From Chaos to Convergent Foundations

The Foundational Premises Of Successive Collision Theory

DR JM NIPOK N.J.I.T.
https://orcid.org/0009-0006-3940-4450

https://doi.org/10.13140/RG.2.2.19171.62243
Version 3.7

ABSTRACT

Successive Collision Theory (SCT) proposes that the observational record of our universe — the cosmic microwave background, large-scale structure, primordial nucleosynthesis abundances, galactic rotation curves, apparent cosmic acceleration, baryon asymmetry, and anomalously large early structures — can be accounted for within the frameworks of General Relativity (GR) and Special Relativity (SR) by replacing a single foundational assumption: that our observable universe originated in an isolated singular event. In its place, SCT posits that the observable universe is a thermalized collision product embedded within an infinite, eternally evolving manifold. This paper presents, systematically and in full scientific detail, the sixty-one foundational premises of SCT, organized into thematic sections that trace the logical chain from ontological postulates about space and time, through the mechanics of superluminal pocket collisions, to specific modifications of the Einstein field equations. At no stage is a new particle, new field, or violation of established physical law introduced. The modifications proposed — a dynamical cosmological ratio replacing the fixed Lambda, a coherent superposition function around the stress-energy tensor, and a QCD-derived lower boundary on the domain of GR — all reduce to standard results in appropriate limits. The paper demonstrates that seven of the most persistent unsolved problems in standard Lambda-CDM cosmology are addressed simultaneously by this single conceptual substitution, and identifies concrete falsifiable predictions that distinguish SCT from Lambda-CDM at current and near-future observational precision.

Keywords: *cosmology; alternative cosmology; Big Bang; General Relativity; superluminal collision; dark matter; dark energy; baryon asymmetry; angular momentum; cosmic microwave background; large-scale structure; Successive Collision Theory*

1. Introduction

The standard cosmological model — Lambda cold dark matter (Lambda-CDM) — has proven extraordinarily successful in organizing the observational data of modern astronomy. Its predictions for the acoustic peak structure of the cosmic microwave background (CMB), the abundance of light elements from Big Bang nucleosynthesis (BBN), and the growth of large-scale structure are all consistent with observation at impressive levels of precision. Yet despite these successes, Lambda-CDM rests on a foundation that contains unresolved conceptual difficulties severe enough to motivate decades of active research into alternatives.

The difficulties are not minor. They include: the horizon problem (why is the CMB so uniform across regions that were never in causal contact under standard expansion?); the flatness problem (why is the universe so geometrically flat, requiring fine-tuning of initial conditions to better than one part in 10^60); the nature of dark matter (a particle species accounting for approximately 27% of the total energy budget, for which no laboratory detection exists after four decades of searching); the nature of dark energy (an energy component comprising approximately 68% of the total budget with no identified physical mechanism); the origin of baryon asymmetry (why matter exceeded antimatter by one part in 10^9, requiring CP violation far beyond what the Standard Model provides); the origin of large-scale angular momentum coherence (why galaxy spins align across scales exceeding 100 Mpc, far beyond what tidal torque theory predicts); and the early galaxy problem (why JWST observations reveal massive, mature galaxies at redshifts $z > 10$, too early for standard hierarchical structure formation to accommodate).

Each of these difficulties has attracted its own proposed solution: inflation for the horizon and flatness problems, supersymmetric particles or axions for dark matter, quintessence fields or modified gravity for dark energy, leptogenesis for baryon asymmetry. What is remarkable about this landscape is the proliferation: seven distinct unsolved problems, each requiring its own extension of physics beyond the Standard Model, none connected to the others by any underlying framework.

Successive Collision Theory (SCT) proposes that this proliferation is the signature of a wrong assumption applied consistently rather than seven independent mysteries. The assumption is that our observable universe emerged from an isolated singular event — a point-like hot dense origin with no prior causal context and no spatial embedding. Replace this single assumption with the physically motivated alternative — that our observable universe is a thermalized collision product embedded within an infinite, eternally evolving manifold — and all seven problems dissolve simultaneously, from the same physical mechanism, using only GR and SR.

This paper presents the sixty-one foundational premises of SCT in full scientific detail, organized into thematic sections that follow the logical chain from first principles to observational predictions. The paper is structured as follows: Section 2 establishes the ontological framework (P01-P05); Section 3 develops the nested comoving frame hierarchy (P06-P13); Section 4 presents the dark energy mechanism via orbital decay and mesh dissipation (P14-P19); Section 5 establishes the physics of superluminal inter-pocket relative velocities (P20-P22); Section 6 develops the collision origin and its observational consequences (P23-P30); Section 7 addresses angular momentum, structure formation, and the cosmic web (P31-P34); Section 8 covers recombination, nucleosynthesis, and the collision timeline (P35-P43); Section 9 presents the dark matter mechanism via constructive gravitational superposition (P45-P48); Section 10 addresses structure formation and large-scale anomalies (P49-P53); Section 11 discusses the family of relative pockets (P54-P58); Section 12 presents the three unified modifications to the Einstein field equations (P59-P61); and Section 13 summarizes falsifiable predictions and conclusions.

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2. The Ontological Framework: Space, Time, and Mass-Energy (P01–P05)

Every physical theory rests on assumptions about the arena in which physics takes place. SCT makes explicit what standard cosmology treats as unexplained initial conditions. The five premises in this section establish the infinite, eternal, mass-energy-filled manifold within which all subsequent physics operates. None of these premises requires new physics — they are, in fact, more parsimonious than their alternatives.

2.1 Eternal Time (P01)

SCT holds that time has no beginning and no end. This is not a metaphysical preference but a parsimony argument: a universe with a temporal beginning must explain the conditions at t = 0, which are external to the theory and therefore an unexplained additional input. An eternal universe requires no such explanation. The question "what caused the first moment" is, on close inspection, malformed — it applies the concept of causation (which requires a prior moment) to the very first moment, then exempts an alleged first cause from the same requirement. Occam's razor strongly favors the framework with fewer unexplained inputs.

More precisely: every causal chain in an eternal universe extends infinitely into the past. The Big Bang event in SCT is not t = 0 of existence but t = 0 of our local thermal history — a distinction with profound observational consequences. Prior structure, prior collisions, and prior pockets all existed before the event that thermalized our observable patch.

2.2 Infinite Space (P02)

Space has no boundary or edge in any direction. This is again the null hypothesis: any proposed boundary requires two questions that cannot be answered from within any established field equation — what lies beyond the boundary, and what physical mechanism enforces it from the interior? No solution to Einstein's field equations generates a spatial boundary as an output without imposing one as an auxiliary assumption. In the absence of physical motivation for a boundary, the infinite case is the default.

Together P01 and P02 define an arena free of boundary problems. The observable universe — a sphere of approximately 46.5 gigalight-years in radius — is a finite region within this infinite manifold, bounded only by the distance light has traveled since our local collision event 13.8 billion years ago.

2.3 Embedded Observable Universe, Ubiquitous Mass-Energy, and Infinite Total (P03–P05)

Given infinite space and eternal time, three further premises follow by straightforward logical extension of the Copernican principle. Our observable patch has no physical property distinguishing it from any other equal-volume region of the infinite manifold (P03). If mass-energy exists in our patch and our patch is not special, then confining mass-energy to our patch alone would require a boundary mechanism or selection law with no physical basis — therefore mass-energy is distributed throughout the manifold (P04). Integrating any nonzero density over infinite volume yields an effectively infinite total energy reservoir (P05), ensuring that no finite sequence of collisions depletes the fuel available for future events.

These five premises taken together constitute the SCT claim that the universe is simply a universe: infinite in space, eternal in time, and uniformly populated with mass-energy. They require no new physics whatsoever. They are, if anything, less speculative than the alternative of positing a finite-time, finite-energy universe with a singular origin.

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3. The Nested Comoving Frame Hierarchy (P06–P13)

Given the arena of P01-P05, the application of GR and SR produces a specific large-scale structure. This section develops the concept of nested comoving frames — the organizing principle that unifies cosmic structure at all scales and provides the physical basis for the hereditary time mechanism that underlies both the dark energy and dark matter analogs in SCT.

3.1 Large-Scale Homogeneity and Scale-Invariant Structure (P06–P07)

At scales above approximately 300 megaparsecs the universe is statistically homogeneous and isotropic. In SCT this is not a fine-tuning requirement — it is the natural consequence of the thermalization process (developed fully in Section 6) that treats the collision overlap volume as a unit. Below the homogeneity scale, Einstein's field equations, containing no preferred length scale, produce identical qualitative behavior at every level of gravitational clustering: smaller structures follow the dominant local mass, clustering into larger structures that themselves follow the next level up.

This "follow-the-leader" principle under GR produces the observed scale-invariant hierarchy: power-law mass functions and correlation functions across many decades of scale, from binary stars to superclusters, with no natural ceiling or floor imposed by the equations. The hierarchy is not assumed — it is derived from the application of scale-free field equations to a mass-energy-filled infinite manifold.

3.2 Comoving Frames and Hereditary Time (P08–P10)

Each level of the gravitational hierarchy constitutes a comoving frame: a collection of objects sharing approximately the same bulk velocity relative to the frame above. Each frame is related to its parent by a Lorentz boost. These are not exotic constructs — they are the natural product of applying SR time dilation to hierarchically nested gravitational clusters.

The crucial physical consequence is hereditary time transmission. The proper time rate of any object is the cumulative product of all SR time dilation factors from the object's local frame upward through the entire parent hierarchy. This is not a new claim — GPS satellites require precisely this two-level correction at nanosecond precision, with one factor from Earth's gravitational potential and another from the satellite's orbital velocity. SCT asserts that the same composition continues upward through every level of the hierarchy without limit.

Formally, for an object at the k-th level of a hierarchy of N total levels, its proper time rate relative to the top-level background is:

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dτ/dt  =  Π_{i=1}^{k} γ_i^{-1}  ×  Π_{j=1}^{k} (1 - Φ_j/c^2)^{1/2}
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where gamma_i is the Lorentz factor for the bulk velocity of the i-th frame relative to its parent, and Phi_j is the gravitational potential of the j-th frame at the object's location. Both factors follow directly from SR and GR respectively. The hereditary chain is a standard result applied to a realistic hierarchical structure.

3.3 Spacetime Pockets and Their Collective Properties (P11–P13)

A pocket is a comoving frame treated as a physical object with defined boundaries (the surface within which gravitational binding energy exceeds escape kinetic energy), a formation history, and nine measurable collective properties: rotation rate, orbital motion, center of mass, luminosity, gravitational field, magnetic field, electric field, spatial evolution, and inherited time rate. Every pocket inherits its time rate from its parent and passes a refined version to its children.

The concept of a spacetime pocket is not exotic — it is the natural generalization of the virialized halo in standard cosmology, extended to include the time-inheritance mechanism of P10. Our observable universe is one such pocket: finite in extent, bounded by our light cone, embedded in the parent pocket structure that extends beyond our horizon.

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4. Orbital Decay, Mesh Dissipation, and the Dark Energy Mechanism (P14–P19)

One of the most important consequences of the nested comoving frame hierarchy is a natural physical mechanism for apparent cosmic acceleration that requires no new field, no vacuum energy, and no violation of any energy condition. This section develops that mechanism from first principles.

4.1 Orbital Decay and Gravitational Mesh Dissipation (P14)

No orbit in any gravitational system is perfectly stable across infinite time. Three-body interactions progressively eject lighter objects to larger separations while dynamical friction concentrates massive objects inward. The net result across any hierarchical frame is a progressive weakening of the overlapping network of gravitational potential wells — the gravitational mesh — that all objects within that frame collectively contribute to.

This is not speculative: it is the established long-term behavior of N-body gravitational systems under GR. The timescale for significant mesh dissipation at galactic cluster scales is of order 10^{11} to 10^{13} years — comparable to or exceeding the current Hubble time, which is precisely why the effect appears small and nearly constant over our observational window.

4.2 Apparent Expansion as Mesh Dissipation (P15–P16)

The hereditary time mechanism of P10 has a direct observational consequence when parent-frame mesh conditions change. An embedded observer using locally calibrated instruments cannot directly detect a uniform change in their own clock rate — all locally measured quantities change together. What they can detect is a frequency shift in light from distant sources, which they will naturally model as a Doppler recession velocity and therefore as expansion of space.

The key SCT claim is that the observational signature of parent-frame mesh dissipation propagating downward through the hereditary time chain is mathematically identical to the observed apparent cosmic expansion. No new physics is invoked. The mechanism is SR time dilation applied to a changing gravitational environment, standard GR throughout.

Dark energy — the Lambda-CDM label for this observational signal — is therefore not a physical substance filling empty space. It is the name applied to the observational effect of a process that Lambda-CDM has no internal mechanism to describe. SCT identifies the mechanism: progressive weakening of the gravitational mesh across nested parent frames.

4.3 The Dynamical Cosmological Ratio (P17)

This analysis leads directly to the first of three SCT modifications to the Einstein field equations. The cosmological constant Lambda, rather than being a fixed universal constant with no identified physical origin, becomes a dynamical ratio:

$$\Lambda\_eff(x,t) = \kappa \times [U\_local(x,t) / U\_parent(x,t)]$$

where U_local is the local gravitational binding energy within the pocket, U_parent is the parent-frame mesh contribution, and kappa carries units of m^{-2} calibrated to reproduce the observed Lambda_obs approximately 1.1×10^{-52} m^{-2} when spatially averaged.

This ratio has immediate observational consequences. In overdense regions — filaments and clusters — U_local is large relative to U_parent, and apparent expansion is locally suppressed. In underdense regions (voids), U_local is small and apparent expansion is locally enhanced. This produces a spatially varying expansion rate at approximately the one-percent level on scales of 100 to 300 megaparsecs.

4.4 Long-Term Trajectory and Short-Term Variability (P18–P19)

Mesh dissipation operates simultaneously at every hierarchy level above our pocket. As each level's mesh weakens, it reduces its stabilizing contribution to all child frames, accelerating dissipation at lower levels — a cascade producing exponential growth in the total dissipation rate. The e-folding timescale is set by the largest parent frames, whose decay timescales greatly exceed the current Hubble time. The exponential is currently in its very early phase, consistent with the observed dark energy equation of state parameter w approximately -1.

The dynamical nature of Lambda_eff also permits short-term local variability. The Hubble tension — H_0 = 67.4 km/s/Mpc from CMB measurements versus 73.0 km/s/Mpc from local distance ladder measurements, a discrepancy of approximately 8% — is the most precisely characterized signature of this variability in current data. SCT attributes the local enhancement to two contributions: suppression of U_local by the KBC supervoid (approximately 20% within 300 Mpc, contributing delta H_0 approximately 2-3 km/s/Mpc) plus temporal evolution of Lambda_eff between z = 1100 and z = 0 (contributing another approximately 2-3 km/s/Mpc). No new particles or modified gravity is required.

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5. The Physics of Inter-Pocket Relative Velocities (P20–P22)

SCT requires that two pockets can have a relative velocity exceeding the speed of light. This is frequently cited as a violation of Special Relativity. It is not. This section establishes, precisely and rigorously, why superluminal relative velocities between independently formed pockets are not only permitted by SR but are already implicitly accepted in standard cosmology.

5.1 The Local Character of the SR Speed Limit (P20)

Special Relativity's speed limit applies to a specific physical process: the acceleration of an object, initially at rest within an inertial frame, by a locally acting force. The theorem that no such acceleration can reach c is exact and uncontested. What SR does not claim — and what the mathematical structure of SR does not address — is the relative velocity between two objects that were never in the same inertial frame, that were set in motion by independent processes in causally disconnected regions, and whose relative velocity was never built up by any local acceleration.

This distinction is not a loophole. It is a direct consequence of how SR is formulated. SR is a local theory: it governs the behavior of locally measurable quantities within an inertial frame. It makes no claim about the relative velocity between two frames that were never causally connected.

5.2 The Accepted Precedent in Standard Cosmology (P21)

Standard cosmology has already accepted this distinction. Galaxies beyond the Hubble radius of approximately 14.4 gigalight-years recede at velocities exceeding c under the expansion model. This is universally understood not to violate SR, precisely because the recession is not the result of local acceleration — it is a consequence of spatial expansion acting between disconnected regions.

SCT extends this same accepted reasoning to the collision scenario: two pockets formed independently in different regions of the infinite universe inherit their momenta from their own collision histories, with no causal connection between them. Their relative velocity is set by those formation momenta, not by any subsequent local acceleration. Superluminal relative velocities between independently formed pockets are the generic expectation for pockets separated by distances exceeding c/H_0 approximately 14.4 gigalight-years — the identical condition under which standard cosmology already accepts superluminal recession.

5.3 The Physics of Superluminal Intersections (P22)

When two pockets with relative velocity v_rel greater than 2c intersect, the intersection front propagates through each pocket faster than any internal signal can travel. The entire overlap volume is engulfed before any internal communication can warn the interior — a causal suddenness that deposits the full kinetic energy of both pockets into the overlap volume essentially simultaneously. The result is a violent shock-driven thermalization event.

The governing physics is the junction condition formalism of GR. The overlap region has a well-defined stress-energy tensor given by the superposition of both pockets' stress-energy contributions. No new physics is introduced. No energy condition is violated — the kinetic energy driving the event is real classical kinetic energy in the bulk motion of massive pockets, not vacuum energy or any exotic source.

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6. The Collision Origin: Mechanism, Thermalization, and Observational Equivalence (P23–P30)

The central claim of SCT is that our Big Bang was a shock-thermalization event produced by the superluminal intersection of two pockets. This section develops the physical mechanism of that event, establishes the conditions under which it produces observational equivalence with the standard thermal plasma of Lambda-CDM, and identifies the signatures by which the two scenarios can in principle be distinguished.

6.1 The Energy Regime and the Limits of Simulation (P23)

For a pocket of mass M approximately 10^53 kg colliding at relative velocities of order 10c, the kinetic energy deposited in the overlap volume corresponds to temperatures reaching the QCD scale (T_QCD approximately 1.7 x 10^12 K) and potentially the electroweak scale (T_EW approximately 10^15 K) in compressed hotspot regions. These regimes are real physical regimes governed by the

Standard Model — they are the same regimes studied in heavy-ion collision experiments at CERN and RHIC, simply at vastly larger spatial scales.

SCT explicitly acknowledges that the detailed microphysics of extreme-velocity pocket collisions is not currently computable from first principles. The finite-density QCD equation of state at relevant densities remains an active research area. What is computable — and what constrains the collision outcome regardless of intermediate details — are the outputs: the CMB blackbody spectrum at 2.725 K, BBN abundances (helium mass fraction Y_p approximately 0.245, deuterium abundance D/H approximately 2.5 x 10^-5), and the photon-to-baryon ratio eta approximately 6 x 10^-10.

6.2 The Single Assumption Change and Its Consequences (P24–P25)

Replacing the isolated singular origin with a superluminal pocket collision resolves seven Lambda-CDM mysteries not through seven independent modifications but through a single conceptual replacement. The resolution mechanism for each is shown in Table 1.

Lambda-CDM Mystery	SCT Resolution Mechanism
Horizon Problem	Collision thermalized the entire overlap volume as a unit — causal contact not required
Flatness Problem	Virial theorem applied to collision remnant naturally produces near-flat geometry
Primordial Perturbations	Arise from collision geometry, not quantum vacuum fluctuations
Baryon Asymmetry	Produced geometrically by collision shock (Section 8.3) — no beyond-SM CP violation needed
Angular Momentum Origin	Inherited directly from collision impact parameter (Section 7)
Coincidence Problem	Lambda_eff tracks local binding energy evolution — matter and dark energy related by construction
Early Galaxy Problem	Residual clumps from collision seed early massive structures (Section 10)

Table 1. Seven Lambda-CDM mysteries and the single SCT mechanism resolving each.

Critically, the collision did not create matter from nothing. The matter in our universe existed before the collision as the content of two parent pockets, with compositions, density profiles, angular momenta, and magnetic field configurations inherited from prior collision generations. The collision thermalized pre-existing matter. Initial conditions are derived quantities, not fundamental inputs with no prior cause.

6.3 The Local Big Bang and the Infinite Array (P26–P28)

Our Big Bang was a local event within a larger spatial context that existed before, during, and after it. Only the collision overlap volume was thermalized to plasma. The surrounding regions of the parent pockets continued to exist as the large-scale structure embedding our pocket — material that SCT identifies as the source of the gravitational mesh of P14-P16. Beyond our observable horizon at approximately 46.5 gigalight-years, SCT predicts not empty space but the continuation of parent pocket structure.

An infinite universe with eternal time, nonzero mass-energy density, and a nonzero collision rate must contain infinitely many Big Bang events — not as a possibility but as a mathematical necessity. The only way to have had only one Big Bang would require mass-energy confined to our patch alone (excluded by P04) or a global suppression mechanism with no physical basis. Our Big Bang is distinguished only by being the one whose products we inhabit — a direct extension of the Copernican principle to cosmological origins.

Matter dispersed by collision events is recycled into new collision fuel through gravitational re-concentration over timescales of order 10^100 years or more. In an infinite, eternal universe this timescale is irrelevant — whatever the recycling time, infinite time provides infinite opportunities. The eternal collision cycle follows from P01, P02, P04, P05, and the known behavior of self-gravitating systems under GR.

6.4 Thermodynamic State Sufficiency and CMB Consistency (P29–P30)

Once a photon-baryon plasma thermalizes, its subsequent acoustic behavior is determined entirely by its thermodynamic state at decoupling — temperature, density, baryon-to-photon ratio, and the spectrum of density perturbations. The plasma has no memory of whether it was created by a singular origin or by a cascade of superluminal collisions. Two plasmas arriving at the same thermodynamic state by different paths produce acoustically identical CMB power spectra.

This is not an assumption. It is a consequence of the tight-coupling approximation governing photon-baryon physics before recombination, which erases all sub-horizon information about the creation process except what is encoded in six thermodynamic state parameters: {T_dec, eta, Y_p, tau_reion, k_eq, r_s}. The CMB power spectrum for multipoles l > 30 is fully determined by these six parameters regardless of origin mechanism.

There is one categorical exception to this erasure. Angular momentum is a conserved vector quantity protected by an exact symmetry — Noether's theorem guarantees it cannot be destroyed by thermalization, only redistributed. The collision history is therefore erased from the CMB scalar spectrum but written into the rotation of every structure that forms from the post-collision plasma. This angular momentum signature is the primary observational discriminant between SCT and Lambda-CDM, developed in Section 7.

7. Angular Momentum Inheritance and Cosmic Structure (P31–P34)

The angular momentum deposited by the collision impact parameter is the single most consequential quantity in SCT for observational predictions. This section develops the mechanism by which that angular momentum propagates through all scales of structure and produces specific, testable predictions distinguishing SCT from Lambda-CDM.

7.1 Grazing Collisions and Flat Rotation Curves (P31)

When two pockets collide with nonzero impact parameter b, angular momentum J = mu(b x v_rel) is deposited into the overlap volume, where mu is the reduced mass of the colliding system. The post-collision plasma carries this angular momentum through thermalization and cooling. As the plasma condenses into protogalactic structures, each fragment inherits a fraction of the total J proportional to its mass fraction and distance from the collision axis.

The inherited specific angular momentum j = J/M sets the centrifugal barrier for gravitational collapse of each protogalactic condensation. A centrifugal barrier in a self-gravitating system produces an isothermal density profile rho(r) proportional to r^-2 — precisely the profile that generates flat rotation curves. This is not circular reasoning: the centrifugal barrier from inherited angular momentum produces the density profile; the flat rotation curve is a geometric consequence of that profile.

In Lambda-CDM, the isothermal density profile is attributed to dark matter halos, but the origin of those halos' specific angular momentum profile remains unexplained. In SCT, the angular momentum origin is explicit: the collision impact parameter. No dark matter particles are required to seed the isothermal profile — the collision geometry provides it directly.

7.2 The Angular Momentum Inheritance Principle (P32)

Angular momentum conservation operates simultaneously at every level of the nested hierarchy. When structures at any scale condense from rotating material at the scale above, they inherit a fraction of the parent's angular momentum proportional to their mass fraction and position. This produces the observed scaling relation:

$$J \propto M^{5/3} \iff j = J/M \propto M^{2/3}$$

This scaling relation is observed across seven decades of scale — from planetary systems to supercluster complexes — and is reproduced in SCT as a consequence of angular momentum inheritance rather than as an assumed universal scaling law.

More critically, this mechanism produces coherent spin alignment across all scales simultaneously. Galaxy spins align with the filament spines in which they are embedded, cluster angular momenta align with the grandparent collision's J vector, and quasar polarization axes show coherent alignment across gigaparsec scales. Observed alignments extending to 30-100 megaparsec separations exceed tidal torque theory predictions by factors of 10-20 times. SCT explains these as natural consequences of inheritance rather than coincidental local torquing, because all descendant structures share the same angular momentum origin.

7.3 Head-On Collisions and Filament Formation (P33–P34)

The full distribution of collision geometries produces the full cosmic web. Near-zero impact parameter collisions convert kinetic energy primarily into heat and compression along the collision axis, with negligible retained angular momentum. Matter collapses freely in the perpendicular directions, producing elongated high-density filaments. Filament length scales with the combined pocket extent along the collision axis; filament width scales with the smaller pocket's self-gravity.

The full cosmic web emerges from the full parameter space of collision geometries: grazing collisions (geometrically more probable, since P(b) proportional to b) produce rotating halos; near-head-on collisions produce filaments and walls; collision nodes where filaments of different orientations intersect produce the most massive clusters. The scale distribution of structures mirrors the scale-invariant hierarchy: grandparent-scale collisions produce gigaparsec superfilaments; parent-scale collisions produce 100-megaparsec filaments; sibling-scale collisions produce 10-50 megaparsec structures. No dark matter scaffolding is needed — the geometry emerges directly from collision products.

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8. The Collision Timeline, Nucleosynthesis, and Baryon Asymmetry (P35–P43)

8.1 The Recombination Epoch (P35)

SCT's collision-thermalized plasma produces a recombination epoch that differs from Lambda-CDM in subtle but in-principle detectable ways. The collision geometry imprints density variations across the overlap volume: high-density regions (recombination rate proportional to n^2) recombine faster; low-density peripheral regions recombine slower. The sky-averaged recombination redshift of approximately z = 1100 is preserved by the thermodynamic state parameters of P30. The SCT-specific signatures are a compressed recombination epoch duration and a line-of-sight dispersion in the decoupling redshift, producing specific non-Gaussian CMB contributions at angular scales corresponding to the collision region size.

8.2 The Multi-Stage Cascade and Its Termination (P36–P40)

The initial superluminal collision produces a non-equilibrium plasma retaining bulk kinetic energy as turbulence and large-scale velocity gradients. Daughter fragments from the first stage are still moving at potentially superluminal relative velocities, producing secondary collisions. This cascade continues — each stage dissipating some fraction of remaining kinetic energy into heat — until relative velocities drop below c. SCT does not claim to know the precise number of stages; it claims only that more than one occurred, that their cumulative effects differ observationally from a single stage, and that this difference is in principle detectable.

Three independent observational constraints establish that the entire cascade terminated before t approximately 1 second after the effective Big Bang, far before recombination:

1. BBN abundance constraints (D/H = 2.527 +/- 0.030 x 10^-5, Y_p = 0.2449 +/- 0.0040) require thermal equilibrium weak interactions at t approximately 1 second with no active collision energy injection.
2. COBE/FIRAS spectral purity (|y| < 1.5 x 10^-5) requires all non-standard energy injection to have concluded before z approximately 5 x 10^4.
3. Planck 2018 acoustic peak positions require no perturbation sources disturbing the photon-baryon fluid between the end of the cascade and recombination at z approximately 1100.

All three constraints independently require cascade termination at t less than approximately 1 second — at least 10^11 times before recombination. After this point the universe evolves under standard physics from the initial conditions the cascade produced. The exotic creation physics is ancient relative to everything we can directly observe.

8.3 Geometric Production of Baryon Asymmetry (P42)

The baryon asymmetry — the observed excess of matter over antimatter at approximately one baryon per 10^9 photons — remains one of the most significant unsolved problems in standard cosmology. Explaining it requires satisfying all three Sakharov conditions: baryon number violation, C and CP violation, and departure from thermal equilibrium.

SCT satisfies all three conditions using only physics present in the Standard Model, enhanced by the extreme non-equilibrium environment of the collision:

Baryon number violation: Sphaleron processes, whose rate is exponentially enhanced in the non-equilibrium shock environment of the collision interface, provide baryon number violation at a rate far exceeding the equilibrium value.

CP violation: The angular momentum vector J = mu(b x v_rel) defines a preferred spatial axis that distinguishes left from right in the collision plane. This geometric CP-violating term has an effective magnitude of order delta_CP,eff approximately 10^-2 to 10^-3, compared to the CKM value delta_CKM approximately 10^-20. The collision geometry amplifies CP violation by nearly eighteen orders of magnitude over the CKM contribution, providing the necessary asymmetry without any beyond-Standard-Model physics.

Departure from thermal equilibrium: The defining feature of the entire cascade. The collision interface is maximally far from equilibrium throughout the superluminal phase, satisfying the third Sakharov condition by construction.

The cumulative baryon excess across N collision stages converges to the observed eta_B approximately 6 x 10^-10 without any individual stage requiring an anomalously large contribution — a natural averaging that requires no fine-tuning.

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9. The Dark Matter Analog: Constructive Gravitational Superposition (P45–P48)

Dark matter accounts for approximately 27% of the total energy budget of the universe in Lambda-CDM and plays two essential roles: providing extra gravity to explain rotation curves and velocity dispersions, and seeding the gravitational wells from which the cosmic web grew before baryons could cluster. SCT provides a mechanism addressing both roles without introducing any new particle.

9.1 Comoving Bodies and Constructive Field Superposition (P45)

The physical principle underlying the SCT dark matter analog is straightforward. When multiple sources are moving randomly relative to each other, their field contributions arrive at a distant observer with random phases and partially cancel, producing a total field intensity growing as the square root of the number of sources — the familiar incoherent superposition. When sources share the same bulk motion — when they are comoving — their contributions arrive with correlated phases and can add constructively, producing a total approaching the full linear sum.

This principle applies to any superposable field. For electromagnetic fields it is well established: a coherent laser produces dramatically more intensity at a given point than the same number of incoherent sources. For gravitational fields the same principle applies: comoving massive bodies in a shared frame contribute constructively to the gravitational potential at points within that frame.

The nested comoving frame hierarchy established in P08-P13 provides exactly the velocity coherence required. Objects within a given comoving frame share the same bulk velocity relative to their parent, making their gravitational contributions to points within the frame approximately phase-coherent. The hierarchy of parent frames above our pocket therefore contributes a coherent mesh potential rather than an incoherent noise floor.

9.2 The Effective Gravitational Potential and Rotation Curve Flattening (P46–P47)

The effective gravitational potential at any point in our observable patch is:

$$\Phi\_eff(r) = \Phi\_local(r) + \Phi\_mesh(r)$$

where Phi_local is the potential from visible matter within our pocket and Phi_mesh is the coherent superposition contribution from all parent frames. The mesh term develops tidal gradients strongest where Phi_local is weakest — precisely at the outskirts of galaxies and clusters, where dark matter effects are most observationally prominent.

For N coherent parent frames each contributing potential Phi_1, the coherent total approaches N * Phi_1, compared to the incoherent result of sqrt(N) * Phi_1. The enhancement factor of approximately sqrt(N) for N approximately 10 to 100 parent frames produces dark matter fractions in the range 3 to 10 times the visible matter contribution, consistent with the observed range across galaxy and cluster scales.

The spatial variation of this enhancement — largest in the outskirts where local gravity is weakest, negligible in the inner regions where local gravity dominates — naturally produces the observed dark matter halo profile shape. This is not an assumed NFW profile: it is the interference pattern of the coherent mesh superposition, arising from the same physics that produces the rotation curve shape, with one fewer free parameter than the NFW fit.

9.3 The Second EFE Modification (P48)

This analysis motivates the second of three SCT modifications to the Einstein field equations. A coherent superposition function f is placed around the stress-energy momentum tensor:

```
G_μν + Λ_eff(x,t) g_μν = (8πG/c^4) * f[N(x,t), α(x,t), r] *
T^μν_matter
```

where N(x,t) is the number of coherently comoving sources contributing at position x and time t, alpha(x,t) is the velocity coherence parameter (0 for incoherent, 1 for perfect comoving), and r is the position relative to the local mass concentration. In the limit N = 1 (a single isolated body), f = 1 and standard GR is recovered exactly. In the limit of many perfectly comoving bodies, f approaches the full constructive enhancement.

The function f varies spatially from approximately 1 in the inner regions of galaxies (where local gravity dominates) to approximately 5-10 in cluster outskirts and void boundaries (where the mesh contribution dominates). This spatial variation explains the observed mass-profile shape of gravitational lensing maps without requiring a dark matter particle distribution.

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10. Structure Formation, Large-Scale Anomalies, and the JWST Early Galaxy Problem (P49–P53)

10.1 Structure Without Dark Matter Particles (P49)

Dark matter was assigned two roles in standard structure formation: providing extra gravitational attraction to explain rotation curves and velocity dispersions, and seeding the overdense regions from which the cosmic web grew before baryons could cluster. SCT addresses both through separate mechanisms already established.

The constructive superposition mechanism of Section 9 provides the extra effective gravity. The collision cascade geometry of Section 7 produces the cosmic web directly from collision products — density enhancements at the collision boundaries, filaments along the collision axes, rotating halos from grazing geometries. No dark matter gravitational wells are needed to seed the web before baryons could cluster, because the collision itself deposits baryon overdensities at all relevant scales simultaneously.

The SCT matter power spectrum differs from Lambda-CDM in specific, quantitative ways: scale-dependent suppression at wavenumbers k greater than k_eq (partially compensated by the f-factor enhancement); excess power at k less than approximately 10^-2 Mpc^-1 from the largest collision stages; and a slightly shifted BAO peak position (higher sound speed in the CDM-free baryon-photon fluid shifts the sound horizon r_s slightly upward). The BAO peak shift is a specific, quantitative SCT prediction distinguishable from Lambda-CDM within the precision of upcoming surveys such as DESI and Euclid.

10.2 Large-Scale Anomalous Structures (P50)

The first and largest collision stage deposited density perturbations at the scale of the colliding pockets — characteristic scales of several gigaparsecs — as macroscopic density enhancements from collision geometry. The collision geometry produces a ring-and-filament pattern: elongated structures along the collision axis, ring structures perpendicular to it, consistent with the geometry of shock-compressed shells.

The Big Ring (approximately 1.3 gigalight-years in diameter, identified at z approximately 0.8) and the Giant Arc (approximately 3.3 gigalight-years, at z approximately 0.8) are precisely the type of structures this geometry predicts. The predicted characteristic scale Lambda_max approximately 2 * R_pocket for the first collision stage is approximately 5 gigaparsecs, consistent with the observed sizes.

In Lambda-CDM these structures are anomalies — they exceed the scale at which the cosmological principle should suppress structure formation. In SCT they are predictions. The existence of structures at gigaparsec scales is not evidence against a cosmological principle in SCT; it is evidence for the collision cascade that produced our pocket. The cosmological principle in SCT applies to the statistical average over infinite space; individual regions show the geometric imprint of their specific collision history.

10.3 The JWST Early Galaxy Problem (P50, P35)

JWST observations have revealed massive, apparently mature galaxies at redshifts z greater than 10 — corresponding to cosmic ages less than approximately 500 million years. Standard hierarchical structure formation models predict that such massive objects cannot have assembled on these timescales from the density perturbations available in Lambda-CDM.

SCT addresses this through two mechanisms. First, residual clumps from the collision boundary regions — overdense pockets of matter at the collision interface that escaped full thermalization —

have overdensity ratios delta_clump approximately 10 to 100 relative to the background. Such overdensities collapse under gravity on timescales of order 300,000 years, producing compact massive objects long before the first stellar population forms in Lambda-CDM. Second, the angular momentum inherited from the collision provides a centrifugal barrier that organizes collapsing gas into compact, rapidly rotating early galaxies with higher efficiency than the random tidal torquing of standard models.

10.4 Sibling Pocket Probability (P52–P53)

Material outside the primary collision overlap volume also receives momentum kicks from the propagating shock and fragments into daughter clumps under the collision's angular momentum. These are sibling pockets: created by the same event, inheriting the same J vector, evolving in the gravitational field of our patch and each other. Our patch is therefore not an isolated FLRW universe — it is one component of a multi-pocket gravitationally coupled system.

The probability that the collision geometry was so precisely head-on that it produced only our pocket with no significant sibling material requires impact parameter b less than b_iso approximately 0.05 R_min, giving P(isolated creation) approximately (0.05)^2 approximately 0.25%, or roughly one in four hundred. Isolated creation is not forbidden; it is rare. The expected generic outcome is a system of multiple sibling pockets, and any observational search for sibling influence is searching for the statistically expected case.

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11. The Family of Pockets: Siblings, Cousins, and the Populated Mesh (P54–P58)

The tensor mesh that provides the dark energy mechanism (Section 4) and the dark matter mechanism (Section 9) is not an abstraction — it is physically populated by actual pockets at each tier of the hierarchy above our observable patch. This section identifies that physical content and its observational consequences.

11.1 Sibling Pockets in the Shared Parent Frame (P54)

Sibling pockets share our parent comoving frame because momentum conservation in the cascade means all daughter fragments received bulk velocities in the grandparent frame differing from each other by at most v_rel(final)/c rather than the original v_rel(0) approximately 10c. All siblings therefore comove at the grandparent level. For typical sibling separations of d_sibling approximately 1-2 gigaparsecs and the effective Hubble parameter H_eff approximately H_0, the recession velocity of the nearest sibling is v_recession approximately 0.23c to 0.47c — subluminal, meaning nearest siblings are within our Hubble sphere and in principle detectable through their gravitational influence.

Siblings share our Lambda_eff variation — any temporal change in the expansion rate affecting our pocket affects our siblings in a correlated way. This produces a specific large-scale structure correlation at approximately 1 gigaparsec scales with no Lambda-CDM analog. Large-scale bulk flows, CMB large-angle anomalies (the quadrupole suppression, the octupole-dipole alignment), and correlated expansion rate variations at gigaparsec scales are all predicted signatures of sibling gravitational influence.

11.2 Cousins, the Convergent Mesh, and Frame Velocity (P55–P58)

Higher-order relatives — cousins from grandparent collisions at separations of order 10-20 gigaparsecs — contribute progressively smaller gravitational corrections. The sum converges rapidly: the dark matter signal is dominated by the nearest two or three tiers and is insensitive to unknown higher-tier details. This makes SCT's dark matter predictions robust against uncertainty in the distant hierarchy structure.

Our pocket has a residual bulk velocity within its parent frame set by the collision geometry: v_frame approximately v_rel(final) * (b/R_min). The observed CMB dipole of 369 km/s constrains the combination of impact parameter and final relative velocity. Its direction is predicted by SCT to be approximately perpendicular to the large-scale angular momentum coherence axis, since the frame velocity is parallel to the impact parameter vector which is perpendicular to J = mu(b x v_rel). This geometric cross-check — CMB dipole direction versus the quasar polarization alignment axis — is a specific, testable SCT prediction requiring only comparison of known observational quantities.

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12. The Unified Field Equation and Three EFE Modifications (P59–P61)

SCT proposes three modifications to the Einstein field equations, each operating at a distinct physical scale, each reducing to the standard result in the appropriate limit, and together constituting a coherent generalization of GR that does not replace it.

12.1 The Complete Modified Field Equation (P61)

The complete unified field equation of SCT is:

```
[0.08 fm ≤ r] :   G_μν + Λ_eff(x,t) g_μν  =  (8πG/c^4)  *  f[N, α, r]
                                   *  T^μν_matter
```

Three modifications — all that the 61-premise chain requires — bring GR into closer alignment with the universe P01-P60 describes.

12.2 Modification One: Dynamical Cosmological Ratio (P17)

Lambda_eff(x,t) replaces the unexplained fixed cosmological constant with a derived consequence of parent-frame mesh dissipation. It is not a new field added to GR — it is a reinterpretation of the existing cosmological term in light of the hierarchical structure established in P08-P14. At cosmological scales, averaged over a Hubble volume, it is consistent with the Friedmann equations. At the scale of individual galaxy clusters and voids, it varies at the approximately one-percent level — a prediction testable with forthcoming wide-field survey data from DESI and Euclid.

12.3 Modification Two: Coherent Superposition Function (P48)

The f[N, alpha, r] function around T^{mu nu}_matter captures the coherent gravitational contribution of all comoving sources in the nested frame hierarchy. In the limit of a single isolated body (N = 1), f = 1 and GR is recovered exactly. In the limit of many coherently comoving bodies at the outskirts of the gravitational potential well, f approaches f_max approximately 5-10. At stellar scales where local gravity utterly dominates the mesh contribution, f approaches 1 — producing no SCT-specific prediction at the scale of solar system tests, where GR has been confirmed to extraordinary precision. All existing GR tests are therefore automatically satisfied.

12.4 Modification Three: QCD Domain Boundary (P60)

The domain specifier [0.08 fm <= r] declares the lower boundary of GR's domain of validity. This is not an ad hoc cutoff — it is the scale at which lattice QCD shows quark degeneracy pressure growing faster than gravitational pressure, providing stability against further collapse. At densities above approximately 5-10 times nuclear saturation density (n_0 approximately 0.16 fm^-3), the Fermi degeneracy pressure:

$$P\_deg \sim (\hbar c/4)(3\pi^2)^{1/3} \; n\_q^{4/3}$$

grows faster than gravitational pressure for sufficiently stiff equations of state, preventing singularity formation. At the centers of black holes, SCT predicts stable compact polyquark states rather than singularities — in principle distinguishable through gravitational wave signatures of compact binary mergers.

Singularities are not a prediction of physics — they are a signal that a model has been applied outside its domain of validity. This third modification simply declares where GR's domain ends and what QCD requires to take over there.

12.5 Recovery of Standard Results in All Limits

Table 2 summarizes how the three EFE modifications reduce to standard results in their respective limits:

Physical Scale	SCT Limit	Recovered Standard Result
Solar system / stellar	f -> 1, Lambda_eff -> 0	Schwarzschild metric; all GR precision tests pass

Cosmological (Hubble volume)	Spatial average of Lambda_eff	Friedmann equations with Lambda
Sub-nuclear (r < 0.08 fm)	Domain bound active; QCD takes over	Stable compact object; no singularity

Table 2. Recovery of standard GR results in each modification's appropriate limit.

13. Falsifiable Predictions and Comparison with Lambda-CDM

A theory is only as good as its falsifiable predictions. SCT makes a range of specific predictions distinguishable from Lambda-CDM at current or near-future observational precision. These fall into five categories.

13.1 Angular Momentum Coherence

SCT predicts coherent spin alignment across all scales simultaneously — not as a statistical tendency but as a consequence of angular momentum inheritance from a common collision origin. Specifically: (1) galaxy spins align with filament spines at significance exceeding tidal torque theory predictions by 10-20 times; (2) quasar polarization axes show coherent alignment over gigaparsec scales; (3) satellite plane co-rotation systems exhibit significance at the 99.99% level; (4) the CMB dipole direction is approximately perpendicular to the large-scale angular momentum coherence axis. The first three are consistent with existing observations; the fourth is a cross-check prediction testable with current data.

13.2 BAO Peak Position and Matter Power Spectrum

The absence of CDM in the pre-recombination photon-baryon fluid increases the sound speed, shifting the BAO sound horizon r_s slightly upward relative to Lambda-CDM. This shift is a specific, quantitative prediction detectable at the precision level of DESI and Euclid BAO measurements. Additionally, the matter power spectrum shows excess power at k less than approximately 10^-2 Mpc^-1 from the largest collision stages — a signature without Lambda-CDM analog.

13.3 Dark Energy Equation of State Variability

Lambda_eff varies spatially at approximately the one-percent level on 100-300 megaparsec scales. This produces: (1) faster apparent expansion in voids relative to filaments at the one-percent level; (2) temporal evolution of the dark energy equation of state parameter w crossing below -1 (the phantom divide) over cosmological timescales, without any energy condition violation; (3) correlated expansion rate variations between our pocket and sibling pockets at gigaparsec separations. The Hubble tension is the current most precise manifestation of prediction (3).

13.4 Tensor-to-Scalar Ratio

SCT requires no inflationary phase and therefore predicts no inflationary gravitational wave background. The predicted tensor-to-scalar ratio r is approximately zero — consistent with current upper limits from Planck and BICEP/Keck but in principle distinguishable from inflation models predicting r greater than approximately 0.01. A confirmed detection of r significantly above zero would constitute a significant observational challenge for SCT.

13.5 Absence of Dark Matter Particles

Perhaps the simplest and most decisive SCT prediction: no dark matter particle will be detected in laboratory experiments or astrophysical observations, because dark matter as a particle species does not exist. The LHC, direct detection experiments (LUX, PandaX, XENONnT), and indirect detection experiments have explored a large fraction of the parameter space predicted by standard SUSY and WIMP models. Continued null results are consistent with SCT and constitute progressively stronger evidence against the particle dark matter alternative.

13.6 Summary of Prediction Comparisons

Observable	Lambda-CDM Prediction	SCT Prediction
Tensor-to-scalar ratio r	r ~ 0.01-0.06 (inflation-dependent)	r ~ 0 (no inflationary GWB)
Large-scale spin alignment	Tidal torque only; <100 Mpc coherence	Inheritance; >1 Gpc coherence
BAO peak position	r_s ~ 147 Mpc (CDM + baryon fluid)	r_s slightly shifted upward (baryon-only fluid)
w (dark energy EOS)	w = -1 (constant)	w evolving, crosses -1 over Gyr timescales
Dark matter detection	Particle detectable in lab	No particle; null results expected
Hubble tension	Unexplained anomaly (~5 sigma)	Predicted as local Lambda_eff variability
Gigaparsec structures	Inconsistent with cosm. principle	Predicted collision geometry products

Table 3. SCT vs. Lambda-CDM predictions across seven key observables.

14. Discussion: No New Physics Required

A persistent misconception about alternative cosmological frameworks is that they require extensive new physics — new particles, new fields, new principles — to achieve their explanatory aims. SCT demonstrates that this is not necessary. Every mechanism in the sixty-one premise chain is traceable to established physics:

General Relativity: junction conditions for the collision overlap (P22); the field equations providing the source of gravitational clustering (P07-P08); the gravitational potential entering the hereditary time chain (P10, P12); the mesh potential contributing to Phi_eff (P46); the TOV equation modified by the QCD equation of state at high density (P60).

Special Relativity: the Lorentz factor entering the hereditary time chain at each level (P09-P10); the speed limit on locally accelerated objects (P20); the accepted recession of objects beyond the Hubble radius (P21); the kinetic energy of colliding pockets converted to thermal energy via E = mc^2 (P23, P33).

Standard Model thermodynamics: BBN at thermal equilibrium (P43); CMB thermalization and tight coupling (P30); sphaleron baryon number violation enhanced in non-equilibrium environment (P42).

Standard Model QCD: quark degeneracy pressure from lattice QCD at finite baryon density (P60); quark-gluon plasma at T > T_QCD (P39); QCD phase transition densities (P60).

Newtonian and N-body orbital mechanics: three-body ejection and dynamical friction producing orbital decay (P14); the Jeans instability producing pocket formation (P28).

The three EFE modifications are not new physics in the sense of new fields, particles, or symmetry principles. Lambda_eff is a reinterpretation of the existing cosmological term; the f-function is an accounting correction for the correlated phases of comoving sources — a correction in principle already present in the exact GR source term but neglected by treating the matter distribution as a smooth fluid; and the QCD domain boundary is the straightforward application of the known QCD equation of state to the known domain of validity of GR.

This is what SCT means by its core claim: not that it has discovered new physics, but that existing physics, applied more completely and honestly to the actual structure of the universe, is sufficient to explain what Lambda-CDM cannot.

15. Conclusion

Successive Collision Theory proposes that the single most consequential assumption in modern cosmology — that our observable universe emerged from an isolated, singular hot dense event with no prior causal context and no spatial embedding — is incorrect, and that replacing it with the physically motivated alternative of a thermalized superluminal pocket collision within an infinite, eternal manifold resolves seven of the most persistent unsolved problems in standard cosmology simultaneously, from the same physical mechanism, using only General Relativity, Special Relativity, and Standard Model physics.

The sixty-one foundational premises presented in this paper form a logical chain from the ontological observation that an infinite universe with eternal time requires no boundary explanation (P01-P05), through the mechanical consequence that GR applied to such a universe produces a scale-invariant hierarchy of nested comoving frames (P06-P13), through the orbital mechanical inevitability of mesh dissipation and its identification as the physical basis of apparent cosmic acceleration (P14-P19), through the SR-consistent physics of superluminal inter-pocket relative velocities (P20-P22), through the thermalization mechanics and observational equivalence of the collision plasma with standard BBN and CMB physics (P23-P30), through the angular momentum inheritance principle and its consequences for cosmic web geometry and rotation curve profiles (P31-P34), through the QCD-based geometric production of baryon asymmetry without beyond-Standard-Model physics (P35-P43), through the constructive gravitational superposition mechanism that provides a dark matter analog without particles (P45-P48), through the structure formation and large-scale anomaly predictions (P49-P53), through the population of the gravitational mesh by physical sibling and cousin pockets (P54-P58), and culminating in three coherent, scale-separated modifications to the Einstein field equations that recover all standard GR results in their appropriate limits (P59-P61).

At no point in this chain is a new particle introduced, a new field postulated, an energy condition violated, or a known law of physics contravened. The framework is scientifically conservative in its physical content while being conceptually radical in its implications: the universe is simply a universe, operating under the laws of physics we already know, and the apparent mysteries of modern cosmology are the accumulated signatures of applying those laws inside an incorrect boundary assumption.

The most important prediction of SCT is not any single number — it is a pattern. All of the theory's distinctive predictions are expressions of the same underlying structure: the angular momentum coherence, the BAO peak shift, the variable expansion rate, the absence of dark matter particles, the gigaparsec-scale anomalous structures, the geometric origin of baryon asymmetry, and the perpendicularity of the CMB dipole to the angular momentum coherence axis. These are not independent predictions added to match individual observations. They are the simultaneous, linked consequences of a single change to a single assumption made a century ago, that can now be reconsidered.

References

Brainerd, T.G. (2005). Anisotropic clustering of nearby galaxies. The Astrophysical Journal Letters, 628(1), L101–L104. https://doi.org/10.1086/432713

Conselice, C.J., et al. (2016). The evolution of galaxy number density at z < 8 and its implications. The Astrophysical Journal, 830(2), 83. https://doi.org/10.3847/0004-637X/830/2/83

Einstein, A. (1916). Die Grundlage der allgemeinen Relativitätstheorie. Annalen der Physik, 354(7), 769–822. https://doi.org/10.1002/andp.19163540702

Fixsen, D.J. (2009). The temperature of the cosmic microwave background. The Astrophysical Journal, 707(2), 916–920. https://doi.org/10.1088/0004-637X/707/2/916

Hinshaw, G., et al. (2013). Nine-year WMAP observations: Cosmological parameter results. The Astrophysical Journal Supplement Series, 208(2), 19. https://doi.org/10.1088/0067-0049/208/2/19

Hou, Z., et al. (2023). DESI 2023 VI: Cosmological constraints from the measurements of baryon acoustic oscillations. arXiv:2306.06308.

Labbe, I., et al. (2023). A population of red candidate massive galaxies ~600 Myr after the Big Bang. Nature, 616, 266–269. https://doi.org/10.1038/s41586-023-05786-2

Lopez, A.M., et al. (2024). A giant arc on the sky. Journal of Cosmology and Astroparticle Physics, 2024(01), 020. https://doi.org/10.1088/1475-7516/2024/01/020

Minkowski, H. (1908). Raum und Zeit. Jahresberichte der Deutschen Mathematiker-Vereinigung, address at the 80th Assembly of German Natural Scientists and Physicians, Cologne, September 21, 1908.

Nipok, J.M. (2026). NIPOK 2026: Companion mathematical derivations for Successive Collision Theory. Zenodo. https://doi.org/10.5281/zenodo.18092309

Peebles, P.J.E., & Ratra, B. (2003). The cosmological constant and dark energy. Reviews of Modern Physics, 75(2), 559–606. https://doi.org/10.1103/RevModPhys.75.559

Penrose, R. (1965). Gravitational collapse and space-time singularities. Physical Review Letters, 14(3), 57–59. https://doi.org/10.1103/PhysRevLett.14.57

Planck Collaboration. (2020). Planck 2018 results VI: Cosmological parameters. Astronomy & Astrophysics, 641, A6. https://doi.org/10.1051/0004-6361/201833910

Riess, A.G., et al. (2022). A comprehensive measurement of the local value of the Hubble constant with 1 km s^-1 Mpc^-1 uncertainty from the Hubble Space Telescope. The Astrophysical Journal Letters, 934(1), L7. https://doi.org/10.3847/2041-8213/ac5c5b

Rubin, V.C., & Ford, W.K. Jr. (1970). Rotation of the Andromeda Nebula from a spectroscopic survey of emission regions. The Astrophysical Journal, 159, 379–403. https://doi.org/10.1086/150317

Sakharov, A.D. (1967). Violation of CP invariance, C asymmetry, and baryon asymmetry of the universe. JETP Letters, 5, 24–27.

Tempel, E., & Libeskind, N.I. (2013). Galaxy spin alignment in filaments and sheets: Observational evidence. The Astrophysical Journal Letters, 775(2), L42. https://doi.org/10.1088/2041-8205/775/2/L42

Vazza, F., et al. (2019). Simulations and observations of cosmic filaments. Galaxies, 7(1), 5. https://doi.org/10.3390/galaxies7010005

Weinberg, S. (1989). The cosmological constant problem. Reviews of Modern Physics, 61(1), 1–23. https://doi.org/10.1103/RevModPhys.61.1

Whitbourn, J.R., & Shanks, T. (2014). The Local Hole revealed by galaxy counts and redshifts. Monthly Notices of the Royal Astronomical Society, 437(3), 2146–2153. https://doi.org/10.1093/mnras/stt2024

Wong, K.C., et al. (2020). H0LiCOW XIII: A 2.4 per cent measurement of H0 from lensed quasars. Monthly Notices of the Royal Astronomical Society, 498(1), 1420–1439. https://doi.org/10.1093/mnras/stz3094

Zel'dovich, Ya.B. (1970). Gravitational instability: An approximate theory for large density perturbations. Astronomy & Astrophysics, 5, 84–89.

Zwicky, F. (1933). Die Rotverschiebung von extragalaktischen Nebeln. Helvetica Physica Acta, 6, 110–127.

Dr. J.M. Nipok | ORCID: 0009-0006-3940-4450