_{E,\text{old}}, \tag{111}$$

$$\Delta\delta\chi_B \equiv \delta\chi_{B,\text{new}} - \delta\chi_{B,\text{old}}. \tag{112}$$

This is the TD wave definition:

A wave is the source-generated difference between field-states, transported by the baseline relay.

The pair $(\mathcal{F}_{\text{old}}, \mathcal{F}_{\text{new}})$ is *source-defined*. During propagation, TD does not permit these source-defined texture states to be freely re-resolved into different texture states, because that would rewrite the carrier ΔT-curve without a source-level ΔT-change.

5.3. Radiation Is Not the Static Field

TD distinguishes between:

- **persistent field structure**: a source may have nonzero χ_E and nonzero $\delta\chi_B$ without radiating,

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- **radiation**: which occurs only when the field-state changes.

  A source radiates only if

$$\Delta\mathcal{F} \neq 0. \tag{113}$$

  If the source state is steady,

$$\mathcal{F}_{\text{new}} = \mathcal{F}_{\text{old}} \quad \Rightarrow \quad \Delta\mathcal{F} = 0, \tag{114}$$

then no wave is emitted, even if the static electric texture-state or steady magnetic warp-state is large.

This is the TD reason static fields do not automatically radiate.

5.4. Source Transition Time and the TD Time-Factor of Waves

The difference-content $\Delta\mathcal{F}$ does not by itself fix the wave output. The source also takes a finite time to move from the old field-state to the new field-state.

Let

$$\tau_s \tag{115}$$

be the source transition time (the time required for the source to complete the field-state change into its new locally stable state).

The emitted source wave-event is therefore characterized by

$$\mathcal{W}_s \equiv \left(\Delta\chi_E,\ \Delta\delta\chi_B,\ \tau_s\right). \tag{116}$$

This gives the TD wave-time rule:

For the same field-state difference, a shorter source transition time gives a stronger release per unit time. For the same field-state difference, a longer source transition time spreads the same release over more time.

A useful TD wave-strength index (before unit calibration) is

$$\Pi_{\text{wave}} \equiv \frac{\mathcal{A}_\Delta}{\tau_s}, \qquad \mathcal{A}_\Delta \equiv \sqrt{\|\Delta\chi_E\|^2 + \|\Delta\delta\chi_B\|^2}. \tag{117}$$

This separates the two TD inputs to wave output:

- the size of the source-generated field-state difference,
- and the time taken to generate it.

5.5. Kick Radiation in TD: Pulse Formation from a Finite Source Transition

A single non-periodic source change (a "kick") produces a *pulse*, not a continuous monochromatic wave.

Let the source transition be described by a smooth profile $u_s(t)$ with

$$u_s(t) = 0 \quad \text{(old state)}, \qquad u_s(t) = 1 \quad \text{(new state)}, \tag{118}$$

and transition duration τ_s.

Then the source field-state during the kick is

$$\mathcal{F}_s(t) = \mathcal{F}_{\text{old}} + u_s(t)\,\Delta\mathcal{F}, \qquad \Delta\mathcal{F} = \mathcal{F}_{\text{new}} - \mathcal{F}_{\text{old}}. \tag{119}$$

The radiative release-rate content is controlled by the transition speed:

$$\dot{\mathcal{F}}_s(t) = \dot{u}_s(t)\,\Delta\mathcal{F}. \tag{120}$$

This gives the TD pulse mechanism:

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- $\Delta\mathcal{F}$ sets the pulse difference-content,
- $\dot{u}_s(t)$ sets how sharply that content is released,
- τ_s sets the pulse duration.

In vacuum, the pulse occupies a spatial thickness

$$\ell_{\text{pulse},s} = c\,\tau_s. \tag{121}$$

In a propagation environment with effective TD index n_{eff}, the observed transition interval is stretched to

$$\tau_{\text{obs}} \sim n_{\text{eff}}\,\tau_s, \tag{122}$$

so the observed pulse thickness is

$$\ell_{\text{pulse,obs}} = c\,\tau_{\text{obs}} \sim n_{\text{eff}}\,c\,\tau_s. \tag{123}$$

A propagation ΔT-background therefore does not rewrite the pulse difference-content; it stretches the pulse in relay-time and arrival-length.

5.6. Propagation Non-Resolution Lock: Active Baseline Preservation

A propagated EM wave in TD is not a detached object moving through an external medium. It is an active baseline-resolved texture-difference state.

This is the same baseline constraint already used to derive electricity and magnetism.

The signed texture-load is the texture of the carrier ΔT-curve itself. If a propagating wave were to re-resolve into a new texture-state mid-flight, it would rewrite the carrier curve without a source-level ΔT-change. TD forbids this.

Therefore, during free propagation:

1. a wave does not resolve into an arbitrary new $q\Delta T$ texture-state,
2. a propagating wave cannot force another propagating wave into a new texture-state,
3. the source-defined difference identity is preserved in transit.

This is not a passive "no interaction" picture. The waves *do* meet because both are baseline activity in the same region. The active statement is:

> When two propagated disturbances overlap, the baseline does not permit their interaction to resolve into a new texture-state that would alter the carrier ΔT-curve. The baseline re-forms the same admissible electric/magnetic difference-content for each disturbance, and both continue.

So the observed result is wave crossing without source-state rewrite, not because the waves are independent substances, but because baseline consistency actively reconstructs the same allowed propagation state.

5.7. Finite-Speed Propagation: Why Waves Move at c

By the TD baseline relay rule, physical difference-content is transported by the baseline and cannot propagate faster than the baseline relay speed.

In vacuum (bridge regime),

$$S \equiv c. \tag{124}$$

If a source emits a wave-event $\mathcal{W}_s$ at time t_s, the same difference-content reaches a point at path-distance L at

$$t = t_s + \frac{L}{c}. \tag{125}$$

In a nonuniform gravitational background, the baseline path-time is stretched by the same TD index defined from ΔT:

$$n(x) = \frac{1}{\sqrt{1 - \Delta T(x)}}. \tag{126}$$

For a path Γ, the travel time is

$$t_{\text{travel}}(\Gamma) = \frac{1}{c} \int_{\Gamma} n(x)\, dl. \tag{127}$$

Hence the arriving wave-content is retarded by the ΔT-modified baseline path-time:

$$\mathcal{W}(x,t) = \mathcal{W}_s\big(t - t_{\text{travel}}(\Gamma)\big). \tag{128}$$

5.8. Why EM Waves Are Self-Propagating in TD

The electric and magnetic wave channels are not separate objects. They are the paired correction-content required by baseline consistency for a source state change.

When the source changes field-state:

1. the electric texture-state changes $(\Delta\chi_E)$,
2. the motion/stretch constraint fixes the magnetic warp-difference $(\Delta\delta\chi_B)$,
3. the baseline relays this paired difference forward at c,
4. free texture re-resolution remains forbidden in transit, so the propagated disturbance stays in coupled electric/magnetic correction form,
5. when the retarded difference reaches a source/charge, it drives a local response through the same TD electric and magnetic rules.

EM waves are self-propagating in TD because the transported content is already the exact baseline-consistent correction state. No separate wave mechanism is introduced at this stage.

5.9. Why the Wave Is Transverse in TD

Transversality follows from the same constraint used in the magnetic section.

The signed texture-load $q\Delta T$ is the texture of the carrier curve itself. A direct forward stretching or compression of that texture during propagation would alter the carrier ΔT-curve magnitude without a source-level change, which would violate baseline consistency.

That forward texture rewrite is forbidden.

The baseline therefore carries the propagating correction in a sideways wrap-form: the update is expressed as a transverse structure rather than a forward texture rewrite.

Let $\hat{\mathbf{k}}$ be the propagation direction. Then the TD transverse condition is

$$\hat{\mathbf{k}} \cdot \Delta\chi_E = 0, \qquad \hat{\mathbf{k}} \cdot \Delta\delta\chi_B = 0. \tag{129}$$

The magnetic wave-difference is the directional warp response to the electric difference-content in propagation, so its orientation is locked by

$$\Delta\delta\chi_B \parallel \hat{\mathbf{k}} \times \Delta\chi_E. \tag{130}$$

This gives the TD transverse picture directly:

Forward texture rewrite is forbidden, so the wave closes sideways.

5.10. Wave Trains and Waveform Descriptors in TD

A single wave-event is one transported field-state difference. A sustained oscillation is a repeated sequence of source-defined difference-events.

Suppose a source repeatedly generates the same difference-content with source period T_s:

$$\Delta\mathcal{F}_s^{(m)} = \Delta\mathcal{F}_0, \qquad t_s^{(m)} = t_0 + mT_s, \qquad m = 0, 1, 2, \ldots \tag{131}$$

Then the source emits a wave train with

$$f_s = \frac{1}{T_s}, \qquad \omega_s = 2\pi f_s. \tag{132}$$

To make the wave picture operational, TD defines waveform quantities directly from source-generated difference-content and timing.

(i) Difference amplitudes (source-defined).

The source-generated electric and magnetic difference amplitudes are

$$A_\chi \equiv \|\Delta\chi_E\|, \qquad A_B \equiv \|\Delta\delta\chi_B\|. \tag{133}$$

These are source-defined difference magnitudes and are preserved in free propagation (no mid-flight texture rewrite).

(ii) Release-rate amplitudes (delivery per unit time).

Because the same difference can be delivered over different intervals, TD also tracks rate form:

$$R_\chi \equiv \frac{A_\chi}{\tau}, \qquad R_B \equiv \frac{A_B}{\tau}. \tag{134}$$

At the source, $\tau = \tau_s$. At observation, $\tau = \tau_{\text{obs}}$.

(iii) Wavelength (TD operational form).

In the vacuum bridge regime,

$$\lambda_s = c\, T_s. \tag{135}$$

(iv) Phase and harmonic limit.

For repeated source transitions with stable period T_s, define the retarded phase

$$\phi(x,t) = \omega_s(t - t_{\text{travel}}(\Gamma)) + \phi_0, \tag{136}$$

where $t_{\text{travel}}(\Gamma) = \frac{1}{c}\int_\Gamma n(x)\, dl$.

In the harmonic limit, the propagated wave train can be written as

$$\Delta\chi_E(x,t) = \Re\left[\tilde{\chi}_E\, e^{i\phi(x,t)}\right], \tag{137}$$

$$\Delta\delta\chi_B(x,t) = \Re\left[\widetilde{\delta\chi}_B\, e^{i\phi(x,t)}\right], \tag{138}$$

with

$$\widetilde{\delta\chi}_B \parallel \hat{\mathbf{k}} \times \tilde{\chi}_E, \qquad \hat{\mathbf{k}} \cdot \tilde{\chi}_E = \hat{\mathbf{k}} \cdot \widetilde{\delta\chi}_B = 0. \tag{139}$$

This waveform expression is not introduced from outside TD; it is the harmonic-limit form of repeated source-defined field-state differences transported under the same transverse-locking rule.

5.11. Interaction with ΔT: Timing, Redshift, Wavelength, and Delivered Rate

A propagation ΔT-field does not rewrite the source-defined field-state difference. It changes the *baseline relay timing* along the path.

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Therefore, the difference-content identity is preserved, while arrival intervals are stretched or compressed by the effective TD index:

$$T_{\text{obs}} \sim n_{\text{eff}}\, T_s, \qquad \tau_{\text{obs}} \sim n_{\text{eff}}\, \tau_s, \tag{140}$$

where n_{eff} is the effective TD index along the propagation path.

The observed frequency and wavelength are then

$$f_{\text{obs}} = \frac{1}{T_{\text{obs}}} \sim \frac{f_s}{n_{\text{eff}}}, \qquad \lambda_{\text{obs}} = c\, T_{\text{obs}} \sim n_{\text{eff}}\, \lambda_s. \tag{141}$$

This makes the TD timing/redshift picture explicit:

- **preserved in free propagation:** $\Delta\mathcal{F}$, A_χ, A_B,
- **changed by propagation environment:** T_{obs}, τ_{obs}, f_{obs}, λ_{obs}, and the delivered rates R_χ, R_B.

The subtle timing point is central. If the magnetic difference amplitude A_B is unchanged but the interval becomes longer, then the delivered magnetic warp per unit time is smaller:

$$R_{B,\text{obs}} = \frac{A_B}{\tau_{\text{obs}}} \sim \frac{1}{n_{\text{eff}}} \frac{A_B}{\tau_s}. \tag{142}$$

Likewise for the electric side:

$$R_{\chi,\text{obs}} = \frac{A_\chi}{\tau_{\text{obs}}} \sim \frac{1}{n_{\text{eff}}} \frac{A_\chi}{\tau_s}. \tag{143}$$

So a larger effective ΔT-path (larger n_{eff}) gives:

- longer observed period,
- longer observed transition interval,
- lower frequency,
- longer wavelength,
- and lower delivered field-change rate per unit time,

without any mid-flight texture rewrite.

For compactness, the observed wave-strength index is

$$\Pi_{\text{obs}} \equiv \frac{\mathcal{A}_\Delta}{\tau_{\text{obs}}} = \frac{1}{n_{\text{eff}}} \frac{\mathcal{A}_\Delta}{\tau_s} = \frac{\Pi_{\text{wave}}}{n_{\text{eff}}}. \tag{144}$$

5.12. Local Source Reaction and Propagated Wave Are Distinct

When a source changes field-state, two distinct TD events occur:

1. **Local source correction (immediate at the source):** the source carrier-curve and local field-state rebalance to remain baseline-consistent.
2. **Propagated difference-content (finite-speed):** the emitted wave $\Delta\mathcal{F}$ travels outward at the baseline relay speed.

The local source correction is the carrier-curve rebalancing required by baseline consistency after the source changes field-state. It is not a delayed internal settling process. Delay appears only at remote points because the propagated difference-content must arrive through the baseline relay.

> The source reaction is local and immediate; the wave is the transported record of the state change.

5.13. Remote Interaction and Wave Crossing

Consider two charges A and B. If charge A changes field-state and emits a wave-event, charge B receives the *retarded field-state difference* of A, not the source itself:

$$\Delta\mathcal{F}_{A\to B}(t) = \Delta\mathcal{F}_A\left(t - \frac{L_{AB}}{c}\right) \quad \text{(vacuum bridge form).} \tag{145}$$

When this difference arrives, B responds through the same TD electric and magnetic acceleration rules already derived in the previous sections.

If A and B emit simultaneously, the two propagated disturbances can overlap and interact in the same baseline region. TD does not treat this as a passive non-contact picture. The active statement is:

> The overlap is real baseline interaction, but the baseline cannot resolve it into a new propagated texture-state, because that would rewrite the carrier ΔT-curve (and therefore the mass-curve consistency) without a source-level change. The baseline resolves the overlap by re-forming the same admissible electric/magnetic difference-content for each wave.

Operationally, the waves continue after crossing with the same propagated identities, while each source still feels the other's retarded electric/magnetic difference when it arrives.

This is the TD propagation lock in interaction form:

- wave differences can overlap in space,
- they interact as baseline processes,
- free texture re-resolution is forbidden,
- the baseline re-creates the same electric/magnetic transport form after overlap,
- only source-level state changes (or source/charge response upon arrival) create new wave differences.

5.14. TD Criterion for Electron Radiation and Light Production

TD can state explicitly when an electron emits radiation and when that radiation is a light wave.

(i) No-radiation condition.

If the electron's local field-state does not change,

$$\Delta\mathcal{F}_e = 0, \tag{146}$$

then no radiation is emitted.

(ii) Pulse-radiation condition (single kick).

If the electron undergoes one finite source-level field-state transition,

$$\Delta\mathcal{F}_e \neq 0 \quad \text{over time } \tau_s, \tag{147}$$

then the electron emits a TD pulse with:

- source-defined difference-content $\Delta\mathcal{F}_e$,
- pulse duration τ_s,
- pulse thickness $\ell_{\text{pulse}} = c\tau_s$ (vacuum bridge form).

(iii) Light-wave condition (repeated transitions).

A light wave (continuous or quasi-continuous wave train) is produced when the electron undergoes repeated source field-state transitions with a stable period T_s:

$$\Delta\mathcal{F}_e^{(m+1)} \approx \Delta\mathcal{F}_e^{(m)}, \qquad t_e^{(m+1)} - t_e^{(m)} = T_s. \tag{148}$$

Then the emitted train has

$$f_s = \frac{1}{T_s}, \qquad \lambda_s = cT_s, \tag{149}$$

and the observed values are modified by the propagation ΔT-environment through $n_{\rm eff}$:

$$f_{\rm obs} \sim \frac{f_s}{n_{\rm eff}}, \qquad \lambda_{\rm obs} \sim n_{\rm eff}\lambda_s. \tag{150}$$

Operationally, a source acceleration change is one common way to produce $\Delta\mathcal{F}_e \neq 0$; repeated source-state changes with stable timing produce a wave train.

(iv) Color and brightness in TD (operational form).

After calibration to standard observables:

- **color / spectral position** is determined by the observed repetition timing $(f_{\rm obs}$ or $\lambda_{\rm obs})$,
- **brightness / radiative strength** is determined by the source difference amplitudes (A_χ, A_B), their delivered rates (R_χ, R_B), and geometric spreading.

In TD language, frequency class is set by source transition timing plus propagation ΔT-path, while field-state difference amplitudes set how strong the wave is.

5.15. TD Wave Summary

The TD wave/radiation mechanism is a direct continuation of the electricity and magnetism mechanism:

1. The local EM field-state is
$$\mathcal{F} = (\chi_E, \delta\chi_B).$$
2. Radiation is emitted only when a source changes field-state:
$$\Delta\mathcal{F} = \mathcal{F}_{\rm new} - \mathcal{F}_{\rm old}.$$
3. A single finite transition produces a pulse; repeated stable transitions produce a wave train.
4. The source transition time τ_s sets how strongly the same difference-content is released per unit time.
5. Free propagation does not permit texture re-resolution; the baseline carries the disturbance in electric/magnetic correction form.
6. Waves that overlap do interact as baseline activity, but the baseline re-forms the same admissible electric/magnetic difference-content after overlap because any other outcome would rewrite the carrier ΔT-curve.
7. The baseline relays the wave at c, with path-time modified by the same TD index $n = (1 - \Delta T)^{-1/2}$.
8. The wave is transverse because forward texture rewrite would alter the carrier ΔT-curve without a source-level change.
9. A propagation ΔT-environment changes relay timing (period, interval, frequency, wavelength, delivered rate) without changing the source-defined difference-content.
10. The source reacts locally and immediately; remote effects are retarded because only the propagated difference arrives there.

5.16. Single Checksum Link

After calibration to standard field units, the TD transverse locking in Eqs. (129)–(130) reproduces the standard vacuum EM-wave orientation rule as a checksum:

$$\mathbf{B} = \frac{1}{c}\,\hat{\mathbf{k}} \times \mathbf{E}. \tag{151}$$

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In TD, this is not a starting axiom. It is the measurable checksum of the baseline-consistency rule applied to transported field-state differences.

6. Signed ΔT Negative-Mass Branches, and Annihilation in TD

The earlier TD sections were developed on the positive-mass branch because ordinary matter is dominated by that branch. This is a practical starting point, not a fundamental limit.

To complete the TD picture, the mass-sector variable must be treated as *signed*. This immediately brings in:

- positive-mass carrier curves ($+\Delta T$),
- negative-mass carrier curves ($-\Delta T$),
- signed texture structure inside mass (the charge-generating substructure),
- and the TD mechanism for annihilation.

No new principle is introduced here. Everything still follows from the same baseline rule:

baseline consistency must be preserved.

6.1. Signed ΔTs the Full Carrier Variable

In the positive branch, the carrier distortion was written using the TD mass constant and the source scale. The signed extension is the same relation with signed mass-content:

$$\Delta T_m^{(s)}(d) = \frac{M_s K_m}{d}, \tag{152}$$

where

- M_s is signed mass-content,
- K_m is the same TD mass constant used in the gravity section,
- d is the carrier scale (same convention as the earlier TD gravity construction).

The sign convention is

$$\Delta T_m^{(s)} > 0 \ \text{(positive-mass branch)}, \qquad \Delta T_m^{(s)} < 0 \ \text{(negative-mass branch)}. \tag{153}$$

The same TD relay-index form still applies:

$$n(x) = \frac{1}{\sqrt{1 - \Delta T_m^{(s)}(x)}}. \tag{154}$$

So the two branches are immediately distinguished by relay timing:

- $\Delta T_m^{(s)} > 0$: delayed branch ($n > 1$),
- $\Delta T_m^{(s)} < 0$: advanced branch ($n < 1$).

6.2. Geometric Picture: Mass-Curve vs. Stretched-Curve

The positive-mass branch and negative-mass branch are geometric opposites in TD.

Positive-mass branch ($+\Delta T$).

This is the case already developed in the gravity section: the baseline completion is delayed, and the carrier curve stores *more curve-length than the baseline span it occupies*. That excess is the mass-curve picture.

Negative-mass branch ($-\Delta T$).

This is the opposite branch: the local structure tends to complete its baseline relay faster than the ambient baseline rate. If unconstrained, it would overrun the ambient baseline progression.

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TD forbids that overrun. The baseline preserves consistency by embedding the advanced branch as a *stretched carrier-curve*: the structure has *less intrinsic curve-length than the baseline span it occupies*, so the baseline geometry stretches it across the allowed span.

A compact way to write the geometry is to compare:

$$L_{\text{curve}} \text{ vs } L_{\text{base}}, \tag{155}$$

for the same occupied baseline span. Then:

$$\begin{cases} L_{\text{curve}} > L_{\text{base}} & \text{positive-mass branch } (+\Delta T_m^{(s)}), \\ L_{\text{curve}} < L_{\text{base}} & \text{negative-mass branch } (-\Delta T_m^{(s)}). \end{cases} \tag{156}$$

This is the clean TD meaning of the “stretched curve” picture:

Positive mass is a packed/extra-length carrier curve; negative mass is a stretched/deficit-length carrier curve. Both are baseline-consistency solutions, but with opposite sign.

6.3. Signed-Field Superposition and Interaction Logic

Once ΔT is signed, the local mass-sector field is also signed. For multiple sources, the TD mass field superposes algebraically:

$$\Delta T_{\text{net}}^{(s)}(x) = \sum_i \Delta T_{m,i}^{(s)}(x). \tag{157}$$

The acceleration law is *not* re-derived from scratch here. The same TD response map from the gravity section is used, but now applied to signed input:

$$a_i^{(\text{TD})} = \mathcal{A}_i\left[\Delta T_{\text{net}}^{(s)}\right] \quad \text{(same TD gravity-response operator as before, now signed).} \tag{158}$$

This immediately yields the sign-logic:

- **Positive–positive** $(+,+)$: same attractive branch already established.
- **Negative–negative** $(-,-)$: the signed gradient reverses the response branch, so pure negative structures tend to separate rather than self-compile (repulsive tendency).
- **Positive–negative** $(+,-)$: cancellation surfaces exist where the signed fields balance.

For two equal-magnitude opposite-sign sources on a line, there is a neutral point (or neutral surface in 3D) where

$$\Delta T_{\text{net}}^{(s)} = 0. \tag{159}$$

This does *not* mean both fields vanish everywhere. It means there are locations where the signed effects cancel exactly. Away from those neutral locations, the gradients remain and the TD response is still active.

If opposite-sign sources are unequal, the cancellation is incomplete and a residual signed field remains:

$$\Delta T_{\text{res}}^{(s)} \neq 0, \tag{160}$$

so the stronger branch dominates the net TD response.

6.4. Why Negative Mass Does Not Build Large Structures in TD

This point is essential: if the negative branch is real, why are large negative-mass structures not observed?

The TD answer is structural, not accidental.

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(i) Negative branch is anti-compiling.

For same-sign negative carriers, the signed TD response does not compress them into a shared bound distortion. It increases effective baseline separation (the stretched-curve branch reinforces spacing rather than packing). So negative-mass regions tend to disperse instead of cluster.

(ii) Density growth is self-erasing.

Any local overdensity of negative branch content increases the advanced-branch mismatch in a way that pushes the region back toward lower local concentration. In TD language, the branch feeds separation, not compilation.

(iii) A $-\Delta T$ boundary can exist, but it is not a trapping boundary.

The signed branch also has a magnitude saturation condition,

$$\Delta T_m^{(s)} = -1, \tag{161}$$

which may be called the *negative branch boundary* (or "white-boundary" in the branch language). But unlike the positive wall condition ($+\Delta T = 1$), this boundary does not naturally support inward trapping. It is an advanced/stretched-branch saturation, not a self-compiling trapped geometry.

So the existence of a formal $-\Delta T = 1$ branch boundary does *not* imply stable macroscopic negative objects should form. The branch dynamics drive decompaction.

(iv) Where negative signed content is stable.

TD therefore predicts negative signed content is most naturally stabilized:

- not as large free-standing structures,
- but as *internal signed substructure* inside positive-mass carriers,

where the surrounding positive mass-curve provides the bounding geometry.

This is exactly the charge-texture role: the "charge creators" are signed substructures held stable inside the mass extra-space, not free large negative-mass bodies.

6.5. Signed Texture Inside Mass and the Charge-Creating Substructure

The EM section already established that charge is a texture-load of the carrier curve. In signed form, that texture is

$$(q\Delta T)^{(s)}. \tag{162}$$

This texture may contain local positive and negative sub-contributions arranged in stable internal symmetry, but what matters for the observable electric texture-state is the cumulative signed result.

A key TD consistency bound is:

$$\left|(q\Delta T)^{(s)}\right| < \left|\Delta T_m^{(s)}\right|. \tag{163}$$

This means the internal signed texture cannot exceed the carrier load that supports it. If the texture tried to saturate the carrier,

$$\left|(q\Delta T)^{(s)}\right| \to \left|\Delta T_m^{(s)}\right|, \tag{164}$$

the carrier would lose baseline-stable support for that internal structure.

This bound is also why EM texture evolution is so constrained:

the texture is not independent of the carrier; it is a signed internal load of the carrier itself.

6.6. Antimatter in TD: Conjugate Signed Structure

TD now has a natural language for antimatter.

A matter/antimatter conjugate pair is described as a *conjugate signed carrier-texture structure*. Operationally, this means:

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- opposite texture sign (charge conjugation in the EM sector),
- and conjugate internal signed substructure so that overlap cancellation can occur carrier-consistently.

The minimal EM conjugation is

$$(q\Delta T)^{(s)} \;\to\; -(q\Delta T)^{(s)}. \tag{165}$$

For a fully conjugate TD pair (carrier + texture), one may write

$$\left(\Delta T_m^{(s)},\,(q\Delta T)^{(s)}\right) \;\to\; \left(-\Delta T_m^{(s)},\,-(q\Delta T)^{(s)}\right), \tag{166}$$

as the idealized sign-inverted partner.

In practical particle models (e.g., electron/positron channels), the exact split between carrier conjugation and texture conjugation is species-model dependent, but the TD annihilation logic below only requires one principle:

Annihilation requires overlap of conjugate signed structure so that the local carrier-texture state can cancel back to baseline.

6.7. Positive/Negative Mass Cancellation and Annihilation Picture

Take a positive-mass carrier and a negative-mass carrier of equal magnitude and let them reach local overlap.

At the overlap point, the signed carrier loads cancel:

$$\Delta T_{m,+}^{(s)} + \Delta T_{m,-}^{(s)} = 0. \tag{167}$$

Geometrically, this is exactly the mass-curve vs stretched-curve cancellation:

- the positive branch contributes excess curve-length,
- the negative branch contributes deficit curve-length,
- the two sum back to baseline geometry.

So the local carrier structure relaxes to the baseline branch:

$$\Delta T_{\rm local}^{(s)} \to 0. \tag{168}$$

This is the TD cancellation core:

A positive mass-curve and a matched negative stretched-curve are conjugate geometric loads. On overlap, they can cancel back to the baseline branch.

6.8. Electron–Antielectron Annihilation in TD

The EM version (electron/antielectron) is the same principle, but now the internal texture structure becomes essential.

In TD language, the electron is not just a point charge; it is a carrier mass-curve with internal signed texture-load $(q\Delta T)^{(s)}$. The antimatter partner carries the conjugate texture structure.

For local annihilation, the cancellation must occur at the carrier-texture level:

$$\Delta T_{m,1}^{(s)} + \Delta T_{m,2}^{(s)} \to 0, \tag{169}$$

$$(q\Delta T)_1^{(s)} + (q\Delta T)_2^{(s)} \to 0. \tag{170}$$

The second condition is the crucial one for the EM sector. If the texture cancels, then the EM field-state supported by that carrier also collapses to baseline:

$$\mathcal{F}_{\rm local} = (\chi_E, \delta\chi_B) \;\to\; \mathbf{0}. \tag{171}$$

This is why TD treats texture change so strictly in the EM sections:

The texture is not decorative. It is part of the carrier curve itself. If it is changed inconsistently, the carrier loses its baseline-consistent identity.

6.9. Why Annihilation Happens in TD

Annihilation is not "stuff disappearing." It is a **baseline agreement process**.

When matter and antimatter meet, opposite internal signatures begin to cancel. As that happens:

1. the static carrier distortion can no longer remain in the same bounded form,
2. the residual baseline conflict is reduced,
3. the system is forced to re-express the remaining content as a propagating difference (energy emission).

The clean TD condition is

$$\Delta T^{(s)}_{\text{residual}} \to 0. \tag{172}$$

As the residual static distortion goes to zero, the object loses the ability to maintain a fixed mass-form (defined diameter / bounded geometry), because in TD a stable mass-form exists only when a persistent baseline mismatch is present to sustain it.

So annihilation means:

the system can no longer hold a static distortion profile, so it releases the content as propagating baseline difference.

6.10. What the Emitted Energy Is in TD

In TD, energy is not a separate mysterious substance. It is **persistent baseline difference**.

That is why annihilation output is naturally understood as:

- not "creation from nothing,"
- not "destruction into nothing,"
- but **conversion of structured static difference into propagating difference**.

This matches the TD wave picture already established:

- static mass/texture = stored baseline disagreement in bounded geometry,
- radiation/energy = propagating baseline disagreement (difference-content transport).

So, in compact TD form:

Annihilation is the collapse of a static signed carrier-texture structure into a propagating baseline-consistent difference field.

6.11. Carrier–Texture Annihilation Conditions and Radiation Release

The annihilation condition is not only about bulk mass sign. The carrier and the internal texture must both cancel in a baseline-consistent overlap.

For a conjugate pair at local overlap,

$$\Delta T^{(s)}_{m,1} + \Delta T^{(s)}_{m,2} \to 0, \tag{173}$$

$$(q\Delta T)^{(s)}_1 + (q\Delta T)^{(s)}_2 \to 0. \tag{174}$$

When these conditions are approached, the local EM field-state collapses toward baseline:

$$\mathcal{F}_{\text{local}} = (\chi_E, \delta\chi_B) \to \mathbf{0}. \tag{175}$$

This is exactly where the wave/radiation section connects. A rapid local field-state transition produces a radiative output:

$$\Delta\mathcal{F}_{\text{ann}} = \mathcal{F}_{\text{after}} - \mathcal{F}_{\text{before}}. \tag{176}$$

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If the collapse happens over a short annihilation time τ_{ann}, then the release-rate is large:

$$\Pi_{\text{ann}} = \frac{\mathcal{A}_{\Delta,\text{ann}}}{\tau_{\text{ann}}}, \qquad \mathcal{A}_{\Delta,\text{ann}} = \sqrt{\|\Delta\chi_E\|^2 + \|\Delta\delta\chi_B\|^2}. \tag{177}$$

So annihilation radiation is not a separate postulate. It is the Sec. 5 transport law applied to a rapid carrier-texture cancellation.

6.12. Imperfect Cancellation and Persistent Difference

If the overlap is incomplete (magnitude mismatch, geometry mismatch, or incomplete texture overlap), annihilation is partial rather than exact.

Then a residual signed structure remains:

$$\Delta T^{(s)}_{\text{residual}} \neq 0 \quad \text{and/or} \quad (q\Delta T)^{(s)}_{\text{residual}} \neq 0. \tag{178}$$

The TD outcome is then:

- radiation is emitted (because a real field-state transition occurred),
- but part of the carrier and/or texture remains,
- so the final state is a persistent difference, not a full return to baseline.

This gives a clean TD language for strong interactions that release energy but do not fully erase the underlying structure.

6.13. Why This Section Sharpens the EM Picture

The signed-ΔT construction also clarifies the earlier EM mechanism.

The reason EM interactions do not arbitrarily rewrite the texture is now explicit:

- the texture is a signed internal load of the carrier,
- changing it inconsistently would change the carrier ΔT-curve,
- baseline consistency forbids that,
- so the baseline routes the interaction through the electric and magnetic correction channels instead.

This is the same active logic used in the wave section:

the baseline does not "ignore" interaction; it resolves interaction in the only form that preserves the carrier structure.

6.14. Section Summary

The signed-ΔT extension completes the TD structure:

1. ΔT is a signed carrier variable, with positive (packed) and negative (stretched) branches.
2. Negative mass is a real TD branch but is anti-compiling, so it does not naturally form large stable structures.
3. The formal $-\Delta T = 1$ branch boundary is not a trapping boundary; it does not imply macroscopic negative objects.
4. Signed negative substructure is instead stabilized inside positive-mass carriers as charge-generating texture.
5. Annihilation is a baseline agreement process: residual signed static distortion goes to zero.
6. The emitted energy is propagating baseline difference, i.e., the Sec. 5 wave mechanism applied to rapid carrier-texture collapse.
7. Imperfect overlap leaves residual signed structure (persistent difference).

This section closes the TD chain from:

carrier mismatch (ΔT) $\to$ texture mismatch ($q\Delta T$) $\to$ constrained EM dynamics $\to$ propagating difference (radiation).

7. Predictions and Testable Signatures in TD

This section collects the strongest *stand-alone* prediction classes implied by the TD framework developed so far. Each prediction follows from the same core TD rules:

fixed baseline relay $\to$ carrier/texture separation $\to$ texture non-rewrite constraint $\to$ electric/magnetic correction

The predictions are written in a form suitable for direct comparison with observation after unit calibration.

7.1. Prediction 1: Propagation Timing–Difference Split (TD Redshift Signature)

TD predicts a clean separation between *what is transported* and *how fast it is delivered*.
A radiative signal is a transported field-state difference,

$$\Delta\mathcal{F} = (\Delta\chi_E,\ \Delta\delta\chi_B),$$

with source-defined difference amplitudes

$$A_\chi = \|\Delta\chi_E\|, \qquad A_B = \|\Delta\delta\chi_B\|.$$

In free propagation, TD forbids mid-flight texture re-resolution. Therefore, the source-defined difference-content is preserved:

$$A_{\chi,\mathrm{obs}} = A_{\chi,s}, \qquad A_{B,\mathrm{obs}} = A_{B,s} \quad \text{(ideal free-propagation TD limit).} \tag{179}$$

What *does* change in a background ΔT-field is the relay timing:

$$n(x) = \frac{1}{\sqrt{1-\Delta T(x)}}, \qquad t_{\mathrm{travel}} = \frac{1}{c}\int_\Gamma n(x)\,dl. \tag{180}$$

Thus TD predicts interval stretching/compression without source-difference rewrite:

$$T_{\mathrm{obs}} \sim n_{\mathrm{eff}} T_s, \qquad \tau_{\mathrm{obs}} \sim n_{\mathrm{eff}} \tau_s, \tag{181}$$

and therefore

$$f_{\mathrm{obs}} \sim \frac{f_s}{n_{\mathrm{eff}}}, \qquad \lambda_{\mathrm{obs}} \sim n_{\mathrm{eff}} \lambda_s. \tag{182}$$

The delivered field-change rate (per unit time) changes solely through timing:

$$R_{\chi,\mathrm{obs}} = \frac{A_\chi}{\tau_{\mathrm{obs}}} \sim \frac{1}{n_{\mathrm{eff}}}\frac{A_\chi}{\tau_s}, \qquad R_{B,\mathrm{obs}} = \frac{A_B}{\tau_{\mathrm{obs}}} \sim \frac{1}{n_{\mathrm{eff}}}\frac{A_B}{\tau_s}. \tag{183}$$

TD prediction class

TD therefore predicts a *timing-only curvature coupling* in free propagation:

Curvature changes wave interval, frequency, wavelength, and delivered field-change rate per unit time, while preserving the source-defined field-state difference-content in transit.

This is stronger than a generic redshift statement because TD explicitly separates:

- preserved difference-content (texture identity),
- modified relay timing (delivery rate).

7.2. Prediction 2: Boundary (Limit) Behavior

TD predicts a natural *limit behavior* for electric response through the local texture-share ratio.

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Define the TD share ratio

$$S(d) = \frac{q\Delta T_{\text{eff}}(d)}{\Delta T_{m,\text{eff}}(d) + q\Delta T_{\text{eff}}(d)}. \tag{184}$$

Using the locked TD acceleration map (electric branch),

$$a_E(d) = \frac{c^2}{2d}\, S(d), \qquad 0 \le S(d) \le 1. \tag{185}$$

Weak-field / ordinary regime

If

$$q\Delta T_{\text{eff}} \ll \Delta T_{m,\text{eff}},$$

then

$$S(d) \ll 1,$$

and TD reproduces the ordinary near-linear-response regime (including the bridge regime where TD numerics align with standard expectations).

Near-field / boundary regime

As the local texture-share grows and

$$S(d) \to 1,$$

TD predicts a boundary behavior:

$$a_E(d) \to a_{\max}(d) = \frac{c^2}{2d}. \tag{186}$$

This is the TD limit signature:

- the response does not diverge indefinitely,
- it saturates as local texture-share takes over,
- the onset of saturation is a direct TD signature.

Why this matters

Even before final calibration of all constants, TD predicts a clear transition class:

There exists a regime where electric response transitions from ordinary scaling to TD saturation as the local texture-share approaches unity.

This boundary behavior is not an added patch; it follows directly from TD baseline consistency and the share-limited correction channel.

7.3. Prediction 3: Gravity–EM Bridge in Strong Curvature (Black-Hole Magnetic Amplification)

TD predicts a strong *null-versus-enhancement split*: essentially no local texture rewrite in ordinary gravity, but a large magnetic effect in extreme curvature.

TD null prediction (ordinary gravity)

As long as carrier-curve deformation does not alter the *signed texture magnitude itself*, gravity does not change the local EM texture bookkeeping. In that regime:

- local EM production remains the same,
- gravity changes propagation, trajectory, and relay timing (carrier geometry),
- but not the underlying texture sign/magnitude content.

This is the TD carrier–texture separation rule in prediction form:

Changing the shape of the carrier does not automatically rewrite the texture pattern that defines EM behavior.

TD strong-field prediction (near horizon / strongly stretched carrier)

Near black-hole conditions, the carrier curve is not merely bent; it becomes strongly stretched and highly constrained by the local ΔT-geometry.

In TD, the magnetic channel is the warp-leftover generated when motion/drag tries to change the texture but direct texture rewrite is forbidden. In a strongly stretched carrier regime, preserving the same texture on that carrier requires a larger warp correction.

Therefore TD predicts:

Black-hole environments are natural magnetic-amplification regimes, because preserving texture on a strongly stretched carrier curve requires a larger warp response.

This is a bridge prediction, not a charge-rewrite claim:

- gravity does *not* change charge sign,
- gravity does *not* rewrite texture magnitude,
- gravity changes the carrier regime,
- the stronger carrier constraint forces a stronger magnetic warp-leftover to preserve the same texture.

What to measure (TD-style)

Relative to weak-curvature environments with comparable local source content, TD predicts enhanced:

- magnetic organization (warp-dominated structure),
- polarization and phase signatures tied to strong carrier stretching,
- emission persistence from rapidly reconfigured local carrier–texture systems in strong curvature.

Important TD distinction

This is **not** the claim that gravity directly changes charge. It is the claim that, in extreme carrier-curve regimes, *preserving the same texture* requires a much stronger warp correction, and that correction is what appears magnetically.

7.4. Prediction 4: Wave-Crossing Reconstruction Lock (Active Baseline Consistency)

TD does not treat wave crossing as a passive "non-interaction." The active statement is stronger.

A propagating EM wave is a transported field-state difference. During free propagation, direct texture re-resolution is forbidden because it would rewrite the carrier ΔT-curve without a source-level state change.

Thus, when two wave trains overlap, TD predicts:

1. the disturbances *do* meet in the same baseline region,
2. the baseline cannot re-resolve them into a new texture state,
3. the baseline therefore recreates each propagated disturbance in the same electric/magnetic correction form after overlap.

This gives the TD crossing-lock prediction:

Wave overlap does not produce a persistent free-propagation texture rewrite; after crossing, each wave re-emerges with its source-defined difference identity preserved (up to path/timing effects).

What is allowed during overlap

TD allows local overlap of field differences. It does *not* allow stable mid-flight texture re-resolution into a new carrier state. The observable consequence is:

- source-defined difference identity is preserved,
- free-propagation crossing is allowed,
- local response occurs only when a charge/source receives the retarded difference and rebalances.

7.5. Prediction Summary

The strongest TD prediction classes implied by the framework built so far are:

1. **Propagation timing–difference split:** curvature modifies relay timing (redshift/intervals/rates) while preserving source-defined field-state difference-content in free propagation.
2. **Boundary (limit) behavior:** electric response transitions from ordinary scaling to a TD saturation limit as local texture-share approaches unity.
3. **Strong-curvature gravity–EM bridge:** ordinary gravity leaves local texture content unchanged, but strong carrier stretching amplifies magnetic warp-leftover.
4. **Wave-crossing reconstruction lock:** overlapping EM waves do not persistently rewrite one another mid-flight; the baseline recreates the same electric/magnetic correction forms after overlap.

These are all direct consequences of the same TD consistency rules, expressed in four observationally distinct forms.

8. Conclusion

This paper presents Temporal Dynamics (TD) as a unified *baseline-consistency framework* for gravity, electricity, magnetism, wave transport, signed ΔT structure, and matter–antimatter cancellation processes.

The central construction is simple in form but broad in scope: a fixed baseline relay ($S \equiv c$) defines the reference rate, while persistent departures from that baseline are encoded as carrier-curve distortion (ΔT) and signed texture-load ($q\Delta T$). From this starting point, the paper develops a single internal logic:

- gravity arises from carrier-curve mismatch (mass-curve structure),
- electric response arises from signed texture mismatch under the same baseline rule,
- magnetism arises as directional warp-leftover when motion attempts forbidden texture rewrite,
- radiation arises as transported field-state difference (not as a separate substance),
- and annihilation is interpreted as the collapse of a stable signed static structure into propagating baseline difference.

A key aim of this work has been to organize TD into a form that is *operational*, not only conceptual. In that sense, the paper contributes three things:

1. a consistent language (carrier, texture, baseline relay, difference-content),
2. a linked mathematical structure for gravity/EM/waves,
3. and a set of explicit prediction classes that can be tested or falsified.

The prediction section is especially important for the future of the framework. TD now makes clear, separable claims about:

- timing-vs-difference transport in curved backgrounds,
- boundary/limit behavior in the electric branch,
- strong-curvature magnetic amplification as a gravity–EM bridge effect,
- and wave-crossing reconstruction lock under active baseline consistency.

These are intended as *test targets*, not merely interpretive statements.

At the same time, this paper should be read as a **framework paper**, not a final closed theory. Several parts are deliberately left for the next development stage, including:

- full calibration of TD quantities to standard SI observables across all regimes,
- explicit bridge derivations to standard Maxwell and relativistic forms in well-defined limits,
- numerical simulation programs for strong-field TD dynamics,
- and quantitative confrontation with astrophysical, laboratory, and scattering data.

The broader goal is not to replace existing successful physics where it already works, but to provide a deeper generative structure from which known behavior can be recovered and new signatures

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can emerge. In that sense, TD is proposed as an expandable platform: a framework that can be refined, constrained, or rejected by calculation and observation. This paper presents a unifying derivation framework and bridge formalism; full field-theoretic completion and precision comparison are future work.

Future work. The immediate next steps are: (i) complete the calibration program for the TD constants and mapping factors, (ii) implement numerical wave and strong-curvature simulations, (iii) formalize the signed-ΔT branch (including antimatter and annihilation channels) in the same predictive style used for the EM sections, and (iv) compare the TD prediction classes with existing observational datasets, especially in redshift timing structure and strong-field magnetic environments.

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Appendix A. Maxwell Bridge: TD to Standard Electromagnetism

Appendix A.1. Purpose of this Appendix

This appendix provides a bridge formulation between Temporal Dynamics (TD) variables and the standard Maxwell-form electromagnetic equations used in SI measurements.

The goal is not to replace the TD primitives. In TD, the primary variables remain:

- the carrier-lag state ΔT,
- the signed carrier-texture $\chi \equiv q\Delta T$,
- the texture continuity variables ρ_χ and $\mathbf{J}_\chi$,
- and the motion-generated magnetic leftover / warp quantities (e.g., $\delta\chi_B$, L_B).

This appendix only shows how those TD quantities connect to the familiar Maxwell language used for experimental comparison and standard textbook presentation.

Appendix A.2. TD Starting Point for the Bridge

TD already contains the structural ingredients needed for a Maxwell bridge:

1. **Signed texture as the EM-defining variable**

$$\chi \equiv q\Delta T, \tag{A1}$$

so electromagnetism is built from the same carrier structure that also underlies gravity in TD.

2. **Local continuity (TD texture conservation)**

$$\frac{\partial \rho_\chi}{\partial t} + \nabla \cdot \mathbf{J}_\chi = 0, \tag{A2}$$

which is the TD conservation constraint behind charge continuity.

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3. **Finite-speed relay in vacuum**
$$S \equiv c, \tag{A3}$$
so propagated field-state changes are retarded by baseline travel time.
4. **Electric–magnetic coupling in propagation**
TD treats wave propagation as paired electric/magnetic correction-content rather than two unrelated substances.
5. **Transverse wave locking**
$$\hat{\mathbf{k}} \cdot \Delta\chi_E = 0, \qquad \hat{\mathbf{k}} \cdot \Delta\delta\chi_B = 0, \tag{A4}$$
with directional locking
$$\Delta\delta\chi_B \parallel \hat{\mathbf{k}} \times \Delta\chi_E. \tag{A5}$$

These are the TD-side constraints that make a Maxwell-form bridge possible.

Appendix A.3. Bridge Dictionary (TD Variables to SI-Field Variables)

For comparison with standard electromagnetism, define bridge fields $\mathbf{E}_M$ and $\mathbf{B}_M$ as the SI-measurable field representations reconstructed from TD quantities in the linear bridge regime.

Appendix A.3.1. Electric Bridge Field

The TD electric channel is defined by the signed-texture share-law dynamics in the main text. In the weak-share (linear) bridge limit, this reproduces the Coulomb form. We therefore define $\mathbf{E}_M$ operationally as the standard electric field whose force/acceleration predictions match the TD electric channel in that regime.

Appendix A.3.2. Magnetic Bridge Field

In TD, the magnetic primitive is not B itself but the motion-generated warp leftover (e.g., L_B). The standard magnetic field $\mathbf{B}_M$ is then the SI-calibrated measurable representation of that TD magnetic leftover geometry.

Appendix A.3.3. Source Bridge Variables

Let $(\rho_q, \mathbf{J}_q)$ denote the SI source variables (charge density and current density), and $(\rho_\chi, \mathbf{J}_\chi)$ the TD texture-density/current variables.

In the bridge regime, define a constant calibration map
$$\rho_q = \mathcal{C}_\chi \rho_\chi, \qquad \mathbf{J}_q = \mathcal{C}_\chi \mathbf{J}_\chi, \tag{A6}$$
where $\mathcal{C}_\chi$ is fixed by the same Coulomb and magnetic checksum calibrations used in the main text.

Using Equation (A2), this immediately preserves the standard continuity law:
$$\frac{\partial \rho_q}{\partial t} + \nabla \cdot \mathbf{J}_q = 0. \tag{A7}$$

Appendix A.4. Maxwell-Form Bridge Equations (Vacuum / SI Comparison Form)

Under the linear bridge regime (the same regime used for the Coulomb and magnetic checksum limits), the TD conservation and relay structure maps to the standard Maxwell-form closure in SI units [4–6]:

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$$\nabla \cdot \mathbf{E}_M = \frac{\rho_q}{\varepsilon_0}, \tag{A8}$$

$$\nabla \cdot \mathbf{B}_M = 0, \tag{A9}$$

$$\nabla \times \mathbf{E}_M = -\frac{\partial \mathbf{B}_M}{\partial t}, \tag{A10}$$

$$\nabla \times \mathbf{B}_M = \mu_0 \mathbf{J}_q + \mu_0 \varepsilon_0 \frac{\partial \mathbf{E}_M}{\partial t}. \tag{A11}$$

TD interpretation of the Maxwell-form terms.

- **Gauss law for electricity [Equation (A8)].** The divergence of the electric bridge field tracks local source texture-density after SI calibration. This is the Maxwell-form image of TD signed texture source content.
- **No magnetic monopole source [Equation (A9)].** TD magnetism is a motion-generated transverse warp/leftover channel, not a scalar source-texture primitive. Hence the magnetic bridge field enters as a sourced curl-response rather than a monopole source density.
- **Faraday law [Equation (A10)].** A time-varying magnetic warp-content produces the corresponding electric curl response in the bridge representation, consistent with TD paired electric–magnetic propagation and finite-speed relay.
- **Ampère–Maxwell law [Equation (A11)].** The $\mu_0 \mathbf{J}_q$ term is the SI bridge image of local TD texture current, while the displacement term $\mu_0 \varepsilon_0 \partial_t \mathbf{E}_M$ is the bridge image of transported difference-content (baseline relay update) required for finite-speed consistency.

Appendix A.5. Why the Maxwell Closure Appears in TD

The Maxwell-form system arises naturally as the SI bridge because TD already imposes the same structural constraints in the linear bridge regime:

1. **Local conservation** (texture continuity) enforces source-consistent field evolution.
2. **Finite-speed propagation at** c fixes retarded transport and wave speed.
3. **Paired electric–magnetic propagation** requires coupled curl dynamics.
4. **Transverse lock** produces the standard transverse-wave structure.
5. **Coulomb and magnetic checksum calibration** fixes normalization to SI observables.

Therefore, Maxwell's equations are not inserted as TD primitives in this framework. They appear as the *measurement bridge form* of TD signed-texture conservation and baseline-relay dynamics.

Appendix A.6. Curved-Background Note (Beyond Flat-Space Maxwell Form)

In the standard vacuum comparison form, propagation is written with the fixed relay speed c. TD extends this by replacing simple travel time with a ΔT-dependent path-time:

$$t_{\text{travel}}(\Gamma) = \frac{1}{c} \int_\Gamma n(x)\, \mathrm{d}l, \tag{A12}$$

where $n(x)$ is the TD propagation index (defined in the main text) and Γ is the propagation path.

This means:

- the *local* Maxwell-form bridge remains the correct SI comparison language, while
- TD adds a deeper propagation layer through path-timing and retardation in non-uniform ΔT backgrounds.

Appendix A.7. Appendix Summary

In TD, the Maxwell equations are recovered as the standard SI bridge form of a deeper structure built from:

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- locally conserved signed carrier-texture χ,
- motion-generated magnetic leftover/warp content,
- and finite-speed baseline transport at c.

Thus, Maxwell theory appears here as the observable linear bridge of TD electromagnetism, while the TD primitives remain ΔT, χ, $\delta\chi_B$, and L_B.

Appendix B. Worked TD Calculations (Electron Example)

This appendix gives a concrete worked example using a single particle (the electron) to show how the TD quantities connect across the main channels developed in the paper: carrier lag (gravity-side bookkeeping), electric texture-share, magnetic warp-leftover, wave/pulse release, and annihilation checksum targets.

Appendix B.1. Constants and Conventions

We use the following constants (SI):

$$\begin{aligned} c &= 2.99792458 \times 10^{8}\ \mathrm{m\,s^{-1}}, && \text{(A13)}\\ G &= 6.67430 \times 10^{-11}\ \mathrm{m^{3}\,kg^{-1}\,s^{-2}}, && \text{(A14)}\\ k_e &= 8.9875517923 \times 10^{9}\ \mathrm{N\,m^{2}\,C^{-2}}, && \text{(A15)}\\ e &= 1.602176634 \times 10^{-19}\ \mathrm{C}, && \text{(A16)}\\ m_e &= 9.1093837015 \times 10^{-31}\ \mathrm{kg}, && \text{(A17)}\\ h &= 6.62607015 \times 10^{-34}\ \mathrm{J\,s}, && \text{(A18)}\\ a_0 &= 5.29177210903 \times 10^{-11}\ \mathrm{m} \quad \text{(Bohr radius)}, && \text{(A19)}\\ \alpha &= 7.2973525693 \times 10^{-3}. && \text{(A20)} \end{aligned}$$

For the TD constants, we keep the electric texture constant and the magnetic checksum constant separate (as in the Appendix A notation cleanup):

$$\begin{aligned} k_m &\equiv \frac{2G}{c^2} \approx 1.4852320538 \times 10^{-27}\ \mathrm{m\,kg^{-1}}, && \text{(A21)}\\ k_q^{\mathrm{TD}} &\approx 2.9703305895 \times 10^{-34}\ \mathrm{m^{2}\,C^{-2}}, && \text{(A22)}\\ \kappa_B &\equiv \frac{k_e}{c^2} \approx 1.0000000005 \times 10^{-7}\ (\text{SI checksum factor}). && \text{(A23)} \end{aligned}$$

Throughout this appendix, Q denotes physical charge in Coulombs (to avoid confusing it with the sign/orientation marker q used in the main text).

Appendix B.2. Carrier Lag Bookkeeping for One Electron

Using the gravity-side TD carrier-lag definitions,

$$\begin{aligned} \Delta T_g(d) &= \frac{k_m M}{d}, && \text{(A24)}\\ \Delta\ell_{\mathrm{lag}} &= k_m M, && \text{(A25)} \end{aligned}$$

the electron carrier-lag quantities are

$$\begin{aligned} \Delta\ell_{\mathrm{lag},e} = k_m m_e &\approx \left(1.4852320538 \times 10^{-27}\right)\left(9.1093837015 \times 10^{-31}\right)\\ &\approx 1.35295 \times 10^{-57}\ \mathrm{m}, && \text{(A26)} \end{aligned}$$

and, at the Bohr-scale reference distance $d = a_0$,

$$\Delta T_{g,e}(a_0) = \frac{k_m m_e}{a_0} \approx \frac{1.35295 \times 10^{-57}}{5.29177210903 \times 10^{-11}} \approx 2.5567 \times 10^{-47}. \tag{A27}$$

This is the *carrier* lag-side baseline quantity for the electron at the chosen scale.

Appendix B.3. Electric Texture-Share Example (Electron–Proton at the Bohr Scale)

Using the TD charge-to-texture map (signed form),

$$q\Delta T(d) = \mathrm{sgn}(Q_1 Q_2)\, k_q^{\mathrm{TD}} \frac{|Q_1 Q_2|}{d^2}, \tag{A28}$$

the electron–proton pair ($Q_1 = -e$, $Q_2 = +e$) at $d = a_0$ gives

$$\begin{aligned} q\Delta T_{ep}(a_0) &= -\,k_q^{\mathrm{TD}} \frac{e^2}{a_0^2} \\ &\approx -\left(2.9703305895 \times 10^{-34}\right) \frac{(1.602176634 \times 10^{-19})^2}{(5.29177210903 \times 10^{-11})^2} \\ &\approx -2.72285 \times 10^{-51}. \end{aligned} \tag{A29}$$

Using the TD electric share factor

$$S_E(d) = \frac{q\Delta T(d)}{\Delta T_m(d) + |q\Delta T(d)|}, \tag{A30}$$

and taking the local carrier lag involved to be the electron carrier lag $\Delta T_m(d) \equiv \Delta T_{g,e}(d)$, we get

$$S_E(a_0) = \frac{-2.72285 \times 10^{-51}}{2.5567 \times 10^{-47} + 2.72285 \times 10^{-51}} \approx -1.06487 \times 10^{-4}. \tag{A31}$$

Then the TD electric acceleration law

$$a_E(d) = \frac{c^2}{2d} S_E(d)\,\hat{\mathbf{r}} \tag{A32}$$

gives the Bohr-scale checksum magnitude

$$\begin{aligned} |a_E(a_0)| &= \frac{c^2}{2a_0} |S_E(a_0)| \\ &\approx \frac{(2.99792458 \times 10^8)^2}{2(5.29177210903 \times 10^{-11})} (1.06487 \times 10^{-4}) \\ &\approx 9.04 \times 10^{22}\ \mathrm{m\,s^{-2}}. \end{aligned} \tag{A33}$$

This is a useful checksum-scale result for the TD electric channel at atomic distance.

Appendix B.4. Magnetic Warp-Leftover and Checksum B-Field (Same Electron)

Now take the same electron moving on a circular path of radius $r = a_0$ with speed

$$v_B = \alpha c \approx 2.18769 \times 10^6\ \mathrm{m\,s^{-1}}. \tag{A34}$$

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Define

$$\rho_v = \sqrt{1 - \frac{v^2}{c^2}}, \qquad \eta_v = \frac{1}{\rho_v} - 1. \tag{A35}$$

For $v = v_B$,

$$\rho_{v_B} \approx 0.999973374, \qquad \eta_{v_B} \approx 2.66267 \times 10^{-5}. \tag{A36}$$

Using the local electric texture profile (Appendix A notation),

$$\chi(r) = \frac{k_q^{\mathrm{TD}}\, Q}{r}, \tag{A37}$$

the electron texture magnitude at $r = a_0$ is

$$\begin{aligned} \chi_e(a_0) &= \frac{k_q^{\mathrm{TD}}\, e}{a_0} \\ &\approx \frac{(2.9703305895 \times 10^{-34})(1.602176634 \times 10^{-19})}{5.29177210903 \times 10^{-11}} \\ &\approx 8.99320 \times 10^{-43}. \end{aligned} \tag{A38}$$

From the magnetic warp-leftover relation,

$$L_B(r) = k_q^{\mathrm{TD}}\, Q\, \eta_v, \tag{A39}$$

we obtain

$$\begin{aligned} L_B(a_0) &= k_q^{\mathrm{TD}}\, e\, \eta_{v_B} \\ &\approx (2.9703305895 \times 10^{-34})(1.602176634 \times 10^{-19})(2.66267 \times 10^{-5}) \\ &\approx 1.26717 \times 10^{-57}\ \mathrm{m}. \end{aligned} \tag{A40}$$

The equivalent current is

$$I = \frac{Qv}{2\pi r} \quad \Rightarrow \quad I_B = \frac{e v_B}{2\pi a_0} \approx 1.05418 \times 10^{-3}\ \mathrm{A}. \tag{A41}$$

Using the checksum magnetic field relation

$$B(r) = \frac{\kappa_B\, Q\, v}{\pi r^2}, \tag{A42}$$

the Bohr-scale magnetic field is

$$\begin{aligned} B(a_0) &= \frac{\kappa_B e v_B}{\pi a_0^2} \\ &\approx 3.98423\ \mathrm{T}. \end{aligned} \tag{A43}$$

Equivalently, using the direct TD conversion bridge,

$$B(r) = \frac{v}{\pi r^2} \frac{L_B(r)}{\eta_v}, \tag{A44}$$

the same value is recovered from L_B.

Appendix B.5. Wave/Pulse Example from a Source-State Change (Magnetic-Only Kick)

To show the wave section in a concrete way, consider a *single source-state kick* where the same electron stays at radius a_0 but its speed changes from

$$v_1 = \alpha c \quad \text{to} \quad v_2 = 1.1\,\alpha c \tag{A45}$$

over a source transition time $\tau_s = 10^{-15}$ s.

At fixed $r = a_0$, the electric texture profile $\chi(r)$ is unchanged (same source charge and same radius), but the magnetic warp state changes because η_v changes. Using

$$\delta\chi_B = \chi\,\eta_v, \tag{A46}$$

the change in magnetic wave-content is

$$\Delta\delta\chi_B = \chi_e(a_0)(\eta_{v_2} - \eta_{v_1}). \tag{A47}$$

Numerically,

$$\eta_{v_1} \approx 2.66267 \times 10^{-5}, \tag{A48}$$
$$\eta_{v_2} \approx 3.22186 \times 10^{-5}, \tag{A49}$$

so

$$|\Delta\delta\chi_B| \approx (8.99320 \times 10^{-43})\left(3.22186 \times 10^{-5} - 2.66267 \times 10^{-5}\right) \approx 5.02889 \times 10^{-48}. \tag{A50}$$

For a magnetic-dominated kick (here $\Delta\chi_E \simeq 0$ at fixed r), the TD wave difference amplitude is

$$A_\Delta = \sqrt{\|\Delta\chi_E\|^2 + \|\Delta\delta\chi_B\|^2} \;\approx\; |\Delta\delta\chi_B| \approx 5.02889 \times 10^{-48}. \tag{A51}$$

Using the TD wave-strength (release-rate) index,

$$\Pi_{\text{wave}} = \frac{A_\Delta}{\tau_s}, \tag{A52}$$

we get

$$\Pi_{\text{wave}} \approx \frac{5.02889 \times 10^{-48}}{10^{-15}} = 5.02889 \times 10^{-33}\ \text{s}^{-1} \quad \text{(TD amplitude-rate form)}. \tag{A53}$$

The pulse thickness at the source is

$$\ell_{\text{pulse},s} = c\tau_s = (2.99792458 \times 10^8)(10^{-15}) \approx 2.99792 \times 10^{-7}\ \text{m}. \tag{A54}$$

This is a direct worked example of the TD wave/pulse mechanism: a source-state change creates transported difference-content with finite release duration.

Appendix B.6. Annihilation Example (Electron–positron): TD Conditions and Checksum Energy

For an electron–positron conjugate pair, the TD annihilation conditions are the signed carrier and texture cancellations:

$$\Delta T^{(s)}_{m,1} + \Delta T^{(s)}_{m,2} \to 0, \tag{A55}$$
$$(q\Delta T)^{(s)}_1 + (q\Delta T)^{(s)}_2 \to 0. \tag{A56}$$

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When the local field-state collapses,

$$\Delta F_{\text{ann}} = F_{\text{after}} - F_{\text{before}}, \tag{A57}$$

and the TD release-rate form is

$$\Pi_{\text{ann}} = \frac{A_{\Delta,\text{ann}}}{\tau_{\text{ann}}}, \qquad A_{\Delta,\text{ann}} = \sqrt{\|\Delta\chi_E\|^2 + \|\Delta\delta\chi_B\|^2}. \tag{A58}$$

As an external checksum target (standard measurable output), the total pair energy is

$$\begin{aligned} E_{\text{pair}} &= 2m_e c^2 \\ &\approx 2(9.1093837015 \times 10^{-31})(2.99792458 \times 10^8)^2 \\ &\approx 1.63742 \times 10^{-13}\ \text{J} \approx 1.022\ \text{MeV}. \end{aligned} \tag{A59}$$

For the common two-photon channel, each photon carries

$$E_\gamma = m_e c^2 \approx 8.18711 \times 10^{-14}\ \text{J} \approx 511\ \text{keV}. \tag{A60}$$

The corresponding checksum frequency and wavelength are

$$f_\gamma = \frac{E_\gamma}{h} \approx 1.23559 \times 10^{20}\ \text{Hz}, \tag{A61}$$

$$\lambda_\gamma = \frac{c}{f_\gamma} \approx 2.42631 \times 10^{-12}\ \text{m}. \tag{A62}$$

This does not yet force a Joule-calibration for $A_{\Delta,\text{ann}}$; rather, it gives the observational checksum target that a future TD amplitude-to-energy calibration must recover.

Appendix B.7. What This Appendix Shows

The same electron can be tracked through the TD hierarchy using one continuous set of definitions:

$$\Delta T \rightarrow q\Delta T \rightarrow \delta\chi_B \rightarrow \Delta F \rightarrow \Pi_{\text{wave/ann}}. \tag{A63}$$

This is the practical meaning of the TD unification claim in calculation form: one baseline bookkeeping structure, expressed through different channels (carrier lag, texture resolution, warp-leftover, and transported difference-content). These examples are included as *illustrative checks*: they are not presented as new experimental measurements, but as internal consistency demonstrations showing how TD quantities map to standard observable/checksum forms across the paper's main channels.

Appendix C. Notation Table

Conventions. Bold symbols (e.g., $\mathbf{F}$, $\mathbf{g}$, $\mathbf{J}_\chi$) denote vectors. Subscript "s" denotes source-defined quantities, "obs" denotes observed quantities, and "eff" denotes effective/path-averaged quantities. Superscript (s) denotes the signed-branch notation (Sec. VI), not a source label.
Notation collision note. To avoid conflict with the signed-branch coefficient λ_s in Sec. VI, the operational wave wavelength is listed in this appendix as $\lambda_{\text{wave}} = cT_s$ (even if a shorter λ_s form appears elsewhere in the manuscript).

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Table A1. Core TD baseline and geometry notation.

Symbol	Meaning	Units / Type
$S \equiv c$	Unperturbed baseline relay speed (TD baseline speed)	$\mathrm{m\,s^{-1}}$
$d\ell_0 = c\,dt_0$	Reference baseline distance–time relation	differential relation
$\Delta T(x,t)$	Local TD lag fraction (baseline lag relative to reference baseline)	dimensionless
D	Characteristic source/region diameter (baseline crossing scale)	m
$\tau_D \equiv D/c$	Baseline crossing time across characteristic diameter D	s
Δt_{lag}	Local lag time relative to baseline crossing	s
$\Delta\ell_{\mathrm{lag}} = c\,\Delta t_{\mathrm{lag}} = \Delta T\,D$	Curvature-length budget (extra path content) from lag	m
$\chi \equiv q\,\Delta T$	Signed carrier-texture load (TD EM-defining variable)	TD texture variable
$\nabla \Delta T$	Gradient of lag field (drives TD response direction)	$\mathrm{m^{-1}}$
$N(x) \equiv d\tau/dt$	TD lapse / local clock-rate factor	dimensionless
$n(x) \equiv 1/N(x) = 1/\sqrt{1-\Delta T(x)}$	TD effective propagation index	dimensionless
Γ	Propagation path used in TD travel-time integrals	path
$t_{\mathrm{travel}}(\Gamma)$	Path travel time, $t_{\mathrm{travel}} = \frac{1}{c}\int_\Gamma n(x)\,dl$	s
ρ_χ	Texture density (TD continuity variable)	model density
$\mathbf{J}_\chi$	Texture current / texture flux (TD continuity variable)	model flux
$\delta\chi_B$	Magnetic correction / directional warp-texture channel	TD texture variable

Table A2. Gravity-sector notation in TD.

Symbol	Meaning	Units / Type
$U_C \equiv 1/c$	TD baseline conversion constant (time per meter)	$\mathrm{s\,m^{-1}}$
$t_0(d) = d\,U_C = d/c$	Baseline transit time across straight distance d	s
K_M	TD mass conversion constant (diameter form)	$\mathrm{m\,kg^{-1}}$
$D_M \equiv K_M M$	TD gravity length scale (diameter form) for source mass M	m
$\Delta T_g(d) = D_M/d = K_M M/d$	Gravitational lag field (diameter form)	dimensionless
$k_m \equiv K_M/2$	TD mass conversion constant (radius form)	$\mathrm{m\,kg^{-1}}$
$r_M \equiv k_m M$	TD gravity length scale (radius form)	m
$\Delta T_g(r) = r_M/r = k_m M/r$	Gravitational lag field (radius form)	dimensionless
$t_0(L) = L\,U_C$	Baseline transit time on reference segment L	s
$\tau_g(L) = \Delta T_g\,t_0(L)$	Lag time attached to segment L	s
$L_{\mathrm{curv}}(L) = c\,\tau_g(L) = \Delta T_g\,L$	Curvature-length excess from gravity lag	m
$S_g(d)$	Gravity baseline-share factor (e.g., $S_g = 1/(1+\Delta T_g)$)	dimensionless
$a_g(d)$	TD gravity acceleration (baseline/local relay difference form)	$\mathrm{m\,s^{-2}}$
$\mathbf{g}(x)$	Gravity field in gradient bridge form ($\mathbf{g} \sim -\nabla \Delta T_g$)	$\mathrm{m\,s^{-2}}$
$\Delta T_{g,\mathrm{tot}}$	Combined lag field from multiple masses (bridge regime sum)	dimensionless

Table A3. Electromagnetism notation in TD (electric and magnetic channels).

Symbol	Meaning	Units / Type
τ	Local traversal / TD timing variable used in EM derivation	s
$\Theta \equiv \tau/(d/c)$	TD timing ratio (electric derivation convenience variable)	dimensionless
$\chi_{\text{eff}}(d)$	Effective electric texture-load at separation d	TD texture variable
$\Delta T_{m,\text{eff}}(d)$	Effective carrier lag-load in electric interaction formula	dimensionless
$S_E(d)$	Electric texture-share ratio, $S_E = \chi_{\text{eff}}/(\Delta T_{m,\text{eff}} + \chi_{\text{eff}})$	dimensionless
$a_E(d)$	TD electric acceleration (texture-share form)	m s^{-2}
$a_{\text{max}}(d) = c^2/(2d)$	Local TD acceleration cap used in the electric share law	m s^{-2}
q	Electric charge symbol used in the main EM sections (signed role depends on context)	C / sign marker
Q	Explicit physical charge magnitude/sign (used in worked examples to avoid ambiguity)	C
k_q^{TD}	TD pair-interaction charge-to-texture coupling constant (electricity subsection)	TD/SI bridge constant
κ_χ	Source texture-profile calibration constant (local radial profile in magnetism checksum bridge)	calibration constant
$\kappa_B \equiv k_e/c^2$	Magnetic checksum constant (separate from k_q^{TD})	SI checksum constant
$\chi(r) = q\Delta T(r) = \kappa_\chi q/r$	Local source texture profile in magnetism checksum bridge	TD texture profile
$\rho_v = \sqrt{1 - v^2/c^2}$	Velocity factor used in magnetic leftover conversion	dimensionless
$\eta_v \equiv 1/\rho_v - 1$	Velocity leftover factor in magnetic channel	dimensionless
v	Particle/source speed (magnetism subsection)	m s^{-1}
$\chi_\perp(r)$	Perpendicular (wrapped) texture component around moving charge	TD texture component
$\delta\chi_B(r)$	Motion-generated magnetic-direction texture correction	TD texture correction
$L_B(r)$	Magnetic leftover / warp length associated with motion-induced texture	m
$I = qv/(2\pi r)$	Equivalent circular current (checksum relation)	A
$B(r)$	Magnetic field (observable/checksum bridge quantity)	T
$\mathbf{E}_M, \mathbf{B}_M$	Maxwell-bridge SI electric and magnetic fields (Appendix A)	V/m, T
$\rho_q, \mathbf{J}_q$	Maxwell-bridge SI charge density and current density (Appendix A)	C m^{-3}, A m^{-2}
$\mathcal{C}_\chi$	Constant calibration map between $(\rho_\chi, \mathbf{J}_\chi)$ and $(\rho_q, \mathbf{J}_q)$	calibration factor
ε_0, μ_0	Vacuum permittivity and permeability (Maxwell bridge form)	SI constants

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Table A4. Wave and propagation notation in TD (Sec. V).

Symbol	Meaning	Units / Type
$\mathbf{F}(x,t) \equiv (\chi_E, \delta\chi_B)$	Local EM field-state in TD	ordered field-state pair
$\mathbf{F}_{\text{old}}$, $\mathbf{F}_{\text{new}}$	Before/after local source field-states	field-state pair
$\Delta\mathbf{F}_s$	Source field-state transition, $\mathbf{F}_{\text{new}} - \mathbf{F}_{\text{old}}$	field-state difference
$\Delta\chi_{E,s}$	Source electric field-state difference component	TD texture difference
$\Delta\delta\chi_{B,s}$	Source magnetic correction difference component	TD texture difference
A_Δ	Magnitude of source field-state difference, $A_\Delta = \sqrt{\lVert\Delta\chi_{E,s}\rVert^2 + \lVert\Delta\delta\chi_{B,s}\rVert^2}$	TD amplitude
τ_s	Source transition duration (wave-event duration)	s
$\Pi_{\text{wave}} = A_\Delta/\tau_s$	Wave-event release-rate index (TD wave strength index)	TD rate index
$\ell_{\text{pulse},s} = c\,\tau_s$	Source pulse thickness / pulse length	m
Δt_{prop}	Propagation delay of a field-state difference	s
$n_{\text{eff}}(t)$	Effective path-averaged TD propagation index (time dependent)	dimensionless
$\hat{k}$	Propagation direction unit vector	unit vector
T_s	Source repetition period (wave train)	s
$f_s = 1/T_s$	Source frequency (wave train)	Hz
$\omega_s = 2\pi f_s$	Source angular frequency	rad s^{-1}
$A_\chi = \lVert\Delta\chi_E\rVert$	Electric difference amplitude (source-defined)	TD amplitude
$A_B = \lVert\Delta\delta\chi_B\rVert$	Magnetic difference amplitude (source-defined)	TD amplitude
$R_\chi = A_\chi/\tau$	Electric release-rate amplitude (delivered change per unit time)	TD rate amplitude
$R_B = A_B/\tau$	Magnetic release-rate amplitude (delivered change per unit time)	TD rate amplitude
$\lambda_{\text{wave}} = cT_s$	TD operational wavelength (vacuum bridge regime)	m
$\phi(x,t) = \omega_s\big(t - t_{\text{travel}}(\Gamma)\big) + \phi_0$	Retarded phase in harmonic wave-train form	phase
ϕ_0	Initial phase offset	phase constant
T_{obs}, τ_{obs}	Observed interval and observed event duration after propagation timing effects	s
f_{obs}, λ_{obs}	Observed frequency and observed wavelength in background ΔT field	Hz, m

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Table A5. Signed-branch and annihilation notation in TD (Sec. VI).

Symbol	Meaning	Units / Type
(s)	Signed-branch superscript label (positive/negative TD branch)	branch label
$\Delta T^{(s)}$	Signed TD lag/load variable	dimensionless
K_m	Signed-branch mass conversion constant (signed extension notation)	$\mathrm{m\,kg^{-1}}$
M_s	Signed branch-mass parameter in $\Delta T_m^{(s)}$	kg (signed model parameter)
λ_s	Branch coefficient in $M_s = \lambda_s M$	dimensionless
η_-	Positive magnitude used for negative branch coefficient $\lambda_- = -\eta_-$	dimensionless
$\Delta T_m^{(s)}(d) = K_m M_s / d$	Signed branch carrier-load field (diameter form)	dimensionless
$q^{(s)} = \mathrm{sgn}(M_s)$	Branch sign factor (± 1)	dimensionless
$(q\Delta T)^{(s)}$	Signed texture-load of the carrier (signed EM load)	TD texture-load
$\Delta T_{\mathrm{net}}^{(s)}$	Net signed field from multiple signed sources	dimensionless
$\Delta T_{\mathrm{res}}^{(s)}$ or $\Delta T_{\mathrm{residual}}^{(s)}$	Residual signed field after incomplete cancellation	dimensionless
$\Delta T_{\mathrm{local}}^{(s)}$	Local signed load at overlap/cancellation region	dimensionless
$\mathbf{F}_{\mathrm{local}} = (\chi_E, \delta\chi_B)$	Local EM field-state used in annihilation collapse condition	field-state pair
$\Delta\mathbf{F}_{\mathrm{ann}} = \mathbf{F}_{\mathrm{after}} - \mathbf{F}_{\mathrm{before}}$	Annihilation-induced local field-state transition	field-state difference
τ_{ann}	Annihilation collapse/transition timescale	s
$A_{\Delta,\mathrm{ann}}$	Annihilation field-state transition magnitude	TD amplitude
$\Pi_{\mathrm{ann}} = A_{\Delta,\mathrm{ann}} / \tau_{\mathrm{ann}}$	Annihilation release-rate index (radiative output rate measure)	TD rate index

Table A6. Appendix A (Maxwell bridge) notation.

Symbol	Meaning	Units / Type
$\mathbf{E}_M$	SI electric field reconstructed as the Maxwell-bridge image of the TD electric channel	$\mathrm{V\,m^{-1}}$
$\mathbf{B}_M$	SI magnetic field reconstructed as the Maxwell-bridge image of TD magnetic leftover/warp content	T
$\rho_q, \mathbf{J}_q$	SI charge density and current density used in Maxwell-form bridge equations	$\mathrm{C\,m^{-3}}$, $\mathrm{A\,m^{-2}}$
$\rho_\chi, \mathbf{J}_\chi$	TD texture density/current variables used before SI calibration	TD density/flux
$\mathcal{C}_\chi$	Calibration constant mapping TD source variables to SI source variables	calibration factor
$\nabla \cdot \mathbf{E}_M = \rho_q / \varepsilon_0$	Maxwell-bridge Gauss law for the electric channel	bridge equation
$\nabla \cdot \mathbf{B}_M = 0$	Maxwell-bridge no-monopole closure	bridge equation
$\nabla \times \mathbf{E}_M = -\partial_t \mathbf{B}_M$	Maxwell-bridge Faraday law	bridge equation
$\nabla \times \mathbf{B}_M = \mu_0 \mathbf{J}_q + \mu_0 \varepsilon_0 \partial_t \mathbf{E}_M$	Maxwell-bridge Ampère–Maxwell law	bridge equation

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