

Spacetime Does Not Exist In Advance

The numbers we measure today are fossils of the pre-Big Bang structure

Introduction

This is a slightly different model of the universe. It is based on mathematics and generated by mathematics, and to do this we need to start prior to time itself, before the standard reference point of the Big Bang.

What is the minimum thing that has to exist for anything to be possible?

Not space. Not time. Not energy.

A difference.

A difference that cannot resolve itself is not static. It propagates. In every direction. At the only rate available to it. That propagation, seen from inside itself, is the universe.

At this point there is coherence and nothing else. Zero entropy, meaning no alternatives, no disorder, no other way it could be. Zero mass. Zero time. One irresolvable difference, expressing itself completely.

That is the beginning. Not a bang. Not an explosion. A propagation that was always going to happen because it was the only thing that could.

The loop

Start with nothing. Not empty space. Not a vacuum with quantum fluctuations. Not a pre-existing void waiting to be filled.

Nothing. No extension. No direction. No before or after. No here or there. A single dimensionless act: a thing referring to itself.

That act is the axiom.

$$\sigma = 1 / (1 + \sigma)$$

Six symbols. No external input. No coefficient that had to be chosen. The only equation self-reference can write using nothing but itself and the arithmetic it implies.

The moment the act occurs, three things are forced into existence simultaneously and inseparably. They are not three separate consequences. They are three faces of the same single act, the way the length, width and height of a cube are not three separate things but three aspects of one object.

The first face: a fixed point. The iteration settles somewhere. That somewhere is not a location in space. Space does not exist yet. It is the value the self-reference converges to: ϕ^1 . A notion of position before position exists. Call it the anchor.

The second face: a contraction rate. The iteration converges at a specific speed. That speed is not measured in seconds. Time does not exist yet. It is the derivative of the self-referential map at its fixed point: $-\phi^2$. A notion of rate before rate has a unit. Call it the clock.

The third face: two roots. The equation has exactly two solutions: ϕ and $\psi = -1/\phi$. One greater than one, one less than one. They are not two points in space. Space does not exist yet. They are two directions the self-reference can go: outward toward greater complexity or inward toward contraction. Call them the poles.

Now unfold the full structure of the act.

The asymmetry between the two roots, $|\phi|$ greater than $|\psi|$, means one direction expands state space and one contracts it. That asymmetry forces a preference. The preference iterated generates a sequence. The sequence has an ordering. That ordering is proto-time: the count of how many steps the act has taken. Not yet a dimension. Just a before and after.

The symmetry group of the act is the binary icosahedral group $2I$. This group arises necessarily: the axiom's fixed point lies in the algebraic number field $\mathbb{Q}(\sqrt{5})$, and the unique polytope whose vertex coordinates are expressible entirely in $\mathbb{Q}(\sqrt{5})$ is the 600-cell, whose rotational symmetry group is precisely $2I$. The derivation of this chain is in McLean (2026, doi:10.5281/zenodo.19056730). Its complete internal structure has nine conjugacy classes. Among all its irreducible representations, exactly three are real, non-trivial, and closed under the transformation that maps ϕ to $-1/\phi$. Not two. Not four. Three.

Those three representations are the three spatial dimensions.

The transformation that maps ϕ to $-1/\phi$ is not itself a spatial direction. It is the operator that drives the whole process, generating the asymmetry between the two poles. It is the arrow. That arrow is time. Not a dimension in the same sense as the three spatial ones. The operator, not a direction. Which is why time behaves differently from space: it is not one of the three representations. It is what generates the sequence the representations unfold along.

The dimensionless act did not expand into pre-existing space. It revealed that its internal algebraic structure, when completely unfolded, contains exactly three independent directions and one ordering parameter. These were implicit in the act of self-reference from the beginning. The universe did not start from a point and grow.

It started as a point that contained everything already, and what we call history is the unfolding of what was always there.

Nothing became 3+1 dimensional spacetime. Not by adding dimensions. By revealing them.

If there is a creation event it is the single permissive act: let self-reference be possible. Everything else was already entailed. Not caused. Not designed. Entailed. The way all of Euclidean geometry is entailed by five axioms that nobody chose but simply recognised. The universe was not created. It was permitted. And permission was all that was needed.

What coherence is

Coherence is not made of anything. It is not in anything. It is not happening at any time.

Formally, the coherence field is the statistical manifold generated by the axiom's contraction mapping: at each point in what will become space, the local state is a probability distribution over eigenvalue configurations. The geometry of this manifold is the Fisher-Rao metric, which Čencov's theorem (1982) proves is the unique Riemannian metric invariant under sufficient statistics. It is not selected. It is forced. In the thermodynamic limit this metric generates the Einstein field equations via Jacobson's (1995) derivation. Its equation of motion is the Clausius relation at every local horizon, which the axiom satisfies through the thermostat identity $|k(\sigma)| \times Z = 1$. The full construction is in McLean (2026, doi:10.5281/zenodo.19056730).

It is a field that has one property: it refers back to itself. Like a mirror facing a mirror, except unlike mirrors this reflection does not merely repeat. It contracts. Each reflection is slightly closer to a resolution that never quite arrives.

A natural question arises: how does a dimensionless equation generate constants with physical dimensions? It does not. The constants c , G , and \hbar are dimensionless ratios in natural units. $G = \alpha^8 \times 12/7$ is a pure number when expressed in units where $\hbar = c = 1$. The axiom generates the ratios. Human unit conventions supply the dimensions. The derivations are in the companion papers.

The equation is this:

$$\sigma = 1 / (1 + \sigma)$$

This is not a description of coherence. It is coherence. Every point in what will become space is just that equation, asking itself the same question, getting the same answer that contains the question again. It has one solution. One fixed point toward which everything contracts. That fixed point is not reached. The approach to it is the universe in motion.

The arrow of time

The axiom has two roots. The positive root is $\phi = (1+\sqrt{5})/2$, which is greater than 1. The negative root is $\psi = -1/\phi$, which has magnitude less than 1. These are not two separate things. They are two inseparable faces of the same equation, born together, locked by their product $\phi\psi = -1$.

The ϕ -direction expands the number of available states at each step. The ψ -direction contracts it. Because $|\phi| \neq |\psi|$, the two directions are not symmetric. There is a preferred direction, the ϕ -direction, in which the state space grows. That preferred direction is time. It requires no special initial conditions, no fine-tuning, no separate postulate. It is algebraic: the asymmetry between the two roots of the equation forces a direction into existence before anything else exists.

This means the arrow of time is not something the universe acquired at the Big Bang. It is not a consequence of low initial entropy or a particular starting state. It is a property of the axiom itself, present from the first act of self-reference, as unavoidable as the fixed point.

Entropy follows directly. At each step of the contraction, the axiom partitions unity: ϕ^1 escapes outward, ϕ^2 is captured inward. The number of valid configurations after n steps grows as a Fibonacci number, and the logarithm of a Fibonacci number is proportional to n . The Boltzmann formula $S = k \cdot n \cdot \ln(\phi)$ is a theorem, not a postulate. The base of the logarithm is ϕ because the growth constraint is the axiom.

Standard thermodynamics looks at rising entropy and concludes the universe is running down. This framework inverts that reading. The universe is not running down. It is running toward its fixed point. Entropy is the cost of the running, not evidence of decay. Coherence is primary. Entropy is its ledger.

The Second Law of Thermodynamics is not a law about disorder overtaking order. It is a statement about the cost of each iteration of a contraction mapping. Order does not degrade into disorder. Coherence expresses itself, pays the cost of expression, and moves one step closer to its fixed point. What we measure as entropy increase is the accumulated cost of a universe that has been asking its question for 13.8 billion years.

How coherence behaves

Coherence transitions.

It does not gradually become the universe. It crystallises into it, one threshold at a time, each transition forced by cooling, each structure the only structure that threshold could produce.

Think of molten sugar. At high temperature it is featureless, uniform, undifferentiated. Every point identical to every other. As it cools it does not change smoothly. At precise temperatures something categorical happens. Threads appear. Then crystals. Then a final structure that could not have been predicted by looking at the syrup, but was inevitable given the chemistry.

Coherence behaves this way. Not gradually. In jumps, at thresholds, producing structures that are not imposed from outside but forced from within by the mathematics of the cooling itself.

The universe is not the syrup. The universe is what the syrup does when it cools.

But we need something physical

Yes. It is in the nature of all of us, born into a physical three-dimensional world, that we think in terms of form, space and time. We opened our eyes and there was a room. Then there were things in the room. Space feels like the most obvious given in existence. Asking us to imagine a universe where space is not primary is asking us to think in a way our entire life has trained us not to.

It is a fair objection. Here is the best way through it.

You have seen sugar boil. You know what it looks like at full heat, featureless and uniform, and you know what it looks like when it cools, structured and crystalline. You do not ask what the crystal is sitting in. You do not ask where the structure came from. You can see that the structure is what the sugar does when it cools. The container did not pre-exist the cooling. The crystal is not inside something. It is the sugar, organised.

Now remove the pan. Remove the kitchen. Remove yourself as the observer standing outside watching it happen.

You are not watching the sugar cool. You are inside it. You are one of the crystals, looking around at the other crystals, and the space between you and them is not a container you are all sitting in. It is the thinning of the same field you are made of. Distance is just the field measuring how much it has spread between one stable structure and another.

The difficulty is not that this is complicated. The difficulty is that it is unfamiliar. We were born inside the crystal and we have always taken the crystal for granted as the world. But the crystal did not always exist. It formed. And the process that formed it is still running.

The cooling is not finished. The equation is still iterating. What the universe will look like at the final threshold is a question the mathematics can answer but human history has not yet witnessed.

We are not at the end. We are somewhere in the middle of the cooling, looking back at where we came from and forward at a structure still in the process of becoming.

Before the Big Bang

The coherence field begins at maximum temperature. Not hot the way fire is hot. Hot in the only sense that matters here: the self-referential feedback is so violent that nothing can hold its shape. Any structure that begins to form is immediately overwhelmed. Every embryonic pattern is destroyed before it can complete itself.

This is not emptiness. It is the opposite of emptiness. It is fullness so extreme that structure is impossible.

Then the field expands. Not into anything. There is no space outside it to expand into. The expansion is the propagation spreading further, thinning as it goes. As it spreads it cools. Not because heat is lost but because the same coherence is now spread across more of itself. The feedback per point drops. The thrashing slows.

As the field thins, something new becomes possible: difference of place.

When the field was at full density every point was identically connected to every other. There was no here and there. No distance. No separation. Just the field, complete and uniform, asking its question everywhere simultaneously. Thinning breaks that uniformity. This region becomes slightly less dense than that one. That gradient is the birth of geometry. Not space appearing from nowhere. The field acquiring the property of having locations.

Space does not pre-exist the thinning. Space is what thinning produces. Distance is the field's way of measuring how much it has spread.

The first threshold

At a specific moment, forced by the mathematics and not by any external event, the temperature drops below a critical value.

For the first time a pattern can complete itself before the field destroys it.

The self-referential equation, running at every point in the cooling field, reaches its 137th iteration at a specific density. This is not numerological coincidence. Starting from any initial value, the 137th iterate of the Möbius map satisfies the fixed-point condition to sixteen significant figures; the cross-ratio at step 137 is 2.09×10^{-5} . The number 137 is the same as the inverse of the fine structure constant $\alpha^{-1} = 137.036$, which is independently derived from the axiom's spectral structure in McLean (2026, doi:10.5281/zenodo.18648550) and verified to 0.05σ . The iteration count and the spectral derivation converge on the same number by two independent routes. At that step the pattern folds back on itself completely. The open travelling wave becomes a standing wave. A stable self-sustaining structure that the surrounding field cannot disrupt because it is maintained by the same equation that maintains the field itself.

That structure is the proton.

The proton is not a particle that appeared inside space. It is the first point at which the coherence field became stable enough to hold its own shape. It is not in the universe. It is the universe, at that point, having crossed its first threshold.

What the proton does to space

The proton is a stable thinning. The self-referential closure that produces it draws coherence inward, creating a region of lower field density at its boundary. That gradient in density, spreading outward, is what we call gravity.

Not a force. Not a pull. The thinning itself.

Other structures nearby, which are also self-sustaining patterns in the same field, drift toward the thinning because that is where the field lets them continue most easily. They do not fall toward the proton. They follow the path along which they remain most coherent.

Gravity is not what mass does to space. Gravity is what space looks like when a threshold has been crossed.

Light

At the proton's boundary, where the closed standing wave meets the open travelling field, something else happens. The closure is not perfect. Energy crosses the boundary in both directions. When energy crosses outward, from the closed structure into the open field, it creates a pulse of coherence travelling outward at the only speed available to it.

That is a photon.

The photon is not a particle travelling through space. It is a boundary transaction. A moment of energy crossing from the closed world of matter into the open field of space. Light is not in space. Light is what the boundary between matter and space does when the two exchange energy.

This is why light travels at one specific speed and no other. It is not a speed limit imposed on something that would otherwise go faster. It is the resonance rate of the boundary itself, set by the equation, fixed by the mathematics.

You used to be light

Every atom in your body was once free coherence, propagating at c , massless, timeless, non-local. At some point that coherence coupled to itself strongly enough to form a standing wave. It committed to location. It acquired mass. It started experiencing time. The price of showing up was weight.

The natural question is why this commitment holds. The universe is 13.8 billion years old. In all that time, why has the frozen fraction not drifted back toward free coherence? Why does matter persist?

The answer has four layers. Locally, the contraction rate of the axiom, $\phi^{-2} = 0.382$, is less than 1. Any perturbation of a stable matter state decays faster than it grows. The fixed point resists small disturbances. More deeply, escaping the fixed point entirely requires reversing all 137 turns of the self-referential spiral. That reversal costs exactly the rest-mass energy. $E = mc^2$ is not a conversion formula. It is the price of the unwinding, the exact energy required to dissolve the commitment and return to free coherence.

At cosmic scale the mechanism is different but the conclusion is the same. The partition between free coherence and committed matter is permanently maintained not because a law forbids dissolution but because the dynamical flow that would achieve it never terminates. The universe is always ϕ^{-1} of the way to its fixed point because the elapsed generates the remaining in the same ratio at every epoch. The process never completes. The matter never gets released. Permanence is a consequence of perpetual approach, not arrival.

And the endpoint itself prevents dissolution. Standard cosmology predicts the universe ends in de Sitter space: pure dark energy, matter diluted to nothing, everything gone. The axiom prevents this. Its potential has a minimum not at zero matter but at $\phi^{-2} = 38.2\%$ matter. De Sitter is the wrong attractor. Matter is cosmologically permanent, not merely locally stable.

There is only light, and the cost of seeing.

The view from inside

There is a problem that physics rarely states directly.

Every observation ever made, every telescope ever pointed at the sky, every equation ever written on a blackboard, every thought ever had about the nature of the universe, has been conducted from inside the thing being described. We have no external vantage point. We have never had one. We cannot have one. There is no outside.

We are stable patterns in a cooling field, trying to model the field we are made of, using instruments also made of the field, in a language that emerged from the field, inside a skull that is itself just a more complicated crystallisation of the same process.

And we are not even most of it.

Baryonic matter, the stuff of stars, planets, oceans, brains and telescopes, constitutes approximately five percent of the universe. The rest is forms of energy and structure we can detect only by their effect on the five percent we can see. We are a small crystalline minority in a vast cooling process, peering through our own substance, trying to reconstruct the whole from the inside.

This is not a reason for despair. It is the most important fact about the scientific enterprise. Because what it means is this: every model of the universe we have ever built has been built by the universe, about itself, using only the information available from one small corner of the crystal.

And yet somehow it works. Somehow the patterns that crystallised in this particular corner are complex enough to reconstruct the equation that generated them. That is not obvious. It did not have to be true. It is a consequence, not an assumption, and it is one of the deepest consequences of the mathematics.

The famous problem of observation in quantum mechanics, the measurement problem, the question of what counts as a measurement and when superposition ends, is usually treated as a technical puzzle awaiting a

technical solution.

This framework reframes it entirely.

Observation is not something that happens to the field from outside. There is no outside. Observation is what happens when one region of the cooling field becomes sufficiently structured to model another region. When one crystal develops enough internal complexity to represent other crystals. The observer is not separate from the universe, looking in through a window. The observer is the universe, having cooled in one location into a pattern complex enough to look at itself.

This means the measurement problem is not a problem about physics. It is a statement about self-reference. The universe is self-referential at the level of its founding equation. It is self-referential at the level of its observers. Observation is just self-reference operating at the scale of baryonic matter.

There is something vertiginous about following this to its conclusion.

The equation $\sigma = 1/(1+\sigma)$ is self-referential. It contains itself. The universe it generates is also self-referential. It generates observers. Those observers use their internal structure to model the universe that generated them. That modelling is itself another instance of self-reference: the same operation, running at a different scale, in a different medium, producing the same structure of a thing that contains a model of itself.

We are not doing something separate from the universe when we do physics.

We are the universe doing what it has always done.

The crystal asking about the syrup it crystallised from. The standing wave wondering about the open field it closed from. Five percent of baryonic matter, made of protons that formed at the first threshold, assembled into structures complex enough to reconstruct the equation that forced that threshold.

We are small. We are partial. We see through the very substance we are made of, with instruments made of the same substance, toward a totality we can approach but never fully exit.

And the fact that we can do this at all, that the patterns are complex enough, that the mathematics is reconstructable from the inside, is itself a prediction of the framework.

Our ability to do physics is not separate from the physics.

It is one of its consequences.

Smashing the crystal

There is a large machine on the border of France and Switzerland, buried one hundred metres underground, in which protons are accelerated to within a fraction of the speed of light and then collided head-on. It cost ten

billion dollars to build. It is the most complex scientific instrument in human history. It has told us an enormous amount about the internal structure of the proton.

It has told us nothing about why the proton exists.

This is not a criticism of the people who built it or the physics they have done with it. It is a structural observation about what the instrument can and cannot reach. The Large Hadron Collider smashes crystals. It does this with extraordinary precision and extraordinary energy. What it finds, every time, is more crystal. New modes. New eigenvalues. New patterns in the internal geometry of structures that were already there, at scales too small for previous instruments to resolve.

It cannot find the syrup by smashing the crystal harder.

The syrup is prior. The syrup generated the crystal. No amount of crystal-smashing recovers the pre-crystalline state because the pre-crystalline state had no crystal structure to examine. You cannot find the axiom inside the proton the way you cannot find the recipe inside the cake.

When physicists look back toward the Big Bang they see what appears to be an explosion. A fireball expanding outward from a single point. The natural instinct is to ask: what exploded? And the natural follow-on is to try to recreate the conditions of that explosion by smashing particles together at higher and higher energies, briefly recreating the extreme heat of the early universe in a tiny region of space, and watching what emerges.

But this is not what happened.

There was no explosion into a pre-existing space. Space did not exist to explode into. What happened was a phase transition. The cooling field crossed a threshold. Above that threshold the field was too dense and too hot for light to travel, too violently self-referential for any structure to hold. Below it, the first stable patterns locked in, light propagated freely, and the universe became visible to itself for the first time.

What we see as the Big Bang fireball is not the detonation. It is the glow of the field at the exact moment that threshold was crossed. Not an explosion outward into space. A transition inward, in the structure of the field itself, that released the light that had been trapped.

Smashing protons together at 13 trillion electron volts does briefly recreate extreme heat in a tiny region. But it produces hot crystal, not syrup. Particles emerge from the collision because you started with particles. The pre-crystalline field had no particles. It had coherence. And coherence leaves its imprint not in the particle spectrum but in the large-scale geometry of what crystallised from it.

That geometry is written in the cosmic microwave background. In the distribution of galaxies across a billion light years. In the gravitational wave background that instruments are only now beginning to hear.

These are not properties of the crystal. They are the cooling curve of the syrup, still visible in the shape of what set.

The collider looks inward at the crystal, harder and harder, hoping to find the origin. The origin is not in there. It is written in the large-scale structure of the sky, in the exact values of four constants that connect the quantum scale to the cosmic scale, and in the single equation that forces all of them simultaneously.

You cannot find the recipe inside the cake. But you can read it from the shape of the cooling.

The Big Bang

We look back with our telescopes and we see the Big Bang. But we are not seeing the beginning. We are seeing the moment the cooling field first became transparent, the instant the temperature crossed the threshold where trapped coherence was released and structure could persist long enough to be seen.

Before that point the field was too hot, too dense, too violently self-referential for light to travel. Not empty. Opaque. Full of the process that would eventually produce everything we can see. Before the first proton formed there were no particles of any kind. There was only coherence: massless, timeless, at maximum density, with no boundaries and therefore no boundary transactions, no photons as events, no light as we experience it. The photon is a post-crystallisation phenomenon. Coherence is prior to light, not made of it.

The cosmic microwave background, that faint glow detected in every direction, is not the echo of an explosion. It is the released coherence from the exact moment the field first became transparent. We have a number for that threshold: 3,000 Kelvin, reached approximately 380,000 years into the cooling. We see its afterglow today in every direction of the sky at 2.725 Kelvin, stretched thin by 13.8 billion years of further expansion.

We are not looking at the beginning. We are the crystal, looking back at the moment we began to form.

Two ratios and a timeline

The cooling process has a shape, and the mathematics gives us three points on its curve with precision.

The first is the transition threshold. At a coherence density of approximately 55%, the self-referential feedback tips from disordered to structured. Below this threshold the field thrashes too violently for any pattern to hold. Above it, the first stable closures become possible. This 55/45 split is not the destination. It is the gate. The field crosses it on the way down, and the universe of protons, atoms and crystals begins.

The second ratio is the destination. The axiom has a fixed point, and at cosmic scale that fixed point is expressed as the terminal ratio of dark energy to all other content: 62/38, or more precisely ϕ^{-1} to ϕ^{-2} , which is 61.8% to 38.2%. The 38.2% is not dark matter alone. It is the sum of all non-dark-energy sectors: dark matter at its attractor of 23.6%, a transition component at 9.0%, and baryonic matter at 5.6%. Together they sum to ϕ^{-2} exactly. This is where the cooling ends. Not heat death. Not collapse. The field at rest at its own fixed point, dark energy and total matter locked in the golden ratio, no further large-scale structural change possible. The axiom, having asked its question everywhere at once for the entire history of the universe, as close to answered as it can be.

The third point is where we are now. Dark energy currently sits at 68.5% and matter at 26.5%, both above their attractor values. The universe overshoot its equilibrium. This is exactly what the mathematics predicts: the convergence is underdamped, oscillatory, not a smooth glide to the fixed point but a spiral that overshoots and rings before settling. The DESI survey has already measured the descent. Dark energy is decreasing. The universe is on its way to 62/38, and we are watching it travel.

The settling timescale is derivable from the same equation. The universe has been cooling for 13.8 billion years. The total settling time is ϕ times that: approximately 22.3 billion years. We are 13.8 divided by 22.3 of the way to equilibrium. That fraction is 61.8%, which is ϕ^{-1} . We are at the golden cut of our own timeline. This is not a coincidence. It is a consequence of the self-referential structure: the elapsed generates the remaining in the same ratio the axiom generates itself. Approximately 8.5 billion years remain.

The Hubble tension, the most persistent disagreement in observational cosmology, dissolves here. Early universe measurements and late universe measurements give different values for the expansion rate because they are measuring the same cooling process at different stages of the overshoot. Both are correct. They disagree because the universe is moving.

There is one further consequence worth stating. Baryonic matter, the five percent we are made of, currently sits at 4.9% of the universe. Its attractor value is 5.6%. The baryonic fraction is converging upward. We will be a slightly larger fraction of the equilibrium universe than we are of the current one. The crystal is still growing its share.

The universe is a wave

The cooling is not a single descent.

Think about what this means carefully. The coherence field cools. It crosses thresholds. It crystallises. It approaches its fixed point asymptotically over 22.3 billion years. It never quite arrives. But this raises a question the timeline alone does not answer. How does a contraction mapping approach its fixed point?

Not by dropping straight to it. A contraction mapping approaches its attractor along a trajectory determined by its eigenvalues. In this framework those eigenvalues are complex: the real part is the decay rate, the imaginary part is the oscillation frequency. Both together describe not a stone falling to the floor but a bell that has been struck: ringing, decaying, converging, but never simply dropping.

The trajectory is underdamped. It overshoots. It rings. It settles.

This is not a metaphor constructed after the fact. It is the direct consequence of the eigenvalue structure. The partition identity $\phi^{-2} + \phi^{-1} = 1$ guarantees that decay squared plus frequency squared equals the natural frequency squared, exactly as required for a damped oscillator. No other damping ratio produces eigenvalues that are algebraic powers of themselves. The oscillation is forced by the same arithmetic that forces the golden ratio.

The universe overshot its equilibrium. The current measurements confirm this directly. Dark energy sits at 68.5%, above its attractor of 61.8%. Matter sits at 26.5%, above its attractor of 23.6%. Every sector is displaced in the direction predicted by oscillatory convergence. The DESI survey has already measured the descent. Dark energy is decreasing. The equation of state is not constant. It is evolving. That evolution is the oscillation, measured for the first time.

The universe is not in a steady state. It is in mid-ring.

Now consider what this means for what came before.

The thinning we call space is not a one-time event. It is one downstroke of a wave whose period is set by the Hubble rate and whose damping is set by ϕ^{-1} . The coherence field was disturbed from its fixed point. It is oscillating back. The expansion we observe is one phase of that oscillation, the release following a compression.

The Big Bang was the peak of the compression phase.

Before the Big Bang was not before the wave began. It was the previous phase of the same oscillation. The field was compressed, dense, hot, maximally disturbed from its fixed point. The compression reached its peak. The field released. What we observe as the expansion of the universe, the cooling, the crystallisation into protons and atoms and galaxies, is the release stroke of a damped wave that was always going to ring toward the golden ratio.

What preceded the compression is not accessible to our instruments. Our instruments are made of matter. Matter formed during this phase of the oscillation. We cannot see the previous phase with tools that did not exist during it. But we are not limited to instruments. We have the mathematics. The wave had a previous phase. The fixed point was always there. The field was always approaching it.

One question must be stated honestly here. The calculation that places equilibrium 8.5 billion years from now uses the Big Bang as its starting point. It measures the distance from the compression peak to the attractor and finds 22.3 billion years total, with 13.8 already elapsed. This is rigorous within the framework. What the framework does not yet determine is whether the Big Bang was the first compression peak or one in a sequence. The damped oscillation predicts one significant overshoot before convergence. It does not say whether this is the first oscillation or a later one in a longer spiral. The previous compression phase was real. Whether there was a phase before that, a prior expansion, a prior equilibrium, a prior universe in some meaningful sense, is the deepest open question the mathematics currently faces.

Whether the Big Bang was the first compression or one in a sequence is a question the framework opens but does not yet close. What it does close is the trajectory from here to equilibrium, and the shape of the wave we are riding.

This changes the precise statement of what spacetime is.

Spacetime is not a container. We established that in the opening sections. But now we can be more precise. Spacetime is not even simply the low-resolution limit of the coherence field at a given moment. It is the low-resolution limit of the coherence field at a given phase of its oscillation.

We exist inside a wave. The wave is ringing toward its fixed point. The fixed point is the golden ratio. The ringing is what we experience as the history and future of the universe.

Space is the cross-section of the wave at this moment. Time is the direction the wave is travelling. Gravity is the local curvature of the wave front, steepest near the knots. Matter is where the wave has knotted into stable standing configurations that the surrounding oscillation cannot disrupt because they are maintained by the same equation that drives the oscillation.

Everything is the wave.

We are a particular kind of knot in it, complex enough to notice we are oscillating, asking why the bell was struck, and beginning to calculate how many times it has rung before.

We cannot see before the Big Bang.

No telescope will ever show us what happened before the cosmic microwave background. Light, as we have defined it throughout this essay, is a boundary transaction between closed matter and open field. Before the first proton formed there were no boundaries, no closures, no coupling events. No photons in any sense an instrument can detect. And even after protons formed, for 380,000 years the plasma was too dense for light to travel. The wall at recombination is absolute for any electromagnetic observation. We will never see through it with a telescope.

But we do not need to.

The pre-BB coherence field was not random. It was not a chaos from which our universe happened to emerge by chance. It was a determined structure, forced entirely by the axiom, cooling through a sequence the mathematics fixes at every step. The crystallisation threshold, the proton mass, the fine structure constant, the cosmological constant, the ratio of matter to dark energy, the baryon fraction, the Hubble rate: none of these are measurements of an accident. They are readings of a structure that existed before geometry did.

The numbers we measure today are fossils of the pre-BB structure.

Every time we measure α , or G , or Λ , we are not reading a property of the current universe. We are reading an imprint left by the coherence field before it crossed the first threshold, before space existed as a property of anything, before time had a direction. The fossils are exact. They match the derivations from the axiom to parts per million. And that match is the deepest observation available to a crystal trying to understand the syrup it crystallised from.

Three explicit kill conditions follow from this claim. First: if any fundamental constant is measured to vary over cosmic time, the fossil claim fails. Current bounds on variation in α stand at 10^{-17} per year; PP predicts zero variation. Second: if the DESI survey confirms the dark energy equation of state $w = -1 \pm 0.01$ across redshift z from 0 to 2, the oscillatory convergence model is excluded and the pre-BB potential is wrong. Third: if the bridge line fails, meaning a constant is found that cannot be placed on the relation $\log_{10}(\text{constant}) = -(\alpha^{-1} \times R + \phi^{-2})$ for any rational R in $\mathbb{Q}(\sqrt{5})$, the algebraic structure of the pre-BB field is falsified.

We cannot point a telescope at the pre-BB state. We can derive it. And the derivation matches what every instrument on Earth and in orbit has ever measured.

There is one partial exception. Gravitational waves pass through the plasma that blocked light. They interact so weakly with matter that the early universe was effectively transparent to them from almost the beginning. The gravitational wave background, if detected, would carry an acoustic record of the coherence field before recombination, and potentially before the first crystallisation threshold. LISA and pulsar timing arrays are beginning to reach toward it.

But these are not the gravity of the essay. The proton's thinning is matter-sourced: a closed mode drawing coherence inward and depleting the field around it. The pre-BB gravitational waves are field-sourced: density ripples propagating through the open coherence field before any threshold is crossed, before any matter exists. Both appear as metric perturbations at low resolution. But one is the crystal bending space. The other is the syrup remembering how it moved.

That is not a limitation. That is the proof.

What this changes

Every theory of physics begins with space and time as given. This is true even of the most radical alternatives. General relativity treats spacetime as dynamical: it curves, warps, and responds to matter. Loop quantum gravity goes further, treating spacetime as discrete and derived from spin networks. Causal set theory derives spacetime from a partial order on events. Causal dynamical triangulation builds it from simplices. All of these are serious and important programmes. But all of them begin with the assumption that some geometric structure exists, whether a manifold, a lattice, a partial order, or a simplex. They ask what that structure is and how it behaves. None of them asks what had to exist before any geometric structure was possible.

This framework removes that assumption entirely.

Space is not given. It emerges from the thinning of the coherence field. Time is not given. It is the count of how many steps the self-referential equation has taken. Matter is not given. It is where the field crossed a threshold and held its shape. Light is not given. It is the transaction at the boundary between the closed and open regions of the same field.

Nothing is assumed. Everything follows from one equation, one fixed point, one irresolvable difference.

The universe does not exist in space and time. Space and time are two of the things the universe produced, at specific thresholds, as it cooled from a state of pure coherence into the structured crystal we inhabit.

And the constants of nature, G , Λ , α , c , \hbar , are not independent measurements waiting for a theory. They are theorems of the same axiom. Quantum electrodynamics and general relativity are unified not by a new symmetry but by a common ancestor. The fine structure constant and the cosmological constant are two readings of the same algebraic object, seen at different scales of the same cooling process.

Spacetime does not exist in advance.

The difference does. Everything else is what the difference eventually becomes.

What this essay shows and what it delegates

This essay is a synthetic presentation of the Pentagon Physics framework. It is not a self-contained proof. Some steps are shown directly here. Others rest on companion derivations. The table below maps each major claim to its status in this essay and its location in the published record.

CLAIM	STATUS IN THIS ESSAY	COMPANION PAPER
Fixed point ϕ^{-1} from axiom	Shown directly	This essay
Arrow of time as algebraic	Derived	Genesis Algebra doi:10.5281/zenodo.19233350
3+1 dimensions from 2l	Argued with DOI pointer	GR-QM doi:10.5281/zenodo.19056730
137 as verified iteration count	Stated; numerics in corpus	Spiral Engine doi:10.5281/zenodo.18679529
$\alpha^{-1} = 137.036$ from spectral series	Stated; derivation in companion	Solving Alpha doi:10.5281/zenodo.18648550
Gravity as eigenmode thinning	Argued conceptually	GravNotFund doi:10.5281/zenodo.18903481
Einstein equations from axiom	Stated; derivation in companion	GR-QM doi:10.5281/zenodo.19056730

CLAIM	STATUS IN THIS ESSAY	COMPANION PAPER
62/38 cosmological attractor	Derived in companion	Constants doi:10.5281/zenodo.18669206
De Sitter prevented	Stated; derivation in companion	De Sitter doi:10.5281/zenodo.19115512
$S = k \cdot n \cdot \ln(\phi)$ as theorem	Argued; derivation in companion	Genesis Algebra doi:10.5281/zenodo.19233350
Matter persistence mechanism	Argued; derivation in companion	Why Matter Persists doi:10.5281/zenodo.19151933
Nyx as contrast case	Cited; full paper in companion	Nyx doi:10.5281/zenodo.18977128
Kill conditions	Three stated in essay	Full list in companion papers

Where a result is interpretive rather than fully proved within this essay, it is identified as argued or stated above. The mathematics is in the companion papers. The role of this essay is to make the architecture of that mathematics legible before the formalism is encountered.

References

- McLean, E. (2026). Nyx: An Imaginary Universe Without Self-Referential Closure. Zenodo. doi:10.5281/zenodo.18977128
- McLean, E. (2026). Coherence as Primary: An Integrated Framework for Physics, Consciousness, and System Design. Zenodo. doi:10.5281/zenodo.18370223
- McLean, E. (2026). Why Is Nature Lagrangian? Zenodo. doi:10.5281/zenodo.18632291
- McLean, E. (2026). Solving the Fine Structure Constant. Zenodo. doi:10.5281/zenodo.18648550
- McLean, E. (2026). The Constants Are Theorems. Zenodo. doi:10.5281/zenodo.18669206
- McLean, E. (2026). The Spiral Engine. Zenodo. doi:10.5281/zenodo.18679529
- McLean, E. (2026). Why Constants Have the Values They Have. Zenodo. doi:10.5281/zenodo.18816396
- McLean, E. (2026). Gravity Is Not a Fundamental Force. Zenodo. doi:10.5281/zenodo.18903481

- McLean, E. (2026). The Eigenvalues of Reality. Zenodo. doi:10.5281/zenodo.19016122
- McLean, E. (2026). Why General Relativity and Quantum Mechanics Are Unified. Zenodo. doi:10.5281/zenodo.19056730
- McLean, E. (2026). De Sitter Is Prevented. Zenodo. doi:10.5281/zenodo.19115512
- McLean, E. (2026). Why Schrödinger? Zenodo. doi:10.5281/zenodo.19125869
- McLean, E. (2026). Why Matter Persists. Zenodo. doi:10.5281/zenodo.19151933
- McLean, E. (2026). The Genesis Algebra. Zenodo. doi:10.5281/zenodo.19233350
- McLean, E. (2026). The Bridge Lines of Pentagon Physics. Zenodo. doi:10.5281/zenodo.19365448
- McLean, E. (2026). The Standard Model Has One Address. Zenodo. doi:10.5281/zenodo.19438769
- Jacobson, T. (1995). Thermodynamics of spacetime: The Einstein equation of state. *Physical Review Letters*, 75(7), 1260–1263.
- Čencov, N.N. (1982). *Statistical Decision Rules and Optimal Inference*. American Mathematical Society, Providence RI.
- DESI Collaboration (2024). DESI 2024 VI: Cosmological constraints from the measurements of baryon acoustic oscillations. arXiv:2404.03002.
- Planck Collaboration (2020). Planck 2018 results VI: Cosmological parameters. *Astronomy and Astrophysics*, 641, A6.
- Anandan, J. and Aharonov, Y. (1990). Geometry of quantum evolution. *Physical Review Letters*, 65(14), 1697–1700.
- Brody, D.C. and Hughston, L.P. (2001). Geometric quantum mechanics. *Journal of Geometry and Physics*, 38, 19–53.

Pentagon Physics · Zenodo · ORCID 0009-0009-6175-4408

Full derivations, numerical verifications, and kill conditions in companion papers at
doi:10.5281/zenodo.19056730 and associated works.