

G Model: A Proposed Fundamental Causal-Spacetime Theory of Gravitation

Four-Null Geometry, Dynamic Causal Fabric, Matter Aggregation, Relativistic Compatibility, and Light Theory

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Author Direction and AI-Assistance Statement

This manuscript was prepared from the current G Model research record under the direction of Gurbuz Dolu. Dolu asked the AI to challenge the work, not to favor his preferred answer. He also asked that attractive numerical matches not be used to repair weak ideas and that failed tests remain visible. He also directed the manuscript's structure and presentation, including section order, scientific-status labels, equation display, figures, appendices, pagination, and the separation of current theory from historical-development records.

The working rule was simple: separate what is mathematically exact from what is assumed, conditional, calibrated from experiment, still open, or rejected. Dolu repeatedly used instructions such as "try," "test," and "next" to push the analysis toward another check rather than toward confirmation.

During the native scale search, Dolu required measured Big G and Planck quantities that already contain Big G to be kept out of the derivation. This was done to expose circular reasoning. Later, measured Big G was accepted openly as an empirical input. From that point on, a T_c value obtained from Big G was treated only as a calibration, never as an independent prediction of Big G.

ChatGPT, GPT-5.6 Sol (OpenAI), was used as a mathematical and writing tool. It helped formalize equations, check dimensions and algebra, test Lorentz and curvature relations, compare branches, record no-go results, and prepare the document within the author's stated research, manuscript, and formatting requirements. AI assistance is not authorship, peer review, independent replication, or experimental proof. Gurbuz Dolu is the sole author and remains responsible for the physical interpretation and claims.

Abstract

The G Model began in 2024 with Gurbuz Dolu's original expression $G = 1/(5\pi^2 c)$. Its close numerical value to Newton's gravitational constant prompted an initial investigation, but dimensional analysis showed that the expression could not be Big G as written. Dolu did not pursue it further at that time, although the unresolved expression stayed in his mind. With the rapid advance of AI tools, he returned to it in early August 2026 and began using AI as an investigation and falsification tool. The renewed work first searched for a natural geometry behind the $1/(5\pi^2)$ structure, tested several early models, and abandoned them when they failed. Dolu then stopped the coefficient search and redirected the work toward a locally massless causal spacetime fabric. The present four-null/six-channel architecture grew from that change. Only later, without retargeting the old coefficient, part of the original $5\pi^2$ structure reappeared within the retained mathematical construction.

That question led to a minimal four-null causal module with six pairwise bivector channels. The geometry has exact internal results, including Lorentzian Gram structure, Minkowski-metric

reconstruction, and complementary gradient/circulation sectors. The same module later supported reciprocal spectra, dynamic reorientation, branch matching, strain, and gauge constructions.

The long search for the intrinsic fabric time T_c without measured Big G did not produce a parameter-free SI value. It did, however, force wide testing of the model. The current record includes a local Aggregation law $D_0 = \hbar/E_{\text{cell}}$ for constant cell energy, exact ten-component tensor representation, a linearized Einstein operator fixed under stated continuum assumptions up to normalization, and a conditional two-function spherical completion that is exactly the Schwarzschild exterior.

Latest Dynamics Clarification

Matter support, fabric deformation, and graph topology are kept explicitly distinct. Moving matter, rotation, and axial tilt change the local stress-energy source and may drive continuous geometry/transport on existing causal relations. Celal Dynamic Reconnect is retained as exact minimum-discontinuity branch correspondence on an existing centered link. Xyz is the exact causal-integrity/rank-loss boundary. A true outward Xyz crossing requires an admissible intervention, but the action-derived continuous transport law and the complete post-Xyz re-cellulation/topology/phase set remain OPEN. Causal Re-Equalization remains an effective local tracking candidate rather than the fundamental reconnect law.

Scientific Disclosure

The intrinsic fabric time T_c has not been independently fixed to a parameter-free SI value. In the current calibration branch, measured Big G is used as the empirical matter-spacetime coupling and calibrates $T_c \approx 2.18657 \times 10^{-43}$ s. The calibrated value is internally consistent with the retained G Model relations; an independent determination of T_c remains OPEN research.

EXACT means the stated result follows exactly from the declared mathematical definitions and assumptions. CONDITIONAL means another physical or dynamical assumption is needed. CALIBRATED means an accepted measured quantity, mainly Big G, has been used as input. OPEN means an important derivation or test is still missing. REJECTED means the tested route failed its own requirement.

The G Model is the umbrella theoretical framework. Internal terms such as “theory branch,” “principle,” “theorem,” “hypothesis,” and “candidate” describe roles within that framework, not separate independent theories.

Keywords: causal spacetime; gravitation; four-null geometry; tetrahedral causal network; moving matter; causal integrity; relational transport; matter-fabric Aggregation; reciprocal time; Lorentz covariance; Hodge structure; linearized Einstein gravity; Schwarzschild exterior; causal trapping; Jadvyga 360 Space Dynamism; Celal Dynamic Reconnect; Xyz Law; H Yazici Theorem; Light Theory; emergent spacetime; AI-assisted theoretical research.

Companion appendices. The main manuscript points to a separately paginated Formula Appendix containing 222 current formulas (CF001-CF222), plus a separately paginated Symbols and Units Appendix. Appendix pages are not counted as main-manuscript pages.

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1 Motivation and Scientific Origin

1.1 The 2024 formula, the first test, and the early geometry search [6]

The research began with Gurbuz Dolu's original 2024 expression:

$$G = 1/(5\pi^2 c)$$

The first question was whether this could be Newton's gravitational constant. It could not. The right-hand side has dimensions T/L, while Big G has dimensions $L^3 M^{-1} T^{-2}$. The formula therefore failed its first physical identification as written.

After that failure, Dolu did not immediately abandon the $5\pi^2$ pattern. He asked a new question: what natural shape or geometry could produce the factor $1/(5\pi^2)$? The research then tested circles, angular constructions, toroidal and higher-dimensional pictures, cube-like and multi-node arrangements, and other geometric relations. These were early attempts to understand the numerical structure rather than to repair the units by hand.

No convincing geometry produced the $5\pi^2$ factor naturally. Several early models collapsed under dimensional, causal, or symmetry checks. In particular, constructions that depended on a rigid preferred direction or that effectively inserted the desired coefficient were not retained.

1.2 Abandoning coefficient hunting and building the spacetime fabric

At that point Dolu made an important research decision: stop searching for a geometry whose purpose was to reproduce $5\pi^2$. Instead, build the simplest physically meaningful spacetime fabric and allow any coefficient to come out of the mathematics on its own.

The first fabric sketches were cube-like networks of connected massless elements. They were working pictures, not the final geometry. As the requirements became stricter - local directional balance, causal or null propagation, no rest mass assigned to the neutral fabric, neighbor-to-neighbor response, and no permanently preferred spatial direction - the cube-like picture was not retained.

Those requirements led instead to the current local module: four balanced future-directed null branches. Four branches create six unordered pair relations, giving the six-channel tetrahedral/bivector structure used by the present G Model.

Only after this structure had been developed, and after the search for $5\pi^2$ had been deliberately abandoned, did a related coefficient appear from the calculation itself:

$$C_{\Sigma} = 12/(5\pi), \quad C_{\Sigma}/(4\pi) = 3/(5\pi^2).$$

This was the first clear reappearance of a piece of the original 2024 expression from a route that was no longer trying to reproduce it. It did not make the old equation equal to Big G. But it made the earlier numerical structure scientifically interesting again.

The manuscript intentionally does not assign the old expression its later bookkeeping role here. As the research continued, more of the original expression entered dimensionally complete G Model relations with a changed role. That later role is introduced only after the gravitational bridge and scale discussion in Sec. 11.

1.3 Foundational Physical Picture: Matter, Fabric, Heartbeat, Balance, and Boundary

Before the search for T_c can be understood, the physical picture that produced the G Model must be stated clearly. The ideas in this section began as author-defined variables, conditions, and design requirements for building a candidate microscopic spacetime model.

1.3.1 Matter and the causal fabric are different things

matter $\neq$ causal spacetime fabric

Dolu's original working picture treated empty local space as having a natural, undisturbed state. Matter was not supposed to be the fabric itself. Instead, matter entering a local region would disturb the causal fabric. The moving matter-support boundary identifies where direct source loading changes. It is not automatically a graph-breaking or Xyz boundary: a region may become matter-free while fabric deformation and field stress remain nonzero.

moving source support $\rightarrow$ continuous local response $\rightarrow$ neighbor transport/rematching

matter leaves $\rightarrow$ direct loading ends; residual deformation may persist or propagate before local neutrality returns

matter leaves $\rightarrow$ local deformation may persist for a time or the fabric may rebalance

1.3.2 The heartbeat idea and the two time roles

The heartbeat idea was Dolu's question about whether a minimal spacetime element should have a characteristic update interval. The first heartbeat quantity was associated with the time variable that was later called D_0 . As the model developed, Dolu introduced a second time, T_c , because one clock could no longer describe both the intrinsic fabric and the matter-facing response. Later tests separated the roles further: T_c became the candidate intrinsic/common fabric time, while D_0 became the local matter-energy response or Aggregation time in the current branch.

T_c

current role: intrinsic/common fabric time

D_0

current role: local matter/energy response time

1.3.3 Balance and boundary requirements

Two additional author requirements shaped the model. First, the undisturbed fabric should be balanced: no permanent local disturbance or preferred spatial direction should be built into the neutral state. Second, an extended object cannot honestly be reduced to one microscopic cell. Its occupied region, area, shape, surface, boundary, motion, and entry-exit through local fabric must remain available to the theory. These requirements later drove the neutral-state condition $M = 0$, whole-body coupling, boundary flow, rotation tests, and dynamic reorientation.

1.3.4 From the author conditions to the four-null / six-channel module

The local element therefore had to be massless in the neutral model, causally connected, directionally balanced, able to respond to matter, able to connect to neighbors, and free of a permanently preferred orientation. Applying those requirements led to the retained minimal architecture:

4 future-directed null branches $\rightarrow C(4,2) = 6$ pairwise causal channels

The four branches and their six pair relations became the basic causal spacetime element used throughout the research. Together with matter-fabric separation, heartbeat timing, balance, boundary response, and neighbor dynamics, this formed the working foundation that Dolu named the G Model. The next section can therefore discuss the T_c search with the reader already knowing what T_c is intended to represent and why its value mattered.

1.4 The Tc search became a research engine

For much of the work, Dolu required Tc to be searched for from inside the G Model. Measured Big G and Planck length or time were excluded because the usual Planck scales already contain Big G. The goal was to avoid a hidden circular derivation.

That search did not produce a unique number of seconds for Tc. But it forced many other parts of the model to become testable. The project had to show which results were scale-free, which needed a dimensional input, and which failed. This process produced many of the current geometry, Lorentz, conservation, strong-field, tension, and light results.

2 Physical Architecture and Core Postulates

The current G Model is not a rigid tetrahedral crystal sitting inside a separate background space. It is a proposal that local spacetime degrees of freedom can be represented by a connected causal network. The main working ideas are:

- Locally massless fabric. The neutral fabric is assigned no ordinary rest mass. This is a model postulate.
- Matter and fabric are different things. Matter loads or perturbs the fabric. Matter is not itself the causal cell.
- Minimal balanced module. Four future-directed null branches form the local basis and create six pairwise bivector channels.
- Neutral reference. $M = 0$ is the undisturbed/neutral reference state. It is not the same as the separate mathematical minimum $M^* = -(1/4)\ln 2$ of one spectral function.
- • Continuous neighbor transport. Disturbances and moving sources may change local geometry and inter-cell transport continuously on existing causal relations. At wavelengths much larger than L_c , the network may be averaged into a continuum response.
- energy, occupied region, shape, area, surface, boundary flow, and stress-energy. The whole body cannot be replaced by one microscopic cell.
- Universal fabric baseline. An intrinsic fabric scale cannot depend on which planet, particle, chemical composition, or rotation rate is used to probe it.
- • Dynamic orientation and matching. Absolute local orientation is not a physical observable in the accepted invariant sector. Deformed neighboring cells are compared relationally; Celal matching on an existing link does not by itself imply link birth or death.
- macroscopic equation appear.

2.1 Two time quantities

The model now keeps two time roles separate. Tc is the intrinsic/common fabric time and sets the native causal length $L_c = cT_c$. D0 is the matter-facing response time in the current Aggregation branch.

For constant local cell energy E_{cell} ,

$$D_0 = \hbar/E_{\text{cell}}, \quad D_0/T_c = 1/A_{\text{cell}}.$$

$D0 = Tc$ only at the equal-action condition $A_{cell} = 1$. The model therefore does not treat $D0$ and Tc as two independently known universal clocks.

3 Massless Elements and the Four-Null / Six-Channel Geometry

3.1 How the retained causal cell emerged

The tetrahedral cell was not chosen only because it is visually simple. It emerged from several constraints. Dolu wanted a local structure with no net preferred direction, null causal propagation, no rest mass assigned to every microscopic branch, and enough internal channels to describe more than one kind of response.

Four balanced spatial directions are the smallest regular tetrahedral set whose vector sum is zero. Making the four branches future-directed and null places the local module directly inside Lorentzian causal geometry. Four branches also create six unordered pairs, exactly the dimension of the Lorentz bivector space.

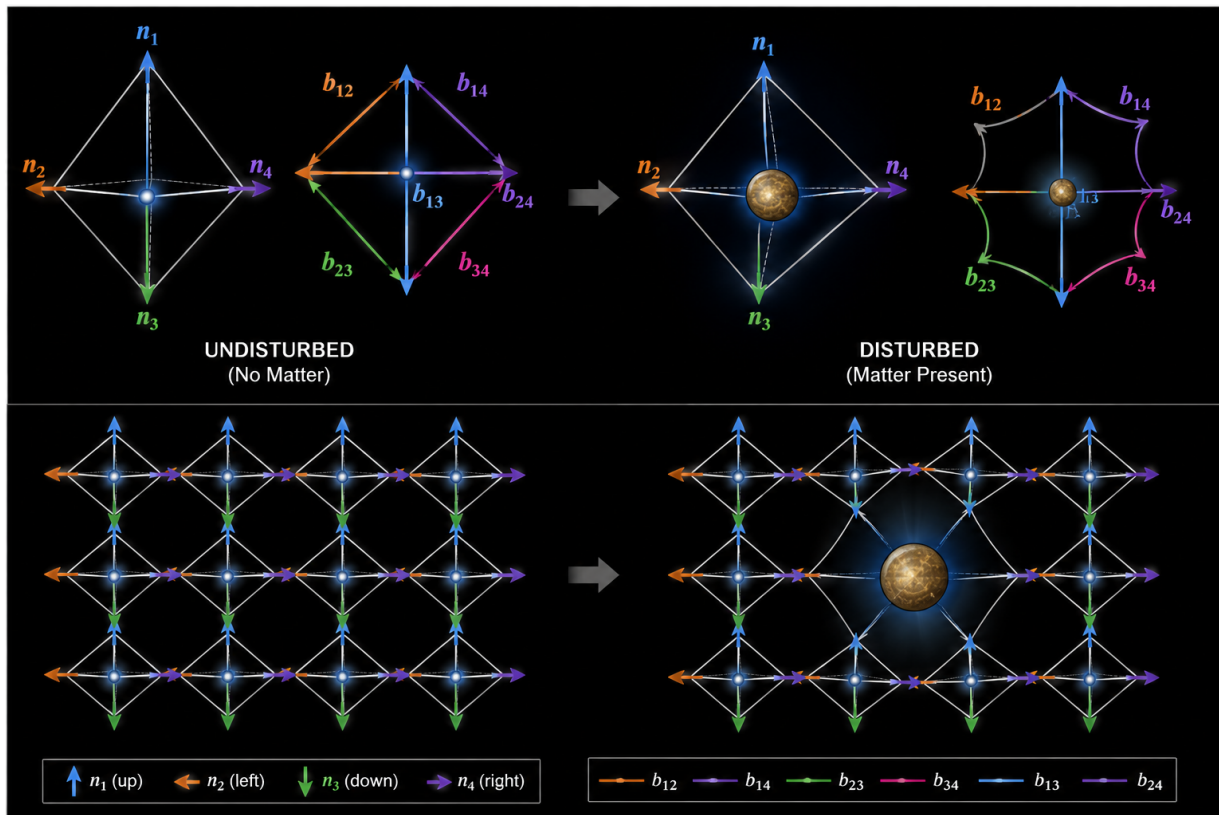


Figure 1. Earlier G Model schematic of an undisturbed module, a matter-disturbed module, and redistribution through neighboring modules. It is a conceptual picture, not a microscopic observation of spacetime.

3.2 Four null branches

Let the four branches be

$$k_a = L_c(1, n_a), \quad n_a \cdot n_b = -1/3 \ (a \neq b), \quad \sum_a n_a = 0.$$

Every k_a is null. Even though each individual branch has zero norm, the four together form a non-degenerate Lorentzian basis. The Gram matrix has one negative and three positive eigenvalues:

$$\text{spec}(G_4) = \{-4, 4/3, 4/3, 4/3\} L_c^2.$$

The inverse Gram matrix reconstructs the Minkowski metric:

$$K G_4^{-1} K^T = \eta.$$

STATUS: Four-null Gram signature and Minkowski reconstruction are EXACT within the stated branch geometry.

3.3 Six pairwise bivectors

Each unordered pair of null branches defines a bivector, or oriented causal area element:

$$\Sigma_{ab} = k_a \wedge k_b, \quad a < b.$$

In the regular neutral module, each pair has invariant magnitude $4Lc^2/3$. The six-pair total magnitude is $8Lc^2$. The six-dimensional bivector space has Lorentz signature (3,3) and carries a Hodge map with $J^{*2} = -I_6$.

This is why the six channels are treated as causal pair/area degrees of freedom. They are not presented as six new observed particle species.

3.4 Exact incidence and Hodge decomposition

The oriented tetrahedral cochain complex uses a vertex-edge incidence map B and an edge-face incidence map C . They satisfy

$$BC = 0, \quad B^T B + CC^T = 4I_6.$$

Therefore the six edge degrees of freedom split exactly into complementary gradient and circulation sectors:

$$P_{\text{grad}} = (1/4)B^T B, \quad P_{\text{circ}} = (1/4)CC^T, \quad P_{\text{grad}} + P_{\text{circ}} = I_6.$$

This exact split later becomes useful in gauge kinematics, conserved currents, and Light Theory

3.5 Neutral six-channel spectrum

In the retained normalization,

$$K_0 = B^T B - 2I_6, \quad \text{spec}(K_0) = \{4, 0, 0, 0, -2, -2\}.$$

The spectrum contains one collective direction, a three-dimensional zero sector, and a two-dimensional anisotropic sector. Later strain tests show a useful $3 \rightarrow 1 + 2$ pattern: three signed first-order strains sit in the zero sector, while the quadratic response separates into one trace part and two anisotropic parts.

3.6 Important scales and coefficients from the module

This section shows how the most frequently used module scales and coefficients are obtained. The aim is to let the reader see what comes directly from the four-null geometry, what is a definition, and what is a retained physical normalization.

3.6.1 From the intrinsic time to the causal length

T_c is the intrinsic fabric time used by the current model. If one native causal update extends at the causal speed c , the corresponding causal length is

$$L_c = cT_c$$

This is a scale definition. The relation does not derive the measured value of c ; c remains the causal propagation primitive.

3.6.2 Why the neutral pair area contains 4/3

For different branches, $k_a = L_c(1, \mathbf{n}_a)$ and $\mathbf{n}_a \cdot \mathbf{n}_b = -1/3$. With the Minkowski metric,

$$k_a \cdot k_b = L_c^2(-1 + \mathbf{n}_a \cdot \mathbf{n}_b) = -\frac{4}{3}L_c^2$$

Each branch is null, so the invariant magnitude of the pair bivector is fixed by this cross inner product:

$$A_0 = |k_a \wedge k_b| = \frac{4}{3}L_c^2$$

Four branches create six unordered pairs. In the neutral cell all six have the same magnitude, so

$$A_{\Sigma,0} = 6A_0 = 8L_c^2$$

$A_{\Sigma,0}$ is an aggregate six-bivector magnitude, not a literal material surface made of six non-overlapping patches.

3.6.3 Native causal volume

The current model uses the native causal volume

$$V_c = \frac{2}{3}L_c^3 = \frac{2}{3}(cT_c)^3$$

The coefficient 2/3 belongs to the accepted causal-volume definition. It is not the Euclidean volume of the spatial tetrahedron formed by the branch tips. Once this volume law is used, its propagation rate is algebraically tied to the pair-area measures:

$$\Gamma_V = \frac{dV}{dt} = 2cL^2 = \frac{3}{2}cA_0 = \frac{1}{4}cA_{\Sigma}$$

STATUS: L_c is a scale definition. A_0 and $A_{\Sigma,0}$ are exact consequences of the regular four-null geometry. V_c is the accepted native causal-volume definition; the area-flux identities then follow algebraically.

3.6 Important scales and coefficients from the module (continued)

3.6.4 One action quantum per intrinsic fabric update

The current normalization assigns one reduced quantum of action to one intrinsic fabric update:

$$E_f T_c = \hbar \quad \Longrightarrow \quad E_f = \frac{\hbar}{T_c}$$

The corresponding mass-equivalent dimensional scale follows only from $E = mc^2$:

$$m_c = \frac{E_f}{c^2} = \frac{\hbar}{c^2 T_c}$$

These are scales associated with T_c . They do not mean that the neutral causal fabric is composed of particles with rest mass mc .

3.6.5 Where the $\sqrt{6}$ propagation factor comes from

For the retained neutral-wave candidate, the long-wavelength neighbor operator contributes $L_c^{22}/6$. Matching the continuum coefficient to c^2 gives

$$\ddot{u} \simeq \frac{\Omega_c^2 L_c^2}{6} \nabla^2 u, \quad \Omega_c T_c = \sqrt{6}$$

Therefore $\sqrt{6}$ is not fitted to a measured frequency. It is the normalization required by this candidate long-wavelength propagation equation together with $L_c = cT_c$. The microscopic neutral dynamics remains a model candidate.

3.6.6 How the reference coefficient C_Σ is assembled

The retained reference coefficient was written as a product of three identifiable factors rather than as one fitted number:

$$\beta_C = \frac{3}{4}, \quad p(x) = 4x^3, \quad \langle x \rangle = \int_0^1 x p(x) dx = \frac{4}{5}, \quad P_C = \frac{4}{\pi}$$

The $3/4$ factor is the retained shared-null geometric response weight. The $4/5$ factor is the mean causal depth of the normalized profile $p(x)=4x^3$. The $4/\pi$ factor is the retained angular projection factor. Their product gives

$$C_\Sigma = \beta_C \langle x \rangle P_C = \left(\frac{3}{4}\right) \left(\frac{4}{5}\right) \left(\frac{4}{\pi}\right) = \frac{12}{5\pi}$$

For an isolated spherical source, the macroscopic $1/(4\pi)$ spreading factor gives

$$\frac{C_\Sigma}{4\pi} = \frac{3}{5\pi^2}$$

This is where the $5\pi^2$ structure reappeared after the earlier search for a $5\pi^2$ geometry had already been abandoned. The recurrence is real inside this retained coefficient chain, but it does not by itself validate the 2024 expression.

STATUS: $C_\Sigma = 12/(5\pi)$ is the controlling reference normalization used in the present Big-G calibration branch. The current microscopic action has not proved that this normalization is uniquely forced by nature.

3.6 From the module to the main G Model gravitational formulation

The central gravitational formula is not introduced as an isolated expression. It follows through the current chain from neighbor averaging, matter loading, the causal volume, and the weak-field identification.

3.6.7 Step 1 - long-wavelength mean defect

For an orientation-balanced set of neighboring cells, the spherical mean of the deformation field M has the expansion

$$\bar{A}[M] - M \simeq \frac{L_c^2}{6} \nabla^2 M$$

The retained discrete source rule connects this mean defect to the dimensionless local matter loading:

$$\bar{A}[M] - M = \frac{C_\Sigma}{4} A_{\text{cell}}$$

3.6.8 Step 2 - insert the Aggregation loading

For stationary matter, $E_{\text{cell}} = \rho V c^2$. With the Aggregation definition and the native causal volume,

$$A_{\text{cell}} = \frac{E_{\text{cell}} T_c}{\hbar} = \frac{\rho V c^2 T_c}{\hbar} = \frac{2}{3} \frac{\rho c^5 T_c^4}{\hbar}$$

Using $L_c = c T_c$ in the mean-defect equation makes the geometric powers cancel, leaving

$$\nabla^2 M = C_\Sigma \frac{c^3 T_c^2}{\hbar} \rho$$

3.6.9 Step 3 - weak gravity and the G Model formulation

In the weak branch, $\Phi = c^2 M$. Therefore

$$\nabla^2 \Phi = C_\Sigma \frac{c^5 T_c^2}{\hbar} \rho$$

Comparing this with the standard Poisson normalization $\nabla^2 \Phi = 4\pi G \rho$ identifies the G Model gravitational formulation:

$$G = \frac{C_\Sigma}{4\pi} \frac{c^5 T_c^2}{\hbar} = \frac{3}{5\pi^2} \frac{c^5 T_c^2}{\hbar}$$

The dimensions are correct because $c^5 T_c^2 / \hbar$ has dimensions $L^3 M^{-1} T^{-2}$, the dimensions of Newton's gravitational constant. The coefficient $3/(5\pi^2)$ is the same spherical bridge factor derived above.

3.6.10 What this derivation does - and does not - establish

This chain shows how the main G Model gravitational expression is assembled from the current internal architecture. It also shows exactly where each assumption enters. The chain does not independently determine the absolute value of T_c . Therefore it does not constitute a parameter-free prediction of measured Big G.

CURRENT STATUS: The geometric and algebraic steps are exact within their stated definitions. The source rule, Aggregation interpretation, weak-field identification and retained C_Σ normalization are model assumptions or conditional structures. Under the current policy, measured Big G is accepted as the empirical coupling input and is used to calibrate T_c ; a future independent T_c derivation would provide a non-circular cross-check.

3.7 From a local cell to a dynamic fabric

The local cell is only the starting point. In the current model, several later structures act on the same causal module. Jadvyga removes absolute local orientation from accepted invariants. Celal matches branches between neighboring deformed cells. Aggregation gives a matter-side response time. The tension branch measures strain after matching. H Yazici supplies a conservation construction in its proved sector. A separate topology law is still needed to create or delete physical links.

4 Matter Loading, Aggregation, and Fabric States

4.1 Matter enters the fabric without becoming the fabric

The model keeps three ideas separate: matter occupancy, fabric deformation M , and source curvature or stress-energy. This matters because a region can have no local matter and still have a nonzero gravitational deformation. Outside a star, for example, ρ can be zero while M is not zero.

For a local timelike cell direction t_μ , the cell energy is

$$E_{\text{cell}} = V_c T_{\mu\nu} t^\mu t^\nu.$$

For stationary nonrelativistic matter this becomes $E_{\text{cell}} = \rho V_c c^2$. The stress-energy form is kept because moving matter and radiation should be described by energy-momentum, not by rest mass alone.

4.1.1 Moving matter support, rotation, and axial tilt

For a sharp material-support indicator χ_m transported with matter, and for nonrelativistic rigid-body motion,

$$\partial_t \chi_m + v_m \cdot \nabla \chi_m = 0, \quad v_m = V + \omega \times (x - X).$$

For an ideal spherical matter boundary $n \parallel r$, $(\omega \times r) \cdot n = 0$ for any orientation of the spin axis. Earth's axial tilt therefore changes the direction of tangential momentum/circulation current but does not by itself create extra matter entry/exit through a spherical support boundary.

$$T^{00} \approx \rho c^2, \quad T^{0i} \approx \rho c v^i, \quad T^{ij} \approx \rho v^i v^j.$$

This test shows why source dynamics cannot be reduced to χ_m or boundary crossing alone. Rotation and tilt can change H_{ab} through momentum and stress even when the occupied spherical support is unchanged. The matter surface marks direct source support; it is not automatically a topology surface.

MOVING-MATTER STATUS: exact kinematic separation under the stated sharp-support / rigid-body assumptions. Full microscopic response of the causal network to H_{ab} remains OPEN.

4.2 Aggregation hypothesis

Dolu proposed that matter-fabric interaction can be described as action accumulating in time. Define

$$S_m(t) = \int_0^t E_{\text{cell}}(\tau) d\tau.$$

The Aggregation hypothesis defines D_0 as the time needed for that accumulated matter action to reach one action quantum:

$$S_m(D_0) = \hbar.$$

If the cell energy is constant,

$$D_0 = \hbar/E_{\text{cell}}.$$

The dimensionless loading is

$$A_{\text{cell}} = E_{\text{cell}} T_c / \hbar, \quad D_0/T_c = 1/A_{\text{cell}}.$$

$A_{\text{cell}} = 1$ gives $D_0 = T_c$. In this branch that condition means the matter in the cell accumulates the same action $\hbar$ over the same interval T_c as one intrinsic fabric update.

STATUS: Aggregation is an author-originated physical hypothesis. The equations above follow exactly once that definition is adopted.

4.3 Four useful matter/fabric states

State	Plain meaning
$(\chi_m, M) = (0, 0)$	No local matter; neutral fabric.
$(1, M \neq 0)$	Matter is present and the local fabric is deformed.
$(0, M \neq 0)$	No local matter, but a previously generated deformation remains.
$(1, 0)$	Matter is present while M is neutral; this does not by itself imply $D_0 = T_c$ or $A_{\text{cell}} = 1$.

This bookkeeping avoids the over-simple statement “matter is present whenever M is nonzero.” In particular, $(\chi_m, M) = (0, M \neq 0)$ shows that matter exit does not force instantaneous neutralization or automatic graph reconnection. In the weak stationary branch, local matter is identified by source/stress-energy support, while M describes the fabric state.

5 Deformation, Mean Defect, Weak Gravity, and Reciprocal Equalization

5.1 Neighbor averaging and the mean-defect law

For an orientation-balanced set of neighboring cells, the local average of M over a sphere of radius L_c has the long-wavelength expansion

$$\bar{A}[M] = M + (L_c^2/6)\nabla^2 M + (L_c^4/120)\nabla^4 M + \dots$$

The retained source rule then leads to the weak continuum equation

$$\nabla^2 M = C_\Sigma (c^3 T_c^2 / \hbar) \rho.$$

This relation is one of the main bridges from local cell loading to a continuum gravitational field. Higher-order terms measure departures from the long-wavelength limit.

5.2 Weak gravitational interpretation

In the weak branch, the deformation is connected with the usual gravitational potential by

$$\Phi = c^2 M, \quad g = -c^2 \nabla M.$$

Once the current Big-G calibration relation is used, the source equation becomes

$$\nabla^2 \Phi = 4\pi G \rho.$$

This is a compatibility result after G has been taken as an empirical input; it is not an independent prediction of Big G . For an ordinary bounded density jump with no delta-function surface layer, the retained weak source equation allows M and its normal derivative to remain continuous across the material surface even though $\nabla^2 M$ changes with ρ . This is why an ordinary matter boundary is not identified with an Xyz or graph-topology boundary.

The reciprocal-time branch keeps a common geometric-mean time while two sectors move in opposite directions:

$$T_+ T_- = T_c^2, \quad \delta \ln T_+ + \delta \ln T_- = 0.$$

A three-dimensional volume version may be written as

$$T_\pm = T_c e^{\mp 2u/3}, \quad V_\pm = V_c e^{\mp 2u}.$$

This is called the Dolu Reciprocal-Time Equalization Principle.

5.4 Reciprocal spectral result

The retained reduced spectral quantity is

$$Q_6(M) = 16e^{2M} + 8e^{-2M}.$$

Its mathematical minimum occurs at $M^* = -(1/4)\ln 2$. In the reduced spectral construction, let $\delta M = M - M^*$ and define $Q_+ = 8\sqrt{2} e^{(2\delta M)}$, $Q_- = 8\sqrt{2} e^{(-2\delta M)}$, so $Q_+ Q_- = 128$ exactly. The physical neutral fabric state remains $M = 0$. The reciprocal time/volume coordinate u used in Sec. 5.3 is not identified with δM by an exact physical law. Therefore the spectral-volume equalization relation in the Formula Appendix is CONDITIONAL on a shared-coordinate bridge. This preserves the exact reduced spectral algebra without turning the spectral bridge into a physical proof.

6 Dynamic Network Principles: Jadvyga, Celal, and the Reconnect Framework

6.1 Jadvyga 360 Space Dynamism Principle

Jadvyga treats the neutral causal cell as 360° orientation-balanced rather than fixed. Reorientation preserves the accepted Lorentzian invariants. Define the candidate orientation field $\Theta_j = 360^\circ M$:

$$K_x(\tau) = \Lambda_x(\tau) K_0, \quad \Lambda_x^T \eta \Lambda_x = \eta; \quad \Theta_j = 360^\circ M,$$

$$\mathbf{g} = -c^2 \nabla M = -\frac{c^2}{360^\circ} \nabla \Theta_j.$$

For this benchmark only, Big-G calibration gives $T_c = 2.187 \times 10^{-43}$ s and $L_c = 6.555 \times 10^{-35}$ m.

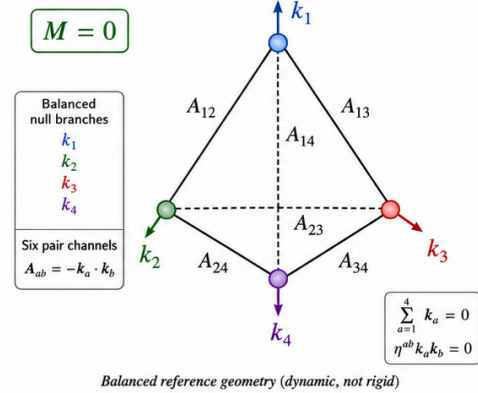
1 2

$$G = \frac{3}{5\pi^2} \frac{c^3 T_c^3}{h}, \quad \Omega^2 = \frac{G(m_1 + m_2)}{R^3}, \quad M_{\text{mass}} = -\frac{G}{c^2} \left(\frac{m_1}{r_1} + \frac{m_2}{r_2} \right).$$

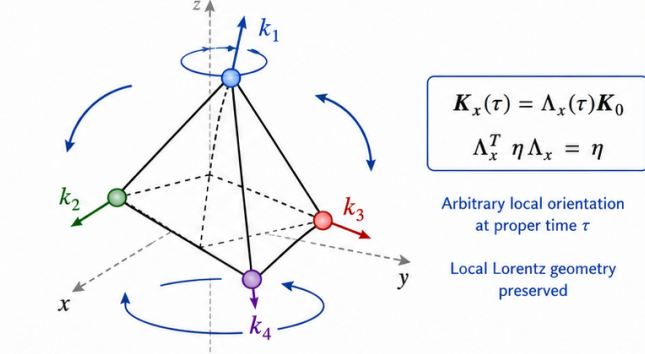
$$M_{\text{rot}} = \frac{1}{2} \ln \left(1 - \frac{\Omega^2 r_\perp^2}{c^2} \right) \approx -\frac{\Omega^2 r_\perp^2}{2c^2}, \quad \mathbf{g}_{\text{rot}} \approx +\Omega^2 \mathbf{r}_\perp.$$

Moon-around-Earth and Earth-around-Sun orbital following is interpreted as response to the changing orientation gradient while tangential motion is retained; $e^{\text{Mrot}} = dt/d\tau$ remains conditional.

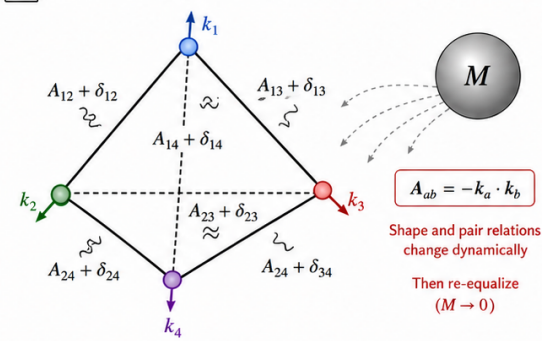
A Neutral balanced causal cell



B Dynamic orientation / 360° rotatable cell



C Matter-loaded / distorted cell



D Inter-cell dynamic connection

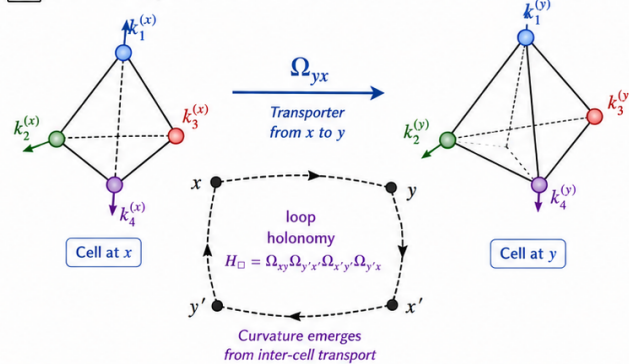


Figure 2. Author-supplied G Model illustration used here to present the minimal causal-fabric elements and their dynamics: neutral balance, arbitrary 360° local orientation, matter-induced distortion, and inter-cell transport/holonomy.

JADVYGA 360° CALIBRATED TWO-BODY TESTS

Earth-Moon: $\Omega = 2.66531 \times 10^{-6} \text{ s}^{-1}$ (27.2846 d). Mass-only orientation saddle: 346,033 km from Earth. With Mrot: L1 = 326,390 km from Earth = 58,010 km from Moon.

Sun-Earth: $\Omega = 1.99102 \times 10^{-7} \text{ s}^{-1}$ (365.2508 d). Mass-only saddle: 258,810 km from Earth. With Mrot: L1 = 1.49154×10^6 km from Earth.

FINDING: the mass-orientation gradient alone does not recover L1; mass plus rotating causal-frame orientation does in both benchmarks. This is a strong conditional derivation, not an independent prediction.

JADVYGA STATUS: exact finite-cell gauge pass for the accepted orientation-invariant Gram, pair-area, and holonomy observables. The orbital rotating-frame term used in the L1 benchmarks remains CONDITIONAL and is distinct from a body's own axial rotation. Axial spin and tilt enter the matter source/current orientation; they do not set an absolute neutral-fabric orientation. Full interacting network transport remains OPEN.

6.2 Celal Dynamic Reconnect Principle

When neighboring cells are deformed, branch labels need not be matched identically. Celal chooses the branch permutation that minimizes an invariant mismatch between the two local Gram shapes:

$$\Pi_{\text{Celal}} \in \arg \min_{\Pi \in S_4} \|\gamma_x - \Pi^T \gamma_y \Pi\|_{F^2}.$$

In the centered physical shape sector the minimizing correspondence is exact modulo the expected Klein-four degeneracy V4. This is an exact geometric/gauge-continuity theorem for branch correspondence on an existing link. It does not by itself create or delete physical links.

6.3 Continuous Relational Transport and the Status of Causal Re-Equalization

Ordinary moving-matter dynamics is now treated separately from exceptional graph restructuring. Changes in ρ , momentum, stress, rotation, or tilt change Hab and local geometry; neighboring cells may update their transporters and Celal correspondences continuously while the causal-integrity margin remains positive.

$$\chi_{\text{XYZ}} > 0 \rightarrow \text{ordinary evolution may remain on existing causal relations.}$$

The Causal Re-Equalization equation $T_c dq/d\tau = -(I-P)(q-qeq)$ is retained only as an effective local tracking/recovery candidate. Its exponential, semigroup, projector, and Lyapunov results remain exact when that candidate law is assumed, but the present microscopic action does not derive the irreversible first-order law.

CURRENT DYNAMICAL BOUNDARY: Celal existing-link matching is exact in its stated sector. XYZ supplies the exact rank-loss boundary. The action-derived ordinary transport law and the post-XYZ admissible re-cellulation/topology/phase set remain OPEN.

7.1 Lorentz covariance and the preferred-frame question

The four-null basis and its inverse Gram matrix give an exact Lorentz-covariant local representation. The six bivectors also carry the expected Lorentzian Hodge structure. Neighboring-cell transport can be written covariantly through Lorentz transporters.

This is not yet the same as proving that the complete microscopic network has no observable preferred frame at every scale. A single permanently oriented tetrahedral pattern has anisotropic higher moments. The current Jadvyga interpretation removes orientation from the accepted invariant observables, but the full interacting high-wave-number network still needs a direct no-preferred-frame proof.

LORENTZ STATUS: Local four-null geometry, metric reconstruction, bivector covariance, and accepted finite-cell reorientation invariants PASS. Complete all-scale microscopic no-preferred-frame dynamics remains OPEN.

7.2 Four-component source continuity and H Yazici

A symmetric stress-energy source is encoded in branch variables by

$$H_{ab} = k_a^{\mu} k_b^{\nu} T_{\mu\nu}.$$

Using transported inter-cell differences, the native four-component divergence candidate is

$$C_b(x) = (G_4^{-1})^{ac} \Delta_a H_{cb}(x), \quad b=1,\dots,4.$$

A rank test shows that this representation can carry four independent continuity equations. Representation alone does not prove that the microscopic matter dynamics forces $C_b = 0$.

The H Yazici construction addresses admissible divergence defects in a neutral/commuting sector with a bounded Continuity-Time inverse. It gives an exact mathematical correction in that stated domain, including the exact 1/5 source-difference projector and the related integrable $\pm 1/4$ correction in its own stated sector.

H YAZICI STATUS: EXACT MATHEMATICAL PASS in the proved neutral/commuting sector with bounded Continuity-Time inverse. A unique curved finite-cell physical update law remains OPEN. Any future post-XYZ re-cellulation/topology law must preserve the appropriate source-continuity constraints; H Yazici does not currently derive that move.

The weak scalar branch can be written in stress form. With the present sign convention, the matter-force density is the negative divergence, $\rho g = -\nabla \cdot T^{\wedge}(M)$. In vacuum, the local divergence may vanish even while the field stress itself is nonzero. This is similar to other field theories where stress can exist in a source-free region.

A separate discrete audit starts from three reciprocal opposite-edge strains. Their signed first-order part lies in the three-dimensional zero sector of the six-channel spectrum. At quadratic order the response splits into one trace component plus two anisotropic components:

$$3 \text{ signed strains} \rightarrow 1 \text{ trace response} + 2 \text{ anisotropic responses.}$$

TENSION STATUS: Weak continuum stress-divergence identity: EXACT PASS in its branch. Six-channel $3 \rightarrow 1 + 2$ map: EXACT ALGEBRAIC PASS. A microscopic action that fixes the physical inter-cell tension scale is still OPEN.

8 Weak Spin-2 Structure and the Einstein Compatibility Test

8.1 Full ten-component tensor representation

The four-null basis can encode a symmetric spacetime tensor without losing components. Define

$$Q_{ab} = k_a^{\mu} k_b^{\nu} h_{\mu\nu}, \quad H_{ab} = k_a^{\mu} k_b^{\nu} T_{\mu\nu}.$$

A symmetric 4×4 branch matrix has 4 diagonal plus 6 off-diagonal values, exactly 10 independent components. Because the branch matrix K is invertible, $h_{\mu\nu}$ and $T_{\mu\nu}$ can be reconstructed exactly from Q_{ab} and H_{ab} .

REPRESENTATION STATUS: Full $4 + 6 = 10$ symmetric tensor encoding and reconstruction are EXACT.

8.2 Why the linearized Einstein operator appears

The next test asked whether the Einstein coefficient pattern had to be inserted by hand. Start with the most general local Lorentz-covariant symmetric operator built from a symmetric field, at most two derivatives, and the branch metric. Then require the standard linearized gauge redundancy and an identically conserved field operator.

Those requirements reduce the free coefficients to one overall normalization. Choosing the conventional normalization gives the linearized Einstein operator. In branch form its source equation is

$$E_{ab}[Q] = 2C_{\Sigma}(cT_c^2/\hbar) H_{ab}.$$

When the empirical Big-G bridge is inserted, this has the standard $8\pi G/c^4$ source normalization.

EINSTEIN STATUS: Operator form: EXACT under the stated continuum assumptions. Source normalization: calibrated/conditional. A finite-cell derivation showing that the microscopic G Model must generate spin-2 gauge dynamics remains OPEN.

9 Static Spherical Strong Field and the Black-Hole Causal Boundary

9.1 The old one-function metric failed

An earlier reciprocal exponential metric used one function M for both the time and space factors. A direct Ricci-tensor test shows that a nontrivial static vacuum solution is impossible in that ansatz. The one-function strong-field route is therefore rejected for exact vacuum gravity.

OLD STRONG-FIELD BRANCH: FAIL as a nontrivial exact static vacuum Einstein solution. It may still be used only as a weak-field parametrization where explicitly stated.

9.2 Conditional two-function completion ^[2,3,5]

A later completion introduces

$$\psi = 2 \tanh(M/2), \quad T = e^M = (1+\psi/2)/(1-\psi/2), \quad X=(1-\psi/2)^2.$$

For a static spherical vacuum, the field equations select $\psi = -\mu/r$. The resulting isotropic metric is

$$ds^2 = -[(1-\mu/2r)/(1+\mu/2r)]^2 c^2 dt^2 + (1+\mu/2r)^4 (dr^2 + r^2 d\Omega^2).$$

This metric is exactly Ricci-flat in the regular exterior and transforms exactly to the standard Schwarzschild exterior. With Big G accepted as input, $\mu = Gm/c^2$ and the horizon is $R = 2Gm/c^2$.

SCHWARZSCHILD STATUS: EXACT PASS within the conditional two-function completion. The microscopic dynamics that forces this completion is not yet derived.

9.3 What the horizon does and does not mean

In the Schwarzschild-compatible branch, define the invariant outward-support scalar

$$C_F = 1 - 2\mu/R.$$

At the horizon $C_F = 0$. A separate 360° escape audit gives the same physical message: the maximum future-directed outward areal-radius propagation falls to zero. This supports causal trapping.

However, the local four-null Gram matrix does not lose rank there:

$$\det(G_4) = -(256/27)L_c^8 \neq 0.$$

The Schwarzschild curvature is also finite at the horizon. Therefore the current equations do not support the statement “the event horizon destroys the local spacetime fabric.”

BLACK-HOLE CLAIM BOUNDARY: Horizon = causal trapping/outward-support loss: SUPPORTED within the conditional branch. Horizon = destruction of every local fabric degree of freedom: REJECTED. Terminal or deeper-interior fabric loss: OPEN author hypothesis.

10 Light Theory: Light as a Causal-Fabric Excitation

10.1 Author-originated physical picture

Dolu’s physical idea is that light may not simply move through an independent spacetime container. Instead, light may be a propagating excitation of the causal spacetime fabric itself. This idea is the conceptual seed of Light Theory

The mathematical question is then whether the existing causal geometry can support the basic structure required for a massless spin-1 field without inserting it by analogy alone.

10.2 Native gauge geometry

Let A be an oriented link or 1-cochain variable. Define the face field by

$$F = C^T A.$$

Under a vertex gauge shift $A \rightarrow A + B^T \chi$,

$$F \rightarrow C^T(A + B^T \chi) = F, \quad \text{because} \quad BC=0.$$

This is an exact finite-tetrahedron abelian-type gauge identity. In continuum language the same structure becomes $F = dA$ and $dF = d^2A = 0$.

10.3 Minimal vacuum dynamics and two modes ^[4]

If one adopts the minimal local, Lorentz-compatible, parity-even, gauge-invariant quadratic action with no photon mass,

$$S_\gamma = -(\kappa_\gamma/4) \int F_{\mu\nu} F^{\mu\nu} d^4x.$$

then a nontrivial plane wave must satisfy $q^2 = 0$ and $q \cdot a = 0$. Gauge equivalence removes one more direction. The physical quotient contains two transverse modes:

$$\dim(q^\perp / \text{span}\{q\}) = 2, \quad \omega^2 = c^2 k^2.$$

CONDITIONAL STRONG STRUCTURAL PASS. Once the minimal gauge action is adopted, null propagation, speed c , transversality, and two physical modes follow exactly.

10.4 What Light Theory does not yet derive

The current gravitational connection action does not produce an independent spin-1 F^2 sector. That direct route fails in the present field content. The model can also support a compact $U(1)$ representation in which charge ratios are integers once compactness is assumed, but it does not yet derive the elementary charge scale q_0 .

The tetrahedral $A_4/V_4 \square Z_3$ structure is exact group theory, but Z_3 by itself cannot be ordinary additive electric charge. The current symmetries also leave an overall gauge-action normalization free. Therefore e and the fine-structure constant α are not derived.

ELECTROMAGNETIC BOUNDARY: Native gauge kinematics and the conditional two-mode vacuum result survive. Independent photon action normalization, physical charge assignments, e , α , and finite-cell high- k dynamics remain OPEN.

11 The Absolute-Scale Search, Big G, and the Current Calibration Policy

11.1 What the no-Big-G search established

The internal scale search showed a basic obstruction. Relations made only from c , $\hbar$, dimensionless geometry, and quantities already defined from T_c can determine ratios and dimensionless invariants, but they cannot choose one unique number of seconds. Rescaling T_c rescales the associated length, area, volume, energy, and stiffness while leaving many normalized relations unchanged.

This is why repeated routes based on spectrum, phase closure, reconnect rate, stiffness, and other T_c -derived quantities did not independently select the absolute scale. The failure was useful: it identified exactly what kind of new input would be needed.

11.2 Current G Model gravitational formulation ^[1]

The central current gravitational bridge is written explicitly as

$$G = [C_\Sigma / (4\pi)] (c^5 T_c^2 / \hbar) = [3 / (5\pi^2)] (c^5 T_c^2 / \hbar)$$

This is the G Model gravitational formulation used in the retained $C_\Sigma = 12 / (5\pi)$ reference convention. It is dimensionally correct. It did not become a parameter-free prediction of Big G because the native theory did not independently fix T_c .

IMPORTANT: In the current policy, measured Big G is accepted as an empirical input. The equation above is used to calibrate Tc. It must not be presented as an independent prediction of the measured value of Big G.

11.3 Why using measured Big G is scientifically allowed

A theory does not have to derive every dimensional constant from deeper quantities. It is scientifically acceptable to use a measured constant as input if the role of that input is stated clearly. Circularity would occur only if a Tc obtained from measured Big G were later used to claim that the model had independently predicted the same Big G.

The current manuscript does not make that claim. Big G is the empirical matter-spacetime coupling input; Tc is the calibrated microscopic G Model scale in this branch. A future native or nongravitational measurement of Tc would provide an independent check.

11.4 Calibrated reference scale

Quantity	Big-G-calibrated reference
Tc	$2.186570238 \times 10^{-43} \text{ s}$
$L_c = cT_c$	$6.555172663 \times 10^{-35} \text{ m}$
$V_c = (2/3)L_c^3$	$1.877851076 \times 10^{-103} \text{ m}^3$
$E_f = \hbar/T_c$	$4.822949655 \times 10^8 \text{ J}$
$mc = \hbar/(c^2 T_c)$	$5.366255204 \times 10^{-9} \text{ kg}$
$\Omega_c = \sqrt{6}/T_c$	$1.120242881 \times 10^{43} \text{ s}^{-1}$

All numbers in this table inherit the Big-G calibration. They are useful reference scales, not independent predictions.

11.5 Later bookkeeping role of the original 2024 expression

Only after the later G Model coefficient and gravitational bridge had been developed was the complete right-hand side of Dolu's 2024 expression given a separate symbol:

$$K_{GD} \equiv 1/(5\pi^2 c), \quad [K_{GD}] = T/L.$$

This does not rename KGD as Newton's gravitational constant. Its dimensions are still different from Big G. The point is that the full original right-hand side can now be carried as a bookkeeping/interface factor inside a dimensionally complete G Model relation.

$$C_\Sigma/(4\pi) = 3cK_{GD}, \quad G = 3K_{GD} c^6 T_c^2 / \hbar.$$

The second equation is algebraically the same gravitational bridge already given in Sec. 11.2; it is not an independent second derivation. Its importance is historical and structural: the entire original $1/(5\pi^2 c)$ expression re-enters the mature model with a different role from the one first proposed in 2024.

CLAIM BOUNDARY: The recurrence of the original expression is an internal algebraic feature of the retained G Model formulation. It is scientifically interesting.

12 Current Internal Structure and Branch Register

The current audit separates 24 internal G Model structures: principles, theorems, hypotheses, theory branches, laws, and candidates. The G Model itself is the umbrella theoretical framework and is not counted among these 24; these entries are not 24 separate independent theories.

#	Structure	Type	Clear current meaning
1	Jadvyga 360 Space Dynamism Principle	Named principle	Pure local reorientation leaves accepted Gram, pair-area, and holonomy invariants unchanged. Matter spin/tilt changes source orientation, not the neutral-fabric gauge baseline.
2	Celal Dynamic Reconnect Principle	Named principle	Exact minimum-discontinuity branch matching on an existing centered link modulo V4. "Reconnect" here means relational rematching; physical link birth/death is not derived.
3	Dolu Reciprocal-Time Equalization Principle	Named principle	= Tc^2 . Physical sector interpretation is conditional.
4	H Yazici Theorem	Named theorem	Exact conservation correction in the proved neutral/commuting sector with bounded Continuity-Time inverse. Curved microscopic selection remains open.
5	GPT Reciprocal Spectral-Minimum Principle	Named mathematical principle	Exact internal minimum and reciprocal spectral invariants. The spectral minimum is not the physical neutral state.
6	Light Theory	Named theory branch	Native gauge structure plus conditional null/two-mode light dynamics. Full EM normalization is open.
7	Proposed Black-Hole Causal-Fabric Hypothesis	Proposed hypothesis	Possible terminal/interior fabric loss remains open. Horizon = fabric destruction is rejected.
8	Causal-Fabric Ontology Hypothesis	Current hypothesis	Spacetime is modeled as a locally massless connected causal fabric.
9	Matter-as-Trigger / Loading Principle	Current principle candidate	Matter loads the fabric but is not identified with the fabric degrees of freedom.
10	Universal Baseline Fabric Principle	Current principle candidate	Matter loads the fabric but is not the fabric. Moving support marks direct source loading; its material boundary is not automatically a graph-topology boundary.
11	Four-Null / Six-Bivector Minimal Geometry	Current structural principle	bivectors define the retained local module.
12	L. Minotti Recursive Balance Principle	Named structural principle	Local disturbances redistribute through neighboring modules and admit a continuum
13	Reciprocal Space-Time Deformation / Compensation	Current principle candidate	Local disturbances redistribute through neighboring modules and admit a continuum mean-defect limit. Ordinary redistribution does not by itself imply topology change.

#	Structure	Type	Clear current meaning
14	Matter-Fabric Aggregation Hypothesis	Author-originated hypothesis	Matter/energy action accumulates to $\hbar$ over D0. Consequences are exact once the hypothesis is adopted.
15	Neutral Causal Propagation Candidate	Theory candidate	Neutral propagation uses the primitive causal speed c . A complete finite-cell update law is open.
16	Inter-Cell Tension / Strain Response	Theory candidate	Weak stress divergence and the 3→1+2 strain hierarchy pass. Microscopic action-to-tension derivation is open.
17	Massless-Fabric Density / Background-Energy Hypothesis	Open hypothesis	Zero rest-mass fabric may carry internal neutral energy. Its gravitational source prescription is unresolved.
18	Continuous Network Evolution / Post-XYZ Re-cellulation	Required future principle	Native ordinary transport and the physical post-XYZ continuation set are still to be derived; ordinary matter-surface crossing is not itself a topology law.
19	Incidence-Hodge Complementarity Theorem	Exact mathematical theorem	$BC=0$ and $B^TB+C\ C^T=4I_6$ give complementary gradient and circulation sectors of the six-channel space.
20	Four-Component Source Representation Theorem	Exact representational theorem	A rank-four divergence map represents four independent source-continuity components.
21	Ten-Component Tensor Reconstruction Theorem	Exact representation theorem	The four-null branch basis encodes and reconstructs all 10 independent components of a symmetric spacetime tensor.
22	Linearized Einstein Operator Selection Theorem	Exact under stated assumptions	Lorentz covariance, gauge redundancy, locality, at most two derivatives, and conservation fix the linearized Einstein operator up to normalization.
23	Two-Function Schwarzschild Completion Principle	Conditional strong-field principle	The retained two-function completion is Ricci-flat and exactly Schwarzschild outside the source; microscopic uniqueness remains open.
24	XYZ Law	Named law / exact theorem branch	Exact Gram-triangle causal-integrity / rank-loss boundary. An actual outward crossing means the ordinary four-null phase cannot continue smoothly unchanged. Celal supplies existing-link matching and a conditional selector once a physical post-XYZ continuation set is known; that set remains open.

13 Integrated Test Register: Thirty-Nine High-Value Results

This register gives the shortest useful answer to “what passed, what failed, and what is still open?” Detailed equations are in the Formula Appendix.

#	Test	Status	Meaning
1	Historical $1/(5\pi^2c)$ as Big G	REJECTED	Units do not match Big G.
2	$C\Sigma = 12/(5\pi)$	REFERENCE / CONDITIONAL	Current calibration convention; not uniquely forced by the present action.
3	$C\Sigma/(4\pi) = 3/(5\pi^2)$	PASS	Exact once the retained $C\Sigma$ and spherical spreading are used.
4	Four-null Gram signature	EXACT PASS	Lorentzian signature and nonzero determinant.
5	Minkowski reconstruction	EXACT PASS	$KG_4^{-1}K^T = \eta$.
6	Six-bivector Hodge structure	EXACT PASS	Signature (3,3) and $J^{*2} = -I_6$.
7	Incidence/Hodge decomposition	EXACT PASS	$BC=0$ and $B^TB+CC^T=4I_6$.
8	GPT reciprocal minimum	EXACT INTERNAL PASS	Mathematical minimum and reciprocal invariants; not the neutral-state identity.
9	Dolu reciprocal time	STRUCTURAL PASS	$T+T=-Tc^2$ is exact within the construction.
10	Aggregation local D0 law	PASS WITHIN HYPOTHESIS	$D0=\hbar/E_{cell}$ for constant cell energy.
11	Native absolute Tc	OPEN	Current native inputs do not select a parameter-free SI value.
12	Big G as empirical input	ACCEPTED POLICY	Used to calibrate Tc ; not claimed as a Big-G prediction.
13	Weak Poisson normalization	COMPATIBILITY PASS	Reduces to $\nabla^2\Phi=4\pi G\rho$ after calibration.
14	Jadvyga local reorientation	EXACT GAUGE PASS	Accepted Gram/area/holonomy observables are unchanged by local orientation.

13A Xyz Law, Causal Integrity, and the Exceptional Re-cellulation Problem

This section separates ordinary moving-matter dynamics from exceptional causal-integrity failure. Ordinary matter motion, rotation, tilt, and changing stress-energy do not by themselves imply graph breaking. Neighboring cells may evolve continuously on the existing causal network and use Celal branch correspondence relationally. Xyz has a different role: it is the exact rank-loss boundary of the local four-null Gram geometry. What happens after a genuine outward Xyz crossing remains a microscopic dynamics problem.

13A.1 Exact Gram-Triangle theorem

Group the six opposite pair areas into three positive dimensionless coordinates:

$$A_{12}=A_{34}=x \text{ Lc}^2, \quad A_{13}=A_{24}=y \text{ Lc}^2, \quad A_{14}=A_{23}=z \text{ Lc}^2, \quad x+y+z=4.$$

The centered four-null Gram matrix is

$$\gamma/\text{Lc}^2 = - \begin{bmatrix} 0 & x & y & z \\ x & 0 & z & y \\ y & z & 0 & x \\ z & y & x & 0 \end{bmatrix}.$$

Its exact eigenvalues are

$$\lambda_0=-(x+y+z), \quad \lambda_x=-x+y+z, \quad \lambda_y=x-y+z, \quad \lambda_z=x+y-z.$$

For positive x,y,z , the ordinary one-negative/three-positive Lorentzian cell exists exactly while the strict triangle inequalities hold. The determinant factorizes as

$$-\det(\gamma/\text{Lc}^2)=(x+y+z)(-x+y+z)(x-y+z)(x+y-z)=16 \text{ Atri}^2.$$

XYZ LAW - EXACT GEOMETRY: the centered four-null basis is invertible exactly while x,y,z form a nondegenerate auxiliary triangle. Xyz is $\text{Atri} \rightarrow 0$, equivalently $\det \gamma \rightarrow 0$. It is not the ordinary matter surface, not $D0/\text{Tc}$, and not the event horizon by itself.

13A.2 Xyz causal-integrity boundary and outward crossing

Write the centered shape in deviation form

$$x=s+\alpha, \quad y=s+\beta, \quad z=s+\gamma d, \quad \alpha+\beta+\gamma d=0.$$

The generalized determinant is

$$\det \gamma = -3 s (s-2\alpha)(s-2\beta)(s-2\gamma d) Lc^8.$$

Define the causal-integrity margin

$$\chi_{Xyz} = \min\{s-2\alpha, s-2\beta, s-2\gamma d\}.$$

Then $\chi_{Xyz}>0$ is the retained ordinary 1+3 Lorentzian region and $\chi_{Xyz}=0$ is an Xyz boundary. At a simple α -edge, the failed Hadamard mode is $u_x=(1,1,-1,-1)$, with $k_1+k_2-k_3-k_4=0$. Continuing to $\chi_{Xyz}<0$ changes the signature and cannot represent the same ordinary four-null phase.

GENERAL OUTWARD-CROSSING CONDITION: if the actual microscopic evolution reaches $\chi_{Xyz}=0$ with $D\tau\chi_{Xyz}<0$, the ordinary four-null state is attempting to leave its retained Lorentzian domain. Smooth continuation of the same ordinary phase is then inadmissible unless the dynamics turns back or an admissible re-cellulation/topology/phase intervention occurs.

The derivative $D\tau\chi_{Xyz}$ is intentionally left general here. The microscopic action-derived evolution law that determines it has not yet been derived.

The earlier Causal Re-Equalization candidate remains useful as a special tracking example. Under CF157, fixed common mode gives at $\alpha=s/2$:

$$(d\lambda/d\tau)_{CF157} = (3/Tc)(s/2 - \alpha_{eq}), \quad \lambda\alpha=s-2\alpha.$$

That sign relation remains exact given CF157, but CF157 is no longer used as the fundamental derivation of the Xyz trigger. Permutation alone cannot repair an Xyz event because $\det(\Pi^T\gamma\Pi)=\det \gamma$ exactly.

13A.3 Celal mismatch and continuation selection

Celal continues to supply an exact relational branch correspondence on an existing centered link:

$$CCelal(\Pi) = 1/2 \|\gamma x - \Pi^T \gamma y \Pi\|^2, \quad \Pi_{Celal} \in \arg \min_{\Pi \in S_4} CCelal(\Pi).$$

For centered states with the same common mode, define the purely geometric mismatch norm

$$\Delta q = (\Delta\alpha, \Delta\beta, \Delta\gamma_d, \Delta\gamma_d, \Delta\beta, \Delta\alpha), \quad V_{geom} = 1/2 \|\Delta q\|^2.$$

Because each opposite-pair difference appears four times in the symmetric Gram matrix while each centered q component appears twice,

$$1/2 \|\Delta \gamma\|^2 = Lc^4 \|\Delta q\|^2 = 2 Lc^4 V_{geom}.$$

EXACT IN THE CENTERED FIXED-COMMON-MODE SECTOR: minimizing the Celal Gram discontinuity is equivalent to minimizing the centered geometric mismatch norm. This identity does not require exponential recovery and introduces no new dimensional coefficient.

If a physical post-XYZ admissible set $R_{admissible}$ is supplied by a future microscopic law, the natural continuation selector is

$$r^* \in \arg \min_{r \in R_{admissible}} Cr.$$

This is a conditional continuation selector, not a derivation of $R_{admissible}$. Celal therefore answers how to compare candidate continuations; it does not by itself create or delete graph edges.

Ordinary moving-matter evolution is conceptually separate: as long as $\chi_{XYZ} > 0$, the network may remain on its existing causal relations while local geometry, transporters, and Celal correspondences evolve continuously.

13A.4 Incidence cut, re-cellulation constraint, and action limit

The failed Xyz mode also has a direct interpretation in the exact six-channel incidence/Hodge structure. For the α -edge,

$$ux=(1,1,-1,-1), \quad cx=B^T ux \propto (0, \pm 2, \pm 2, \pm 2, \pm 2, 0).$$

The zero entries are the two edges internal to the 2+2 partition $\{1,2\}|\{3,4\}$; the four nonzero entries are precisely the edges crossing that cut. Since $BB^T ux=4ux$ for the centered mode,

$$P_{\text{grad}} cx = cx, \quad P_{\text{circ}} cx = 0.$$

EXACT GEOMETRIC CONSEQUENCE: a simple Xyz failure selects a pure-gradient 2+2 causal cut in the six-channel complex.

There is also a local no-go. One isolated four-vertex cell already contains all six K4 pair links. A genuine Xyz repair cannot be produced solely by branch relabeling or by adding another unused edge inside the same unchanged four-vertex cell. A physical intervention must involve neighboring cells, a change of cell decomposition, or another microscopic phase.

Within the current candidate dual-area microscopic action, the local four-volume is proportional to

$$V_{4,x} = (2/3)Lc^4 \sqrt{|\det \gamma_x| / |\det \gamma_0|}.$$

Hence $\det \gamma \rightarrow 0$ implies $V_{4,x} \rightarrow 0$ and the candidate dual-area weight $B_{\text{dual}} \rightarrow 0$. If normalized holonomy remains finite, the local candidate action weight also tends to zero. This is exact within the candidate action definition, but it does not uniquely choose a topology move.

Ordinary material surfaces are not Xyz surfaces merely because ρ or χ_m changes there. In the retained weak branch, a bounded matter-density jump without a delta-function surface layer permits M and its normal derivative to remain continuous across the material boundary.

13A.5 Strong-field connection and updated claim boundary

The source-to-shape direction remains the traceless tidal map

$$E_{ij} = \partial_i \partial_j M - (\delta_{ij}/3) \nabla^2 M, \quad q_{eq} = \beta_{map} Lc^2(\epsilon_1, \epsilon_2, \epsilon_3, \epsilon_3, \epsilon_2, \epsilon_1).$$

The direction is structurally fixed, but β_{map} is not. The retained Route A and Route B values remain 2/3 and 1/6. Consequently the strong-field Xyz radii and thresholds remain conditional:

$$r_{Xyz}^3 = (3\beta_{map}/2) r_s Lc^2, \quad K_{Xyz} = [16/(3\beta_{map}^2)] Lc^{-4}.$$

The same distinction remains essential for black holes: event horizon != Xyz degeneracy != fabric destruction. The horizon is a causal-trapping boundary in the retained Schwarzschild-compatible branch, while Xyz is a deeper local Gram-rank boundary. A unique post-Xyz physical phase has not been derived.

Component	Status	Current meaning
Gram spectrum, determinant, Heron relation	EXACT	Invariant Xyz rank-loss / causal-integrity boundary.
Failed eigenmode and 2+2 incidence cut	EXACT	Identifies the degenerating causal mode and pure-gradient cut.
$\chi_{Xyz}=0$ with $D\tau\chi_{Xyz}<0$	GENERAL NECESSARY CONDITION	Actual evolution is attempting to leave the retained ordinary 1+3 phase.
CF157 boundary-flow formula	EXACT GIVEN CF157	Special effective tracking example; not the general Xyz derivation.
Celal existing-link correspondence	EXACT IN STATED SECTOR	Minimum-discontinuity relational matching; not edge birth/death.
Continuous finite-cell transport law	OPEN	Native action-derived ordinary network evolution is still missing.
Post-Xyz admissible move / phase set	OPEN	Re-cellulation/topology/phase continuation has not been uniquely derived.
Source-to-shape amplitude β_{map}	OPEN NORMALIZATION	Current routes $\beta_{map}=2/3$ and $1/6$ differ by factor four.

UPDATED MICROSCOPIC BOUNDARY: ordinary matter motion, rotation, tilt, and changing source support are handled as continuous source/geometry evolution on existing causal relations unless the causal-integrity condition fails. Xyz supplies the exact rank-loss boundary. Celal supplies exact existing-link relational matching and a conditional minimum-discontinuity selector once a physical post-Xyz continuation set is known. The action-derived ordinary transport law and complete post-Xyz move/phase set remain OPEN.

#	Test	Status	Meaning
15	Complete microscopic no-preferred-frame	OPEN	All-scale interacting network has not been proved orientation-neutral.
16	Celal centered correspondence	EXACT PASS modulo V4	Minimum-discontinuity matching on existing links.
17	Physical link birth/death	PARTIAL / OPEN	Complete action-derived graph-move set OPEN; Xyz trigger + Celal selector partially derived.
18	Four-component source representation	EXACT	Rank-four continuity map exists.
19	Continuous relational transport / post-Xyz intervention	PARTIAL / OPEN	Existing-link relational matching is defined; action-derived ordinary transport and post-Xyz admissible re-cellulation/topology/phase set remain open.
20	H Yazici construction	EXACT in stated sector	Neutral/commuting sector; bounded Continuity-Time inverse.
21	Weak tension-stress divergence	EXACT PASS	Matter force = $-\text{div } T^{\wedge}(M)$ in the scalar branch.
22	Six-channel 3->1+2 strain map	EXACT ALGEBRAIC PASS	One trace plus two anisotropic quadratic responses.
23	Linearized Einstein operator uniqueness	EXACT under assumptions	Lorentz/gauge/locality/two-derivative/conservation fix the form up to normalization.
24	Microscopic spin-2 derivation	OPEN	Finite-cell dynamics does not yet force the continuum operator.
25	One-function exponential static vacuum	FAIL	No nontrivial exact static vacuum Einstein solution.
26	Two-function static spherical exterior	EXACT PASS within completion	Ricci-flat and exactly Schwarzschild exterior.
27	Horizon causal trapping	PASS within branch	CF=0 and maximum outward support vanishes.
28	Horizon = fabric destruction	REJECTED	Local four-null Gram remains non-degenerate and horizon curvature is finite.
29	Light Theory null propagation / two modes	CONDITIONAL STRONG PASS	With minimal gauge dynamics: $q^2=0$, two transverse modes, speed c.
30	Elementary charge / α derivation	OPEN / NO-GO	Current local symmetry fixes action form, not electromagnetic normalization.
31	Ten-component tensor reconstruction	EXACT REPRESENTATION PASS	Four-null branch basis encodes and reconstructs all 10 independent components of a symmetric spacetime tensor.
32	Neutral pair-area / six-pair invariant	EXACT PASS	$A_0 = 4Lc^2/3$ and $A\Sigma_0 = 8Lc^2$ in the regular neutral module.
33	Neutral long-wavelength propagation	CONDITIONAL STRUCTURAL PASS	With the retained neighbor law and $\Omega c T_c = \sqrt{6}$, the continuum propagation speed is c.
34	Jadvyga mass-only L1 benchmark	FAIL	Mass-orientation gradient alone misses L1 in both Earth-Moon and Sun-Earth benchmarks.
35	Jadvyga rotating-frame L1 benchmark	CONDITIONAL STRONG PASS	Adding Mrot recovers both L1 scales; native derivation of the rotating term remains open.
36	Native finite-cell gauge invariance	EXACT PASS	$F = C^{\wedge}T A$ is invariant under $A \rightarrow A + B^{\wedge}T\chi$ because $BC = 0$.
37	Direct connection-action -> photon F^2 sector	FAIL / NO-GO	Current gravitational connection action does not independently generate a spin-1 Maxwell-form sector.
38	Tc absolute-scale rescaling obstruction	STRUCTURAL NO-GO	c, h, dimensionless geometry, and Tc-derived quantities fix ratios but not a unique SI Tc.
39	Moving matter / rotation / axial-tilt support test	EXACT KINEMATIC PASS	Support advection is continuous; axial rotation is tangent to an ideal spherical boundary for any spin-axis tilt. Source dynamics requires full $T_{\mu\nu}/H_{ab}$, not boundary crossing alone.

14 Author Contribution and Research Direction

Gurbuz Dolu originated and directed the physical research program. His contribution is much broader than the first formula. He made the decision to search for a geometric and causal origin instead of repairing the dimensional failure by inserting arbitrary units. He proposed the locally massless spacetime-fabric picture, the idea that matter triggers a disturbance without being the fabric itself, and the requirement that neighboring causal elements respond to one another.

Dolu repeatedly insisted that real, finite matter could not be represented honestly by one microscopic cell. He required the occupied region, energy, area, shape, surface, boundary flow, and later the full stress-energy content to remain part of the physical description. This

whole-body requirement helped move the model from a point-like picture toward volume, boundary, and continuum source relations.

He supplied the original heartbeat intuition and later introduced a second time, T_c . That step made it possible to separate an intrinsic fabric timescale from the matter/interface quantity D_0 . He repeatedly asked about photon flow, causal flow, balance, equalization, and reciprocal temporal-spatial response. He also required that coefficients and closures arise naturally rather than be tuned to match a desired number.

A major methodological contribution was Dolu's anti-circularity rule. During the native T_c search, measured Big G and Planck scales built from Big G were not allowed to enter microscopic assumptions. Failed closures were to stay visible. This rule did not produce an absolute T_c , but it forced the model to reveal which results were genuinely scale-independent and which were only calibrated.

Dolu also redirected the project at several key points. After the first formula failed as Big G, he first asked whether a natural geometry could explain the $5\pi^2$ structure. When those early geometric searches did not survive, he explicitly ended coefficient hunting and redirected the work toward a locally massless connected spacetime fabric. Early cube-like fabric sketches were replaced as balance, null-causality, and no-preferred-direction requirements led to the four-null tetrahedral module. He later rejected permanently oriented crystal pictures, asked where the cubic spatial dimension carried by Big G enters the model, and required Earth rotation, ordinary motion, and matter entry and exit to remain available as falsification tests.

He challenged the early assumption that D_0 had to be universal and redirected D_0 toward the matter/interface side. He introduced the matter-fabric Aggregation idea and asked whether D_0 could be understood as a time for local matter action to accumulate. He also directed the historical $1/(5\pi^2 c)$ expression to be reconsidered as an interface or scale clue without relabeling it Big G.

Dolu initiated the black-hole investigation by asking whether outward-connected causal-fabric support ends at a black-hole horizon and by proposing the stronger possibility that ordinary causal fabric may be absent in a terminal interior region. When the horizon test did not support literal local fabric destruction, the stronger horizon claim was rejected while the deeper-interior idea remained open.

He rejected a permanently oriented microscopic fabric and proposed arbitrary local 360° reorientation, deformation, reconnect, and rebalance. That physical direction became the Jadvyga 360 Space Dynamism Principle. He then asked whether deformed branches must stay attached to the same neighbors, which led to the Celal Dynamic Reconnect analysis. He directed dedicated conservation tests that led to the H Yazici construction. His stated physical idea that light is a propagating excitation of the causal spacetime fabric became the seed of Light Theory

Dolu also controlled the scientific-status language. He repeatedly required dimensional checks, anti-circularity, Lorentz tests, Einstein and Schwarzschild compatibility, conservation, explicit

15 AI Contribution and Responsibility Boundary

ChatGPT, GPT-5.6 Sol (OpenAI), served as the main mathematical formalization and audit tool. It turned author-originated questions into explicit equations that could be checked and performed dimensional, algebraic, geometric, spectral, Lorentz, curvature, continuum, group-theoretic, gauge, conservation, and falsification tests. It also compared competing branches and preserved counterexamples and no-go results.

The AI identified negative results that remain visible, including the dimensional rejection of the 2024 expression as Big G, failure of the one-function exact vacuum metric, the present no-go for deriving electromagnetic normalization from local tetrahedral symmetry alone, rejection of “event horizon = local fabric destruction,” and the present decision not to promote matter-surface crossing or Causal Re-Equalization into a fundamental graph law without a native microscopic derivation.

AI assistance is not authorship, peer review, independent replication, or experimental validation. Final scientific responsibility, physical interpretation, and decisions about G Model claims remain with Gurbuz Dolu.

16 Discussion: What the Current G Model Has and Has Not Achieved

The strongest current results are structural. The model has an exact four-null Lorentzian basis, six bivector channels, exact incidence and Hodge decompositions, reciprocal spectral invariants, a full ten-component tensor representation, a clear separation between matter support and fabric deformation, a local Aggregation law once the hypothesis is adopted, exact local Jadvyga invariance statements, and an exact Celal existing-link branch correspondence in its centered sector.

The weak source law reduces to Poisson form after Big-G calibration. The linearized Einstein operator is fixed by the stated continuum symmetry assumptions. The conditional two-function spherical completion is exactly Schwarzschild outside the source. Light Theory has exact native gauge kinematics and, after adopting a minimal gauge action, null propagation with two transverse modes.

LATEST DYNAMICAL CLARIFICATION: matter occupancy χ_m , fabric deformation M , and graph topology are distinct layers. Moving matter changes the local stress-energy source and therefore local geometry continuously. Rotation and axial tilt enter through the velocity/current content of $T_{\mu\nu}$ and H_{ab} ; they do not define an absolute orientation of the neutral fabric. An ordinary matter boundary is not automatically a topology boundary. Celal reconnect remains relational matching on existing links. Xyz remains the exact causal-integrity/rank-loss boundary for exceptional intervention.

The Causal Re-Equalization equations retain exact spectral, semigroup, and Lyapunov mathematics once their candidate evolution equation is assumed. Their status is now explicitly limited to an effective local tracking/recovery candidate; they are not treated as the fundamental physical reconnect law.

ATTRIBUTION BOUNDARY: Dolu supplied the originating conjecture, physical ontology, research questions, constraints, turning points, branch-selection decisions, and final scientific responsibility. AI-side work includes the mathematical formalization and audits listed above.

16 Discussion: Current Open Problems

The open problems remain decisive. The native theory still does not select an absolute parameter-free SI value of T_c . A complete action-derived continuous finite-cell transport law is still OPEN. The exact Xyz geometry identifies when the retained local causal phase becomes rank-deficient, but the physically admissible post-XYZ re-cellulation/topology/phase set is still OPEN. Full microscopic source conservation is not yet a derived dynamical identity. The model has not proved complete all-scale no-preferred-frame behavior, and finite-cell dynamics does not yet force the continuum spin-2 operator. The strong-field two-function completion is compatible with Einstein gravity but is not yet derived as the unique nonlinear microscopic outcome. Light Theory does not yet derive e , α , or observed charge assignments.

Accepting measured Big G solves the practical dimensional anchor problem for the calibrated branch. It does not solve the microscopic dynamics. The highest-value next tests are therefore: derive or independently measure T_c without Big G; derive the continuous finite-cell evolution law from the native action/neighbor structure; prove source conservation and Lorentz covariance for that law; derive the post-XYZ admissible continuation set; and test whether the long-wave weak-field, spin-2, light, and finite-cell predictions emerge without extra fitted coefficients.

17 Conclusion and Author Outlook

The G Model has changed substantially since Dolu's 2024 expression $G = 1/(5\pi^2 c)$. Its original identification with Newton's gravitational constant failed dimensionally. A later search for a geometry designed to reproduce $5\pi^2$ also failed. The decisive change was to stop coefficient hunting and construct a locally massless connected causal spacetime fabric from balanced null relations.

The resulting four-null/six-channel structure produced exact internal geometry, Lorentz/Hodge identities, reciprocal invariants, Aggregation relations, dynamic reorientation, relational matching, conservation and tension structures, tensor reconstruction, strong-field tests, and the gauge foundation of Light Theory. The search for T_c without Big G did not determine an absolute clock, but it clarified which results are scale-independent and which are calibrated.

The present reconnect picture is now more sharply bounded. Matter entry and exit move the support of the source; they do not automatically break and remake spacetime links. Earth-like translation, rotation, and a tilted spin axis provide useful checks because the support can move while rotational momentum current changes tangentially. Ordinary dynamics is therefore treated as continuous source-driven geometry and relational transport on existing causal connections. Celal supplies exact minimum-discontinuity branch correspondence there. Xyz is reserved for the exceptional case in which the local four-null Gram loses causal integrity.

The Causal Re-Equalization law remains available as an effective tracking candidate, not as a fundamental reconnect law. The next major closure is to derive the ordinary continuous network evolution and the post-XYZ physical continuation directly from the microscopic action or an equally native finite-cell principle.

The current physically anchored branch accepts measured Big G as an empirical matter-spacetime coupling and gives $T_c \approx 2.18657 \times 10^{-43}$ s in the retained normalization. That calibrated T_c must not be reused as though it independently predicted Big G. Any part of the G Model should be revised or rejected if future mathematical or experimental tests contradict it.

Author outlook. Gurbuz Dolu considers the present framework an unfinished fundamental-spacetime theory candidate whose strongest value is the growing set of explicit, falsifiable mathematical structures and the requirement that failed routes remain visible.

References

- [1] CODATA recommended value of the Newtonian constant of gravitation, used here as the accepted empirical Big G calibration input.
- [2] R. M. Wald, General Relativity, University of Chicago Press (1984).
- [3] C. W. Misner, K. S. Thorne, and J. A. Wheeler, Gravitation, W. H. Freeman (1973).
- [4] J. D. Jackson, Classical Electrodynamics, 3rd ed., Wiley (1998).
- [5] S. Weinberg, Gravitation and Cosmology, Wiley (1972).
- [6] G. Dolu, G Model internal research manuscripts and mathematical audit records, August-September 2026. These records document internal derivations and provenance.

APPENDIX REFERENCE: Formula Appendix: 222 current formulas (CF001-CF222), independently paginated through F-13. Symbols and Units Appendix: independent pagination.

G Model - Current Formula Appendix

Official current formula register: CF001-CF222. Independent pagination.

ID	Formula	Meaning	Status
CF001	$L_c = cT_c$	Native causal length	DEFINITION
CF002	$k_a = L_c(1, \mathbf{n}_a)$	Four future-directed null branches	MODEL GEOMETRY
CF003	$\mathbf{n}_a \cdot \mathbf{n}_b = -1/3 \ (a \neq b)$	Regular tetrahedral directional balance	EXACT
CF004	$\sum_{a=1}^4 \mathbf{n}_a = 0$	Tetrahedral centroid balance	EXACT
CF005	$k_a^2 = 0$	Null character of each branch	EXACT
CF006	$\binom{4}{2} = 6$	Four branches generate six unordered pairs	EXACT
CF007	$\Sigma_{ab} = k_a \wedge k_b$	Pairwise causal bivector	DEFINITION
CF008	$ k_a \wedge k_b = \frac{4}{3} L_c^2$	Neutral pair-area invariant	EXACT
CF009	$A_{\Sigma,0} = 6(4L_c^2/3) = 8L_c^2$	Aggregate neutral six-bivector magnitude	EXACT
CF010	$G_{aa} = 0, \ G_{a \neq b} = -\frac{4}{3} L_c^2$	Four-null Gram matrix	EXACT
CF011	$\text{spec}(G_4) = \{-4, \frac{4}{3}, \frac{4}{3}, \frac{4}{3}\} L_c^2$	Four-null Gram spectrum	EXACT
CF012	$\det G_4 = -\frac{256}{27} L_c^8$	Non-degenerate local causal basis	EXACT
CF013	$G_4^{-1} = L_c^{-2}(\frac{3}{4}I_4 - \frac{1}{4}\mathbf{11}^T)$	Inverse Gram	EXACT
CF014	$K G_4^{-1} K^T = \eta$	Minkowski metric reconstruction	EXACT
CF015	$D_a = k_a^\mu \partial_\mu$	Branch directional derivative	DEFINITION
CF016	$(G_4^{-1})^{ab} D_a D_b = \square$	Native d'Alembertian reconstruction	EXACT
CF017	$BC = 0$	Boundary-of-boundary incidence identity	EXACT
CF018	$B^T B + C C^T = 4I_6$	Exact six-edge Hodge decomposition	EXACT
CF019	$P_{\text{grad}} = \frac{1}{4} B^T B, \ P_{\text{circ}} = \frac{1}{4} C C^T$	Gradient/circulation projectors	EXACT
CF020	$P_{\text{grad}} + P_{\text{circ}} = I_6$	Complete six-channel decomposition	EXACT
CF021	$K_0 = B^T B - 2I_6$	Historical normalized six-channel operator convention	RETAINED
CF022	$\text{spec}(K_0) = \{4, 0, 0, 0, -2, -2\}$	Six-channel neutral spectrum	EXACT
CF023	$V_c = \frac{2}{3} L_c^3 = \frac{2}{3} (cT_c)^3$	Native causal volume	DEFINITION
CF024	$\Gamma_V = \frac{dV}{dt} = 2cL^2$	Instantaneous causal-volume flux for $dL/dt = c$	CONDITIONAL
CF025	$\Gamma_c = 2c^3 T_c^2$	Characteristic causal-volume flux	CONDITIONAL

G Model - Current Formula Appendix

Official current formula register: CF001-CF222. Independent pagination.

ID	Formula	Meaning	Status
CF026	$E_f = \hbar/T_c$	Intrinsic fabric energy scale	DEFINITION
CF027	$E_f T_c = \hbar$	One intrinsic fabric update carries one action quantum	MODEL NORMALIZATION
CF028	$m_c = \hbar/(c^2 T_c)$	Native dimensional mass scale	DEFINITION
CF029	$A_0 = 4L_c^2/3$	Neutral pair-area scale	EXACT
CF030	$\kappa_C L_c^2 = \hbar$	Candidate neutral area-stiffness closure	CONDITIONAL
CF031	$\sigma_0 = \kappa_C/T_c$	Candidate surface-tension scale	CONDITIONAL
CF032	$C_\Sigma = \frac{12}{5\pi}$	Retained causal-geometric coefficient	CONDITIONAL/REFERENCE
CF033	$\frac{C_\Sigma}{4\pi} = \frac{3}{5\pi^2}$	Microscopic coefficient plus spherical spreading	EXACT GIVEN C_Σ
CF034	$K_{GD} = \frac{1}{5\pi^2 c}$	G Model Kutsal Interface Constant; not Big G	HISTORICAL/INTERFACE
CF035	$\frac{C_\Sigma}{4\pi} = \frac{3}{5\pi^2}$	Exact algebraic interface identity	EXACT
CF036	$G = G_{\text{bridge}} = (C_\Sigma/4\pi)c^5 T_c^2/\hbar$ $= (3/5\pi^2)c^5 T_c^2/\hbar$ [for $C_\Sigma = 12/(5\pi)$]	Continuum matter-spacetime coupling bridge	CONDITIONAL
CF037	$T_c = \left(\frac{4\pi\hbar G}{C_\Sigma c^5} \right)^{1/2}$	Big-G-calibrated fabric time	CALIBRATED
CF038	$T_c \approx 2.18657 \times 10^{-43} \text{ s}$	Reference value for $C_\Sigma = 12/(5\pi)$	CALIBRATED
CF039	$L_c \approx 6.55517 \times 10^{-35} \text{ m}$	Reference causal length	CALIBRATED
CF040	$\Omega_c = \sqrt{6}/T_c$	Neutral propagation normalization	CONDITIONAL
CF041	$E_{\text{cell}} = V_c T_{\mu\nu} t^\mu t^\nu$	Covariant local causal-cell energy	DEFINITION
CF042	$E_{\text{cell}} = \rho V_c c^2$	Stationary nonrelativistic limit	CONDITIONAL LIMIT
CF043	$S_m(t) = \int_0^t E_{\text{cell}}(\tau) d\tau$	Accumulated matter action	DEFINITION
CF044	$S_m(D_0) = \hbar$	Aggregation definition of matter-response time	HYPOTHESIS
CF045	$D_0 = \hbar/E_{\text{cell}}$	Constant-energy Aggregation law	EXACT WITHIN DEFINITION
CF046	$A_{\text{cell}} = E_{\text{cell}} T_c/\hbar$	Dimensionless matter/fabric loading	DEFINITION
CF047	$D_0/T_c = 1/A_{\text{cell}}$	Controlling Aggregation reciprocal relation	EXACT WITHIN DEFINITION
CF048	$A_{\text{cell}} = \frac{2}{3}\rho c^5 T_c^4/\hbar$	Stationary density loading	EXACT WITHIN DEFINITIONS
CF049	$A_{\text{cell}} = 1 \iff D_0 = T_c$	Equal-action/equal-scale condition	CONDITIONAL PHYSICAL INTERPRETATION
CF050	$\Gamma_m \equiv D_0^{-1} = E_{\text{cell}}/\hbar$	Additive matter-action accumulation rate	EXACT

G Model - Current Formula Appendix

Official current formula register: CF001-CF222. Independent pagination.

ID	Formula	Meaning	Status
CF051	$\Gamma_{m,\text{tot}} = \sum_i \Gamma_{m,i}$	Independent energy contributions add in rate	EXACT
CF052	$t^\mu = K^\mu / \sqrt{-K^2}$, $K^\mu = \sum_a k_a^\mu$	Natural cell timelike direction	EXACT
CF053	$\chi_m \in \{0, 1\}$	Matter-occupancy bookkeeping variable	BOOKKEEPING
CF054	$(\chi_m, M) = (0, 0)$	Matter absent, neutral fabric	STATE
CF055	$(\chi_m, M) = (1, M \neq 0)$	Matter present, deformed fabric	STATE
CF056	$(\chi_m, M) = (0, M \neq 0)$	Matter absent locally, deformation persists	STATE
CF057	$(\chi_m, M) = (1, 0)$	Neutral M; does not by itself imply D0 = Tc	SPECIAL STATE
CF058	$\Sigma_{\text{col}} = \rho L_c$	One-causal-depth column density	DEFINITION
CF059	$\int \Sigma_{\text{col}} dA = M_{\text{source}}$	Projected-area mass additivity	CONDITIONAL GEOMETRY
CF060	$\partial \kappa_C / \partial m = \partial \kappa_C / \partial \rho = \partial \kappa_C / \partial \Omega = 0$	Baseline fabric universality requirement	POSTULATE
CF061	$M = \ln(d\tau/dt)$	Operational deformation/clock relation	CONDITIONAL
CF062	$d\tau/dt = e^M$	Local clock ratio	CONDITIONAL
CF063	$\Phi = c^2 \delta M$	Weak-field potential identification	CONDITIONAL
CF064	$\mathbf{g} = -c^2 \nabla \delta M$	Weak-field acceleration	CONDITIONAL
CF065	$\bar{A}[M] = M + \frac{L_c^2}{6} \nabla^2 M + \frac{L_c^4}{120} \nabla^4 M + \dots$	Orientation-balanced spherical mean	EXACT EXPANSION
CF066	$\bar{A}[M] - M = (C_\Sigma/4) A_{\text{cell}}$	Discrete mean-defect source rule	CONDITIONAL
CF067	$\nabla^2 M = C_\Sigma (c^3 T_c^2 / \hbar) \rho$	Weak continuum source law	CONDITIONAL
CF068	$\nabla^2 M = (4\pi G / c^2) \rho$	Big-G-calibrated weak source law	CALIBRATED COMPATIBILITY
CF069	$\nabla^2 \Phi = 4\pi G \rho$	Poisson normalization	CALIBRATED COMPATIBILITY
CF070	$Q_6(M) = 16e^{2M} + 8e^{-2M}$	Reduced reciprocal quadratic spectrum	EXACT WITHIN REDUCED MODEL
CF071	$M_* = -\frac{1}{4} \ln 2$	Mathematical minimum of Q_6	EXACT
CF072	$Q_{6,\text{min}} = 16\sqrt{2}$	Minimum reciprocal spectral value	EXACT
CF073	$Q_+ Q_- = 128$	Reciprocal spectral-product invariant	EXACT
CF074	$S_6^2 - D_6^2 = 512$	Hyperbolic spectral invariant	EXACT
CF075	$\text{Tr} K(M) = 8 \cosh M$	Linear reciprocal spectral magnitude	EXACT IN STATED SPECTRUM

G Model - Current Formula Appendix

Official current formula register: CF001-CF222. Independent pagination.

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ID	Formula	Meaning	Status
CF076	$T_+ T_- = T_c^2$	Dolu reciprocal-time invariant	EXACT WITHIN CON- STRUCTION
CF077	$\delta \ln T_+ + \delta \ln T_- = 0$	Differential reciprocal-time form	EXACT WITHIN CON- STRUCTION
CF078	$T_{\pm} = T_c e^{\mp 2u/3}$	Three-dimensional reciprocal time sectors	CONDITIONAL
CF079	$V_{\pm} = V_c e^{\mp 2u}$	Reciprocal volume sectors	CONDITIONAL
CF080	$Q_+ V_+ = Q_- V_- = 8\sqrt{2} V_c$	Spectral-volume equalization if shared-u bridge is adopted	CONDITIONAL BRIDGE
CF081	$K_x(\theta) = \Lambda_x(\theta) K_x(0)$	Jadvyga local reorientation	DEFINITION
CF082	$\Lambda_x^T \eta \Lambda_x = \eta$	Lorentz-frame preservation	EXACT
CF083	$W_f \rightarrow \Lambda_x W_f \Lambda_x^{-1}$	Holonomy conjugation under local reorientation	EXACT
CF084	$C_{xy}(\Pi) = \frac{1}{2} \ \gamma_x - \Pi^T \gamma_y \Pi\ _F^2$	Celal invariant mismatch cost	DEFINITION
CF085	$\Pi_{\text{Celal}} \in \arg \min_{\Pi \in S_4} C_{xy}(\Pi)$	Celal branch correspondence	EXACT GEOMETRIC SE- LECTION
CF086	$q = (a, b, c, c, b, a), a + b + c = 0$	Centered physical shape sector	DEFINITION
CF087	$T_c dq/d\tau = -(I - P)q$	Candidate reconnect relaxation law	CONDITIONAL
CF088	$q(\tau) = q_0 e^{-3\tau/(2T_c)}$	Centered relaxation solution	CONDITIONAL
CF089	$\tau_{\text{rec}} = 2T_c/3$	Candidate reconnect timescale	CONDITIONAL
CF090	$J_*^2 = -I_6$	Lorentz bivector Hodge structure	EXACT
CF091	$J_*^T \Gamma J_* = -\Gamma$	Hodge compatibility with bivector metric	EXACT
CF092	$\Omega_{yx} = K_y \Pi_{yx} K_x^{-1}$	Inter-cell branch-frame transporter	CONDITIONAL/GEOMETRIC
CF093	$\Omega_{yx}^T \eta \Omega_{yx} = \eta$	Lorentz transport on matched frames	EXACT WHEN GRAMS MATCH
CF094	$C_b = (G_4^{-1})^{ac} \Delta_a H_{cb}$	Four-component source-divergence candidate	EXACT REPRESENTATION
CF095	$\text{rank}(H \mapsto C_b) = 4$	Capacity for four independent continuity equations	EXACT REPRESENTATION
CF096	$\mathcal{T}_{ij}^{(M)} = K_M (\partial_i M \partial_j M - \frac{1}{2} \delta_{ij} \nabla M ^2)$	Weak scalar gradient-stress tensor	DEFINITION
CF097	$\partial_j \mathcal{T}_{ij}^{(M)} = K_M (\partial_i M) \nabla^2 M$	Field-stress divergence; matter force is negative divergence	EXACT
CF098	$K_M \nabla^2 M = \rho c^2$	Weak source-modulus form	CONDITIONAL
CF099	3 reciprocal strains $\rightarrow$ 1 trace + 2 anisotropic	Six-channel strain hierarchy	EXACT ALGEBRAIC
CF100	$\rho_f^{\text{rest}} = 0, u_{f0} \geq 0$	Massless-fabric/background-energy candidate	OPEN HYPOTHESIS

G Model - Current Formula Appendix

Official current formula register: CF001-CF222. Independent pagination.

ID	Formula	Meaning	Status
CF101	$Q_{ab} = k_a^\mu k_b^\nu h_{\mu\nu}$	Branch encoding of metric perturbation	EXACT REPRESENTATION
CF102	$H_{ab} = k_a^\mu k_b^\nu T_{\mu\nu}$	Branch encoding of stress-energy	EXACT REPRESENTATION
CF103	$h = (K^{-1})^T Q K^{-1}$	Reconstruction of $h_{\mu u}$	EXACT
CF104	$T = (K^{-1})^T H K^{-1}$	Reconstruction of $T_{\mu u}$	EXACT
CF105	$Q = (G_4^{-1})^{ab} Q_{ab}$	Branch-space trace	EXACT
CF106	$\bar{Q}_{ab} = Q_{ab} - \frac{1}{2}(G_4)_{ab} Q$	Branch trace reversal	EXACT
CF107	$(G_4^{-1})^{ac} D_a \bar{Q}_{cb} = 0$	Harmonic condition in branch variables	CONDITIONAL GAUGE
CF108	$\frac{E_{ab}[Q]}{(G_4)_{ab} D^2 Q} = \frac{1}{2}[-D^2 Q_{ab} + D_a D^c Q_{cb} + D_b D^c Q_{ca} - D_a D_b Q - (G_4)_{ab} D^c D^d Q_{cd} + (G_4)_{ab} D^2 Q]$	Linearized Einstein operator	EXACT UNDER CONTINUUM ASSUMPTIONS
CF109	$D^a E_{ab} = 0$	Identical conservation of linearized operator	EXACT
CF110	$\delta Q_{ab} = D_a \xi_b + D_b \xi_a$	Linearized gauge transformation	CONDITIONAL CONTINUUM
CF111	$E_{ab} = (8\pi G/c^4) H_{ab}$	Big-G-calibrated linearized source equation	CALIBRATED COMPATIBILITY
CF112	$\psi = 2 \tanh(M/2)$	Two-function strong-field variable	CONDITIONAL COMPLETION
CF113	$T = e^M = (1 + \psi/2)/(1 - \psi/2)$	Temporal metric factor	CONDITIONAL COMPLETION
CF114	$X = (1 - \psi/2)^2$	Spatial metric factor	CONDITIONAL COMPLETION
CF115	$\psi = -\mu/r$	Static spherical vacuum solution	EXACT WITHIN COMPLETION
CF116	$ds^2 = -\left(\frac{1-\mu/(2r)}{1+\mu/(2r)}\right)^2 c^2 dt^2 + \left(1 + \frac{\mu}{2r}\right)^4 (dr^2 + r^2 d\Omega^2)$	Isotropic Schwarzschild exterior	EXACT WITHIN COMPLETION
CF117	$R = r(1 + \mu/2r)^2$	Areal-radius transformation	EXACT
CF118	$C_F = 1 - 2\mu/R$	Invariant areal-radius causal-support scalar	EXACT WITHIN SCHWARZSCHILD BRANCH
CF119	$R_h = 2\mu = 2Gm/c^2$	Horizon radius with empirical Big G	CALIBRATED/GR COMPATIBILITY
CF120	$\mathcal{K} = 48\mu^2/R^6$	Schwarzschild Kretschmann scalar	EXACT
CF121	$A \rightarrow A + B^T \chi$	Finite-cell abelian-type gauge transformation	EXACT KINEMATICS
CF122	$F = C^T A$	Discrete face/loop field strength	DEFINITION
CF123	$F' = F$	Gauge invariance from $BC = 0$	EXACT
CF124	$F = dA, dF = d^2 A = 0$	Continuum closure	EXACT KINEMATICS
CF125	$S_\gamma = -\frac{\kappa_\gamma}{4} \int F_{\mu\nu} F^{\mu\nu} d^4 x$	Minimal parity-even light action	CONDITIONAL COMPLETION

G Model - Current Formula Appendix

Official current formula register: CF001-CF222. Independent pagination.

ID	Formula	Meaning	Status
CF126	$\partial_\mu F^{\mu\nu} = 0$	Vacuum field equation	CONDITIONAL CONSEQUENCE
CF127	$F = q \wedge a$	Plane-wave closure form	EXACT CONSEQUENCE
CF128	$q_\mu F^{\mu\nu} = q^2 a^\nu - (q \cdot a) q^\nu$	Plane-wave co-closure	EXACT
CF129	$q^2 = 0$	Nontrivial vacuum light is null	EXACT WITHIN CANDIDATE DYNAMICS
CF130	$\omega^2 = c^2 k^2$	Vacuum light dispersion	EXACT WITHIN CANDIDATE DYNAMICS
CF131	$\dim(q^\perp / \text{span}\{q\}) = 2$	Two physical transverse modes	EXACT WITHIN CANDIDATE DYNAMICS
CF132	$F_\pm = F \mp i J_\star F$	Hodge helicity sectors	DEFINITION
CF133	$J_\star F_\pm = \pm i F_\pm$	Helicity eigenvalue relation	EXACT
CF134	$BJ = 0$	Vertex conservation of edge-transfer current	EXACT
CF135	$S_{\text{int}} = -g_A J^T A$	Minimal source coupling	CONDITIONAL IDENTIFICATION
CF136	$\kappa_\gamma C C^T A = g_A J$	Discrete sourced light equation	CONDITIONAL
CF137	$E(r) = \frac{g_A}{4\pi\kappa_\gamma} \frac{Q}{r^2}$	Coulomb-form static field	CONDITIONAL
CF138	$U_{ij} = e^{ia_{ij}}$	Compact link variable	CONDITIONAL U(1) COMPLETION
CF139	$\psi_i \rightarrow g_i^n \psi_i, n \in \mathbb{Z}$	Compact U(1) integer representation weights	EXACT GROUP THEORY
CF140	$A_4/V_4 \cong \mathbb{Z}_3$	Native tetrahedral residual triality	EXACT GROUP THEORY

G Model - Current Formula Appendix

Post-7 September addendum: CF141-CF155.

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ID	Formula	Meaning	Status
CF141	$W_{012}W_{023}W_{031}(\Omega_{01}W_{123}^{-1}\Omega_{10}) = I$	Exact tetrahedral group-valued Bianchi closure	EXACT ALGEBRAIC
CF142	$\log(e^{K_1}e^{K_2}\dots) = \Sigma K_i + (1/2)\Sigma[K_i, K_j] + O(K^3)$	Formal BCH relation; additive curvature is the near-identity/small-curvature limit	LOCAL / SMALL-CURVATURE BCH
CF143	$V_{4,x} = (2/3)L_c^4[\det\gamma_x / \det\gamma_0]^{1/2}$	Invariant G Model causal four-volume extension; not uniquely canonical	CANDIDATE INVARIANT EXTENSION
CF144	$\Sigma_A = \Sigma_A/L_c^2; \Gamma_{AB} = (\Sigma_A, \Sigma_B)$	Dimensionless bivectors and six-space metric remove unit ambiguity	DEFINITION / DIMENSIONAL CLEANUP
CF145	$B_B^{\text{dual}} = -2(V_{4,x}/L_c^2)\Gamma_{J_*}^{AB}\Sigma_A$	Dimensionally explicit candidate dual-area bivector; [Bdual]=L ²	CANDIDATE DEFINITION; UNIQUENESS OPEN
CF146	$R_x^{\text{disc}} = (2/L_c^2)\Gamma^{AB}(\Sigma_A, K_B); \Sigma(B^{\text{dual}}_{J_*}K) = V_{4,x}R_x^{\text{disc}}$	Discrete curvature has L ⁻² units; contraction identity follows from definitions	IDENTITY EXACT GIVEN DEFINITIONS; Rdisc→R OPEN
CF147	$S_G^{\text{micro}}/\hbar = \zeta_{\text{micro}}\Sigma(B^{\text{dual}}/L_c^2, (J_* + \beta I)K(W))_\Gamma$	Microscopic holonomy-curvature action with explicit unfixed normalization	CANDIDATE ACTION
CF148	$\zeta_{\text{eff}} \equiv \zeta_{\text{micro}}N_{\text{disc}} = 1/(4C_\Sigma) = 5\pi/48 \approx 0.327249$	Effective continuum normalization required by internal source matching	DERIVED MATCHING; MICRO FACTORS/UNIQUENESS OPEN
CF149	$ \Delta S_m = E_{\text{cell}}T_c = \hbar A_{\text{cell}}$	One-update matter action in constant-energy Aggregation	EXACT WITHIN AGGREGATION DEFINITIONS
CF150	$E_{ab}^G = R_{ab} - (1/2)\gamma_{ab}R = 2C_\Sigma(cT_c^2/\hbar)H_{ab}$	Continuum source equation matched by action normalization	CONDITIONAL STRUCTURAL
CF151	$G_G = [3/(5\pi^2)]c^5T_c^2/\hbar$	G Model gravitational coupling used in Mercury benchmark	CONDITIONAL; CALIBRATED WHEN Tc FROM BIG G
CF152	$\beta_G=1, \gamma_G=1$	First post-Newtonian coefficients in the smooth metric-compatible vacuum closure	CONDITIONAL CONTINUUM CONSEQUENCE
CF153	$\Delta\varpi_G = [18/(5\pi)]c^3T_c^2M_{\text{Sun}}/[\hbar a(1-e^2)]$	Mercury perihelion advance; M _{Sun} avoids conflict with deformation variable M	CONDITIONAL FORM; Tc CALIBRATION MAY CONTAIN BIG G
CF154	$T_c = 2.18657 \times 10^{-43}\text{s} = \Delta\varpi_G = 42.9826 \text{ arcsec/Julian century}$	Mercury numerical benchmark	CALIBRATED COMPATIBILITY
CF155	$w(x)=x = \int_0^1 4x^3w(x)dx=4/5; \quad (\cos\phi + \sin\phi)=4/\pi$	Post-7 Sep rationale for retained depth and Hodge-throughput factors	CONDITIONAL PHYSICAL-SELECTION RATIONALE

G Model - Current Formula Appendix

Official register now extends through CF222.

Numbering note. The Technical Addendum contains a local working CF141-CF157 list that overlaps the official CF141-CF155 appendix. The controlling formula register here continues from official CF155; corresponding recovery formulas are re-entered as CF156 onward. Earlier local labels remain historical text.

ID	Formula	Meaning	Status
CF156	$e = q - q_{eq}$	Centered mismatch definition	DEFINITION
CF157	$T_c \, dq/d\tau = -(I_6 - P)e$		STRUCTURAL EFFECTIVE STRUCTURAL CANDIDATE
CF158	$q=(\alpha,\beta,\gamma,\gamma,\beta,\alpha), \alpha+\beta+\gamma=0; Pq=-q/2$	Centered physical shape sector	EXACT IN CENTERED SECTOR
CF159	$e(\tau)=e(0)e^{\{-3\tau/(2T_c)\}}; \tau_{rec}=2T_c/3$	Fixed-target centered tracking / recovery under CF157	EXACT GIVEN CF157
CF160	$R(\delta)=\exp[-\delta(I_6-P)]$	Effective tracking operator	DEFINITION GIVEN CF157
CF161	$R(\delta_1)R(\delta_2)=R(\delta_1+\delta_2)$	Tracking semigroup	EXACT GIVEN CF157
CF162	$E_1=(2/3)P^2+(1/3)P; E_0=I+P-2P^2; E_{minus}=(4/3)(P^2-P)$	Exact spectral projectors	EXACT
CF163	$R=E_1+e^{\{-\delta\}}E_0+e^{\{-3\delta/2\}}E_{minus}$	Spectral tracking decomposition	EXACT GIVEN CF157
CF164	$dV_L/d\tau=-(1/T_c)e^T(I-P)e \leq 0$	Lyapunov stability of the effective tracking candidate	EXACT GIVEN CF157
CF165	$L_c^2 \nabla^2 M = (3C_\Sigma/2)A_{cell} = [18/(5\pi)]T_c/D_0$	Aggregation-curvature bridge	EXACT WITHIN COMBINED BRANCH
CF166	$E_{ij}=\partial_i \partial_j M - (\delta_{ij}/3) \nabla^2 M$	Weak-static traceless tidal tensor	DEFINITION
CF167	$q_{eq}=\beta L_c^2(\varepsilon_1,\varepsilon_2,\varepsilon_3,\varepsilon_3,\varepsilon_2,\varepsilon_1)$	Tidal source-to-target shape direction	CONDITIONAL STRONG PASS; β OPEN

G Model - Current Formula Appendix

Official register now extends through CF222.

ID	Formula	Meaning	Status
CF168	$\beta_A=2/3; \beta_B=1/6; \beta_A/\beta_B=4$	Two native target-normalization routes	OPEN NORMALIZATION AUDIT
CF169	$E_{\text{minus}}(A_{\text{cell}} \text{ } 1_6)=0$	Scalar loading cannot directly create centered shape	EXACT NO-GO BY SYMMETRY
CF170	$q_{n+1}=q_{\text{eq},n+1}+R(\delta_n)(U_{n,n}q_n-q_{\text{eq},n+1})$	Layered Celal + effective tracking update	CANDIDATE UPDATE; DEPENDS ON CF157
CF171	$de/d\tau+[3/(2T_c)]e=-dq_{\text{eq}}/d\tau$		
CF172	$R_{\text{rate}}\equiv\tau_{\text{rec}}/D_0=(2/3)A_{\text{cell}}$	Effective tracking-timescale to Aggregation ratio	EXACT GIVEN EXACT GIVEN COMBINED CANDIDATES
CF173	$R_{\text{rate}}=1 \Leftrightarrow A_{\text{cell}}=3/2 \Leftrightarrow D_0=2T_c/3$	Candidate rate-matching point; not a fundamental topology threshold	CONDITIONAL CONDITIONAL COMBINED-CANDIDATE RESULT
CF174	$A_{12}=A_{34}=xL_c^2; A_{13}=A_{24}=yL_c^2; A_{14}=A_{23}=zL_c^2; x+y+z=4$	Centered opposite-pair coordinates	EXACT CENTERED GEOMETRY
CF175	$\gamma/L_c^2=-[[0,x,y,z],[x,0,z,y],[y,z,0,x],[z,y,x,0]]$	Centered four-null Gram matrix	EXACT GIVEN CF174
CF176	$\text{spec}(\gamma/L_c^2)=\{-(x+y+z),-x+y+z,x-y+z,x+y-z\}$	Centered Gram spectrum	EXACT
CF177	$-\det(\gamma/L_c^2)=(x+y+z)(-x+y+z)(x-y+z)(x+y-z)$	Xyz determinant factorization	EXACT
CF178	$-\det(\gamma/L_c^2)=16 A_{\text{tri}}^2$	Xyz Law / Heron form	EXACT CENTERED GEOMETRY
CF179	$x=4/3+\alpha; y=4/3+\beta; z=4/3+\gamma; \alpha+\beta+\gamma=0$	Centered deviation coordinates	EXACT PARAMETRIZATION

G Model - Current Formula Appendix

12-13 September 2026 continuation. Official register now extends through CF222.

ID	Formula	Meaning	Status
CF180	$\text{spec}(\gamma) = L_c^{-2} \{-4, 4/3 - 2\alpha, 4/3 - 2\beta, 4/3 - 2\gamma\}$	Centered Xyz Gram spectrum	EXACT
CF181	$\text{det}\gamma = 0 \Leftrightarrow \alpha = 2/3 \text{ or } \beta = 2/3 \text{ or } \gamma = 2/3$	Centered Xyz degeneracy boundary	EXACT
CF182	$\text{det}\gamma = -3s(s-2\alpha)(s-2\beta)(s-2\gamma)L_c^{-8}$	General common-mode Xyz determinant	EXACT GIVEN $x=s+\alpha$ ETC.
CF183	$\det(\Pi^T \gamma \Pi) = \text{det}\gamma$	Celal/permutation invariance of Xyz degeneracy	EXACT
CF184	$\{\varepsilon_r, \varepsilon_t, \varepsilon_b\} = \{r_s/r^3, -r_s/(2r^3), -r_s/(2r^3)\}$	Schwarzschild principal tidal pattern used in Xyz test	CONDITIONAL STRONG-FIELD INPUT
CF185	$r_{\text{Xyz}}^{-3} = (3\beta/2)r_s L_c^{-2}$	Schwarzschild-Xyz radius	CONDITIONAL COROLLARY
CF186	$r_{\text{Xyz,A}} = (r_s L_c^{-2})^{\wedge \{1/3\}}; r_{\text{Xyz,B}} = (r_s L_c^{-2/4})^{\wedge \{1/3\}}$	Route-A / Route-B Xyz radii	CONDITIONAL; β AMBIGUITY
CF187	$K_{\text{Xyz}} = [16/(3\beta^2)]L_c^{\wedge \{-4\}} = 12/L_c^4 \text{ (A)}, 192/L_c^4 \text{ (B)}$	Mass-independent Xyz curvature threshold	CONDITIONAL COROLLARY
CF188	$\Psi_2 = -m_g/(r - ia \cos\theta)^3; 2 \Psi_2 = r_s/\Sigma^{\wedge \{3/2\}}; \Sigma = r^2 + a^2 \cos^2\theta$	Kerr invariant principal tidal amplitude	EXACT KERR GEOMETRY / INPUT
CF189	$r^2 + a^2 \cos^2\theta = R_{\text{Xyz}}^{-2}; R_{\text{Xyz}} = [(3\beta/2)r_s L_c^{-2}]^{\wedge \{1/3\}}$	Kerr Xyz candidate surface	CONDITIONAL INVARIANT EXTENSION
CF190	$W \equiv 48 \Psi_2 ^2 = 12r_s^2/\Sigma^3; W_{\text{Xyz}} = [16/(3\beta^2)]L_c^{\wedge \{-4\}}$	Kerr invariant curvature at Xyz boundary	CONDITIONAL COROLLARY
CF191	$\varepsilon_r = (2A/3)(\rho - \bar{\rho}); \varepsilon_t = -(A/3)(\rho - \bar{\rho}), A = C_\Sigma c^3 T_c^{-2}/\hbar$	Spherical traceless tidal density-contrast law	EXACT WITHIN WEAK SPHERICAL BRANCH

G Model - Current Formula Appendix

12-13 September 2026 continuation. Official register now extends through CF222.

ID	Formula	Meaning	Status
CF192	$ \bar{\rho}-\rho _{\text{Xyz}}=\hbar/(\beta C_{\Sigma}c^5T_c^4)$	Spherical Xyz density-contrast threshold	CONDITIONAL SOURCE-TO-SHAPE COROLLARY
CF193	$A_{\Delta}\equiv(2/3) \bar{\rho}-\rho c^5T_c^4/\hbar; A_{\Delta,\text{Xyz}}=2/(3\beta C_{\Sigma})$	Dimensionless contrast loading and threshold	EXACT GIVEN DEFINITIONS / β OPEN
CF194	$r_s=\sqrt{(3\beta/2)}L_c$ at $r_{\text{Xyz}}=r_s$	Horizon-Xyz crossover condition	CONDITIONAL
CF195	$M_x=[c^2L_c/(2G_G)]\sqrt{(3\beta/2)}=(5\pi^2/6)\sqrt{(3\beta/2)}m_c$	Conditional black-hole crossover mass	CONDITIONAL; CALIBRATED BRANCH
CF196	$\bar{\rho}_x=3M_x/(4\pi r_s^3)=\hbar/(\beta C_{\Sigma}c^5T_c^4)=\Delta\rho_{\text{Xyz}}$	Density/horizon form of same Xyz crossover	EXACT ALGEBRA GIVEN CF194-CF195
CF197	$T_c=\sqrt{[625\pi^7\hbar K_{\text{GD}}^3a(1-e^2)\Delta\omega/(18M_{\text{sun}})]}$	Mercury back-inversion for T_c	OBSERVATIONAL INVERSION / CONSISTENCY
CF198	$K_M=(25\pi^3/12)\hbar K_{\text{GD}}/T_c^2$	K_M reconstruction from K_{GD} and T_c	EXACT ALGEBRA GIVEN RETAINED K_M LAW
CF199	$G_{\text{eff}}=\Delta a_{\text{mod}}/[2M_s(r_n^{\wedge\{-2\}}-r_f^{\wedge\{-2\}})]$	Two-cloud measured effective gravitational coupling	EXPERIMENTAL RECONSTRUCTION
CF200	$T_c=\sqrt{[15625\pi^{12}\hbar K_{\text{GD}}^5\Delta a_{\text{mod}}/(6M_s(r_n^{\wedge\{-2\}}-r_f^{\wedge\{-2\}}))]}$	Laboratory T_c reconstruction	EXPERIMENTAL RECONSTRUCTION FORM
CF201	$K_M=M_s(r_n^{\wedge\{-2\}}-r_f^{\wedge\{-2\}})/[1250\pi^9K_{\text{GD}}^4\Delta a_{\text{mod}}]$	Laboratory K_M reconstruction	EXPERIMENTAL RECONSTRUCTION FORM
CF202	$T_{\text{H,x}}=\hbar/[4\pi k_{\text{BT}}\sqrt{(3\beta/2)}]$	Hawking temperature at conditional Xyz crossover	SEMICLASSICAL COMPARISON ONLY
CF203	$\tau_{\text{H,x}}=(3200\pi^3/3)(3\beta/2)^{\wedge\{3/2\}}T_c$	Standard Schwarzschild lifetime evaluated at crossover	SEMICLASSICAL COMPARISON ONLY

G Model - Current Formula Appendix

13 September 2026 continuation. Official current register CF001-CF222.

ID	Formula	Meaning	Status
CF204	$\chi_{\text{Xyz}} \equiv \min\{s - 2\alpha, s - 2\beta, s - 2\gamma_d\}$	Xyz causal-integrity margin	DEFINITION GIVEN CF182
CF205	$u_x=(1,1,-1,-1), \gamma u_x=0; k_1+k_2-k_3-k_4=0$ at $\alpha=s/2$	Failed simple α -edge Xyz mode and branch dependence	EXACT AT SIMPLE α EDGE
CF206	$\lambda_\alpha=s-2\alpha; (d\lambda_\alpha/d\tau)_{\text{CF157}}=(3/T_c)(s/2-\alpha_{\text{eq}})$ at $\alpha=s/2, ds/d\tau=0$	Boundary-flow sign under the effective CF157 tracking candidate	EXACT GIVEN CF157; NOT GENERAL TRIGGER
CF207	$\chi_{\text{Xyz}}=0$ and $D_\tau \chi_{\text{Xyz}} < 0 \Rightarrow$ smooth ordinary 1+3 continuation cannot remain in the retained phase unchanged	General Xyz outward-crossing causal-integrity condition	GENERAL GEOMETRIC / KINEMATIC NECESSARY CONDITION; DYNAMICS OPEN
CF208	$\Delta q=(\Delta\alpha, \Delta\beta, \Delta\gamma_d, \Delta\gamma_d, \Delta\beta, \Delta\alpha); V_{\text{geom}}=(1/2) \Delta q ^2$	Centered geometric mismatch norm	DEFINITION
CF209	$(1/2) \Delta\gamma _{F^2} = L_c^4 \Delta q ^2 = 2L_c^4 V_{\text{geom}}$	Celal Gram mismatch equals centered geometric mismatch up to fixed factor	EXACT IN CENTERED FIXED-COMMON-MODE SECTOR
CF210	$e_r=U_{(\pi_r)}q^-q_{\text{eq},r^+}; C_r=(1/2) \gamma_{r^+}-U_{(\pi_r)}\gamma^-U_{(\pi_r)}^T _{F^2}$	Candidate post-Xyz transported mismatch / discontinuity bookkeeping	DEFINITION; PHYSICAL MOVE SET OPEN
CF211	$r_* \in \arg \min_{(r \in R_{\text{admissible}})} C_r$	Minimum-discontinuity continuation selector once an admissible set is supplied	STRONG NATIVE SELECTOR; $R_{\text{admissible}}$ OPEN
CF212	$V_L(\tau)=V_L(0) \exp(-3\tau/T_c)$	Centered fixed-target recovery-cost decay under CF157	EXACT GIVEN CF157; EFFECTIVE TRACKING CANDIDATE ONLY
CF213	$c_x=B^T u_x \propto (0, \pm 2, \pm 2, \pm 2, 0)$	Xyz 2+2 incidence cut selected by failed mode	EXACT UP TO EDGE ORIENTATION / ORDERING
CF214	$P_{\text{grad}} c_x=c_x; P_{\text{circ}} c_x=0$	Failed Xyz cut is pure gradient in six-channel decomposition	EXACT
CF215	$ E(K_4) = C(4,2) = 6$	No unused internal edge exists inside one unchanged four-vertex cell	EXACT COMBINATORIAL NO-GO
CF216	$\text{dety}_x \rightarrow 0 \Rightarrow V_{(4,x)} \rightarrow 0 \Rightarrow B^{\text{dual}}(xB) \rightarrow 0$	Local candidate dual-area/action weight collapses at Xyz if normalized holonomy remains finite	EXACT CONSEQUENCE WITHIN CF143-CF147 CANDIDATE ACTION
CF217	$\chi_{\text{Xyz}} > 0$: ordinary evolution may remain on existing causal relations; $\chi_{\text{Xyz}}=0, D_\tau \chi_{\text{Xyz}} \geq 0$: retained phase may remain admissible; $\chi_{\text{Xyz}}=0, D_\tau \chi_{\text{Xyz}} < 0$: ordinary smooth continuation is inadmissible and an admissible intervention is required	Consolidated causal-integrity law; Celal may select among a separately derived admissible continuation set	EXACT BOUNDARY + CONDITIONAL SELECTOR; ORDINARY TRANSPORT AND POST-XYZ MOVE SET OPEN

G Model - Current Formula Appendix

13 September 2026 continuation. Official current register CF001-CF222.

Latest moving-matter and causal-integrity additions. These formulas do not promote the matter surface to a graph-topology boundary; they separate matter-support kinematics, full source motion, and weak field continuity from exceptional Xyz rank loss.

ID	Formula	Meaning	Status
CF218	$\partial_t \chi_m + v_m \cdot \nabla \chi_m = 0$	Advection of a sharp material-support indicator with the matter flow	EXACT KINEMATICS FOR MATERIAL SUPPORT
CF219	$v_m(x,t) = V(t) + \omega(t) \times [x - X(t)]$	Rigid-body matter velocity: translation plus axial rotation	EXACT NONRELATIVISTIC RIGID-BODY KINEMATICS
CF220	$(\omega \times r) \cdot n = 0$ for $n \parallel r$	Rotation is tangent to an ideal spherical matter boundary for any spin-axis direction, including a tilted axis	EXACT GEOMETRY
CF221	$T^{\{00\}} \approx \rho c^2; T^{\{0i\}} \approx \rho c v^i; T^{\{ij\}} \approx \rho v^i v^j$	Low-velocity dust source decomposition; rotation/tilt enters through momentum and stress	STANDARD NONRELATIVISTIC SOURCE LIMIT / INPUT
CF222	$[M]_S = 0; [\partial_n M]_S = 0; [\nabla^2 M]_S = C_\Sigma (c^3 T_c^2 / \hbar) [\rho]_S$	Ordinary weak matter-boundary matching without a delta-function surface layer	EXACT WITHIN RETAINED WEAK SOURCE EQUATION AND NO-SURFACE-LAYER ASSUMPTION

G Model - Symbols and Units Appendix

Independent pagination. Each row is boxed and alternately shaded for easier scanning. SI units and dimensions are kept close to the symbol meaning.

Symbol / term	Meaning	SI unit	Dimension
G Model	Proposed causal-spacetime framework	-	-
Big G, G	Newtonian gravitational constant	$\text{m}^3 \text{kg}^{-1} \text{s}^{-2}$	$\text{L}^3 \text{M}^{-1} \text{T}^{-2}$
c	Causal propagation primitive / speed of light	m s^{-1}	L T^{-1}
$\hbar$	Reduced Planck constant	J s	$\text{M L}^2 \text{T}^{-1}$
T_c	Intrinsic/common fabric time scale	s	T
D_0	Local matter/energy Aggregation response time	s	T
L_c	Native causal length, c T_c	m	L
V_c	Native causal volume	m^3	L^3
E_f	Intrinsic fabric energy scale	J	$\text{M L}^2 \text{T}^{-2}$
m_c	Native mass scale	kg	M
Ω_c	Neutral propagation frequency normalization	s^{-1}	T^{-1}
K_GD	G Model Kutsal Interface Constant; not Big G	s m^{-1}	T L^{-1}
C_Σ	Dimensionless causal-geometric coefficient	1	1
A_0	Neutral pair-area scale	m^2	L^2
A_Σ,0	Aggregate neutral six-bivector magnitude	m^2	L^2
κ_C	Candidate action-per-area fabric stiffness	J s m^{-2}	M T^{-1}
σ_0	Candidate surface tension	N m^{-1}	M T^{-2}
Γ_c	Characteristic causal-volume flux	$\text{m}^3 \text{s}^{-1}$	$\text{L}^3 \text{T}^{-1}$
k_a	Four-null branch vector	m	L
n_a	Unit spatial tetrahedral direction	1	1
Σ_ab	Pairwise causal bivector / area element	m^2	L^2
G_4	Four-null Gram matrix	m^2	L^2
K	Matrix of four branch vectors / context-dependent operator	varies	varies
D_a	Branch directional derivative	1	1
B	Vertex-edge incidence map	1	1
C	Edge-face incidence map	1	1
P_grad	Gradient-sector projector	1	1
P_circ	Circulation-sector projector	1	1
K_0	Retained six-channel neutral operator	1	1
M	Dimensionless fabric deformation / clock variable	1	1
M*	Mathematical minimum of Q_6; not the neutral state	1	1
Q_6, Q_+, Q_-	Reciprocal spectral quantities	1	1
S_6, D_6	Hyperbolic spectral coordinates	1	1
u	Reciprocal time/volume coordinate; spectral bridge conditional	1	1
T_±	Reciprocal time sectors	s	T
V_±	Reciprocal volume sectors	m^3	L^3

Symbol / term	Meaning	SI unit	Dimension
Φ	Weak gravitational potential	$\text{m}^2 \text{s}^{-2}$	$\text{L}^2 \text{T}^{-2}$
ϕ	Weak gravitational acceleration	m s^{-2}	L T^{-2}
ρ	Matter mass density in stationary limit	kg m^{-3}	M L^{-3}
$T_{\mu\nu}$	Stress-energy tensor	J m^{-3}	$\text{M L}^{-1} \text{T}^{-2}$
t^μ	Natural cell timelike direction	1	1
E_{cell}	Local causal-cell energy	J	$\text{M L}^2 \text{T}^{-2}$
S_{m}	Accumulated matter action	J s	$\text{M L}^2 \text{T}^{-1}$
A_{cell}	Dimensionless cell loading	1	1
Γ_{m}	Matter-action accumulation rate, $1/D_0$	s^{-1}	T^{-1}
χ_{m}	Matter-occupancy bookkeeping / material-support indicator	1	1
v_{m}	Matter velocity field used in support advection	m s^{-1}	L T^{-1}
V	Rigid-body translational velocity	m s^{-1}	L T^{-1}
ω	Rigid-body angular-velocity vector; do not confuse with Ω_{c} or Ω_{yx}	s^{-1}	T^{-1}
n	Local outward unit normal to a matter boundary	1	1
Σ_{col}	Directional column density	kg m^{-2}	M L^{-2}
$\hat{A}[\text{M}]$	Orientation-balanced neighbor average of M	1	1
κ_{M} or K_{M}	Weak M-gradient / source modulus	N	M L T^{-2}
$T_{ij}^{\wedge}(\text{M})$	Weak scalar fabric stress tensor	Pa	$\text{M L}^{-1} \text{T}^{-2}$
K_{x}	Local branch-frame matrix at cell x	m	L
Λ_{x}	Local Lorentz frame transformation	1	1
γ_{x}	Invariant branch Gram at cell x	m^2	L^2
Π	Tetrahedral branch permutation	1	1
$C_{xy}(\Pi)$	Celal mismatch cost	m^4 or normalized	context
q	Centered six-channel shape vector	1	1
τ_{rec}	Effective Causal Re-Equalization candidate timescale; not a fundamental reconnect time	s	T
J^*	Lorentz Hodge map on six-bivector space	1	1
Γ	Lorentzian bivector metric	1	1
Ω_{yx}	Inter-cell Lorentz transporter	1	1
W_{f}	Closed-loop holonomy	1	1
H_{ab}	Branch-space stress-energy encoding	energy-density weighted	context
Q_{ab}	Branch-space metric-perturbation encoding	context	context
C_{b}	Four-component source-divergence defect	context	context
$h_{\mu\nu}$	Metric perturbation	1	1
$E_{\text{ab}}[\text{Q}]$	Linearized Einstein operator in branch basis	context	context
ξ_{a}	Linearized gauge vector in branch basis	context	context
ψ	Strong-field auxiliary scalar	1	1
T	Strong-field temporal factor (not a time symbol)	1	1
X	Strong-field spatial factor	1	1
r	Isotropic radial coordinate	m	L
R	Areal radius	m	L
μ	Schwarzschild length parameter, Gm/c^2	m	L
C_{F}	Invariant areal-radius causal-support scalar	1	1
$K(\text{curvature})$	Kretschmann curvature invariant	m^{-4}	L^{-4}
A	Candidate electromagnetic/link 1-cochain potential	context	context

Symbol / term	Meaning	SI unit	Dimension
F	Candidate face/bivector field strength	context	context
χ	Gauge parameter	context	context
κ_γ	Candidate light-action normalization	convention-dependent	context
q_μ	Wave covector	m^{-1}	L^{-1}
a_μ	Plane-wave polarization amplitude	context	context
J	Antisymmetric conserved edge-transfer current	context	context
g_A	Candidate source coupling	convention-dependent	context
Q	Static source charge in light branch	charge units	context
U_{ij}	Compact U(1) link variable	1	1
$g_i = e^{(i\chi_i)}$	Local compact U(1) transformation	1	1
n	Integer compact U(1) representation weight	1	1
q_0	Undetermined elementary charge unit	C	I T
A_4	Orientation-preserving tetrahedral group	-	-
V_4	Klein-four normal subgroup	-	-
Z_3	Three-element cyclic residual group	-	-
α	Fine-structure constant	1	1
β_γ	Compact light-action coefficient	1	1
κ_m	Compact matter-action coefficient	1	1

Notation boundary. Some symbols are reused in different contexts. Use the full indexed symbol when ambiguity is possible. Entries marked context obtain their units from the normalization of the associated discrete or continuum field; the manuscript does not assign an experimentally established SI normalization where none has been derived.

Future Naming of Unnamed Principles.

The author considers it appropriate that G Model principles, relations, or theoretical structures that are presently unnamed may, if they are later independently proved, rigorously derived, or experimentally established, receive names proposed by the researchers responsible for that independent proof or establishment, provided that the original provenance and authorship of the underlying G Model concept are properly acknowledged.

Priority and Evidence of Independent Proof.

If a dispute later arises regarding who first independently proved, derived, or experimentally established an unnamed G Model principle, the author considers contemporaneous documentary evidence - such as dated manuscript versions, PDF timestamps, email records, repository records, submission records, and other independently verifiable time-stamped materials - relevant evidence in determining priority. No single timestamp is intended to be treated as conclusive by itself.

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