

The Origin Of The Big Bang Singularity (Entangled Dawn Model)

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June 18, 2024

Abstract

For centuries, scientists and philosophers have grappled with the enigma of the Big Bang's singularity, seeking to understand the primordial trigger that ignited the universe's explosive expansion. Despite significant advances in cosmology, the origins of this singularity remain shrouded in mystery, fueling ongoing debate and research. We all learn that the Big Bang marked the birth of our observable universe from an ultra-hot, ultra-dense singularity of infinite density and zero volume. But if we follow the logic rigorously, this conventional picture turns out to be incomplete and inconsistent with some fundamental premises. For any volumetric increase or growth to occur, there must be pre-existing available space or "room" to expand into initially. This intuitive - things simply cannot begin increasing in size if there is no space to expand into. Now consider the conventional model of the Big Bang - our entire observable universe emerged from an initial state of infinite density called the "singularity" which had zero volume. Zero volume means no dimensions, no space whatsoever. Here's the key point - if the singularity truly started with zero volume, and yet it expanded rapidly in all directions producing the vast volumes we see today, then there logically had to be some pre-existing space surrounding that singularity to allow for that expansion. Total zero volume couldn't just grow spontaneously into something with dimension - that violates the premise. But there's more. In our current understanding, the concepts of space and time are inseparably inter-linked through Einstein's theories. Space and time are woven together into the fabric of spacetime. So if there was pre-existing space before the singularity, basic logic demands there must also have been some

form of pre-existing time dimension as well. I know this may seem contradictory to the standard idea that space and time themselves emerged from the Big Bang event. But follow the logic clearly - if there was room for the expansion, and space implies time, then some sort of primordial space-time must have pre-dated the singularity itself. This doesn't negate or deny the Big Bang paradigm. The initial inflation could still have propelled the singularity outwards rapidly creating the spacetime we experience today. But it shows that the Big Bang wasn't the beginning of all existence - some earlier form of space and time had to have preceded and allowed for that expansion in the first place. Now that space is what I call the quantum vacuum in my hypothesis. This model postulates that the origin of the big bang' singularity is as a result of the collision of quantum fluctuations. In the beginning, from eternity, there have always been quantum vacuum (A place seeming to be nothing but it's actually not nothing but a state of minimum energy where quantum fields still exist and fluctuate). At a point in time, quantum fluctuations acting photon-like (massless) popped out of this quantum vacuum travelling at the speed of light from opposite directions and with extreme force collided together releasing an enormous amount of energy that potentially created a highly energetic and dense point. The energy density was so high that it led to gravitational collapse making space-time curve infinitely, leading to the formation of the big bang' singularity.

Comparison to Other Theories:

Comparison to Eternal Inflation: ETERNAL INFLATION THEORY:

- Core Idea: Our universe is one bubble in an eternally inflating multiverse.
- Mechanism: Quantum fluctuations in the inflaton field cause regions to inflate at different rates.
- TIMELINE:
Pre-Inflation: Unknown initial conditions
During Inflation: Rapid, exponential expansion
Post-Inflation: Fluctuations seed cosmic structure

- Spacetime: Inflaton field defines an ever-expanding background spacetime.
- Energy Source: Positive vacuum energy of the inflaton field drives expansion.
- Our Universe: A region where inflation ended, releasing energy as matter/radiation.
- Many Universes: Different regions stop inflating, forming distinct "bubble universes."
- Eternal Nature: Some regions always inflate, continually spawning new universes.
- Scale: Operates above our cosmic horizon, explaining universal homogeneity.

So while both theories rely on quantum effects, the Entangled Dawn model proposes a more direct path from the vacuum state to the Big Bang singularity, without requiring an existing inflating space-time or invoking additional fields or dimensions.

ENTANGLED DAWN MODEL:

- Core Idea: The Big Bang singularity arose from a specific quantum collision.
- Mechanism: Two photon-like fluctuations collide, focusing immense energy.
- TIMELINE:
 Pre-Bang: Eternal quantum vacuum The Event: High-energy collision forms singularity Post-Event: Singularity evolves into Big Bang
- Spacetime: Quantum vacuum is the substrate; collision warps it infinitely.
- Energy Source: Transfer from quantum vacuum to particles via collision.
- Our Universe: Direct result of this specific collision event.
- Universality: Not directly addressed; focus is on our universe's birth.

- Eternal Nature: Quantum vacuum is eternal, but Big Bang is a unique event.
- Scale: Focuses on sub-Planckian scales leading to our observable universe.

KEY DIFFERENCES:

- What is Eternal?
Eternal Inflation: The inflationary process itself My Model: The quantum vacuum substrate
- Universe's Birth:
Eternal Inflation: End of inflation in a region My Model: Specific quantum collision event
- Multiverse:
Eternal Inflation: Central feature; infinitely many universes My Model: Not addressed; focuses on our universe
- Role of Quantum Effects:
Eternal Inflation: Seeds density variations post-inflation My Model: Directly causes the Big Bang itself
- Nature of Space:
Eternal Inflation: Continuous background that expands My Model: Emergent from quantum vacuum dynamics
- Energy Mechanism:
Eternal Inflation: Constant vacuum energy drives expansion My Model: Single collision transfers vacuum energy
- Initial Conditions:
Eternal Inflation: Assumes some pre-inflationary state My Model: Starts from timeless quantum vacuum.
- Predictive Differences: Eternal Inflation: Vary between bubble universes My Model: Specific to our universe's birth conditions

POTENTIAL SYNERGIES:

Interestingly, my model could potentially nest within Eternal Inflation:

- **Quantum Vacuum:** The eternal vacuum could underlie the inflation field.
- **Singularity Origin:** Each bubble universe in Eternal Inflation needs a starting point—your collision could provide this.
- **Varied Physics:** Different collision events might explain why bubble universes have different properties.

This synergy is speculative but shows how innovatively your idea could integrate with or extend other theories.

Comparison to Cyclic Models:

- Cyclic models, such as those proposed by Steinhardt and Turok, suggest that the universe undergoes a recurring cycle of expansion and contraction, with each cycle potentially seeded by the collapse and subsequent "bounce" of the previous universe.
- In contrast, the Entangled Dawn model does not rely on the existence of a previous universe or its collapse. Instead, it proposes that the origin of the Big Bang singularity lies in the collision of quantum fluctuations directly emerging from the vacuum state, without the need for a pre-existing cosmic cycle.
- While Cyclic models aim to address the initial singularity problem by proposing a cyclical universe, the Entangled Dawn model tackles the issue by providing a quantum-based mechanism for the formation of the singularity from the vacuum itself.
- Additionally, Cyclic models often invoke additional fields or modifications to general relativity to enable the cosmic "bounce," whereas the Entangled Dawn model operates within the framework of established quantum field theory and general relativity, without requiring extra fields or significant modifications to these theories.

Comparison to String Theory Models: Like some string theory models, the Entangled Dawn model invokes the quantum vacuum as the fundamental state from which the universe emerges. However, there are some key differences:

- String theory models often require the existence of extra spatial dimensions beyond the three spatial dimensions we experience. In contrast, the Entangled Dawn model operates within the framework of standard four-dimensional space-time and does not invoke extra dimensions.
- Many string theory models propose specific mechanisms or fields (e.g., branes, fluxes) that shape the vacuum state and lead to the formation of the observable universe. The Entangled Dawn model, on the other hand, relies solely on the intrinsic quantum fluctuations of the vacuum itself, without invoking additional fields or mechanisms beyond those described by quantum field theory.
- String theory models aim to provide a unified description of all fundamental forces, including gravity, by describing them as different vibrational modes of strings or branes. The Entangled Dawn model attempt to provide some form of unification between general relativity and quantum mechanics and also focuses on explaining the origin of the Big Bang singularity using established theories of quantum fields and general relativity.
- While string theory models often involve complex mathematical formalisms and assumptions about extra dimensions and symmetries, the Entangled Dawn model presents a more phenomenological approach, grounded in well-understood physics concepts and making testable predictions about the early universe's observable signatures.
- Thus, while both frameworks acknowledge the importance of the quantum vacuum, the Entangled Dawn model takes a more minimalist approach, avoiding the complexities of extra dimensions and specific fields, and instead relying on the inherent quantum nature of the vacuum to provide a mechanism for the universe's origin.

Challenges Brought Up By Critiques Regarding This Hypothesis And My Approach Of Solving Them:

1. Scale Issue: Quantum fluctuations typically occur at the Planck scale (10^{-35} meters). How do they gain enough energy to affect cosmic scales?

My Approach:

- (a) The universe large scale structure comes from quantum fluctuations amplified by inflation. Note that my hypothesis aim to explain what came before the big bang.

2. Directionality Issue:

You posit fluctuations moving in "opposite sides and opposite directions." In quantum field theory, virtual particles do appear in pairs that conserve momentum.

So, the idea of oppositely moving pairs is consistent with Quantum Field Theory.

But why would a significant number move precisely head-on to create a massive collision? This still needs explanation.

My Approach: The mechanism of the directionality depends on One's belief. Either lucky cosmological accident or A Result of An Intelligent Mind

More on the cosmological accident part:

- (a) Cosmological Accident:

Among countless quantum events, some rare configurations lead to universe formation.

We observe this particular universe because it's one that allows our existence.

3. Can quantum fluctuation move long enough to travel macroscopic distances before colliding?

My "NOVEL" Solution: In the quantum vacuum, quantum coherence enables the fluctuations to persist, while non-equilibrium dynamics drive the sustained interactions and collisions.

- (a) Quantum Coherence:
This refers to the delicate quantum states where phases of the wavefunction remain correlated.
Usually, decoherence quickly destroys these states in most environments.
But in the pristine quantum vacuum, absent external disturbances, coherence can persist.
This could prolong the life of high-energy fluctuations.
- (b) Non-Equilibrium Dynamics:
In thermodynamics, equilibrium is a "blank" state where not much happens.
Non-equilibrium states are where interesting dynamics occur—energy flows, pattern formation, self-organization.
By invoking non-equilibrium dynamics, I suggest that the vacuum is not static but actively churning.
This could continuously generate high-energy fluctuations and drive their interactions.
- (c) Combined Effect:
 - i. Coherence preserves the quantum nature and energy of the fluctuations.
 - ii. Non-equilibrium dynamics sustain their creation and collision.
 - iii. Together, this could allow high-energy fluctuations to "live longer" and travel further.

OTHER CHALLENGES:

- 5. Energy Conservation:
The quantum vacuum's net energy is typically considered zero.
How does your model produce so much positive energy without equal negative energy?
Could the universe's positive energy (matter) be balanced by negative gravitational potential energy, maintaining net zero?
My "NOVEL" Approach: Quantum vacuum fluctuations. In quantum field theory, virtual particle-antiparticle pairs constantly appear and annihilate. The collision of quantum fluctuations transfers energy

from the vacuum to the virtual particles, allowing them to become real particles thereby conserving energy.

6. Before the Vacuum?

You start with the quantum vacuum, which is more fundamental than space-time.

But what determines the properties of this vacuum (its fields, coupling constants)?

Is there a "meta-stability" argument, or does this lead to an infinite regress?

My Hypothetical Approach: There is no such thing as before the vacuum otherwise, this universe might not exist because for this universe to exist, there have to be something maybe looking like nothing but not actually nothing since nothing comes from nothing. The vacuum have always existed eternally. Asking "before the quantum vacuum" is like asking "before time began." The quantum vacuum is the foundation of the universe. There's no "before" because it's always there.

Some Conditions Necessary For The Formation Of The Big Bang' Singularity And How My Hypothesis Address Them:

1. Infinite Energy Density:

THE critical condition.

In general relativity (GR), singularity means physical quantities become infinite.

For Big Bang, it's specifically the energy density (ρ) that goes to infinity.

My Model: High-energy fluctuations collide, concentrating immense energy in a point.

2. Infinite Space-time Curvature:

Direct consequence of infinite energy density.

Einstein's Field Equations: $G_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$

As $T_{\mu\nu}$ (energy-momentum tensor) goes to infinity, so does $G_{\mu\nu}$ (curvature).

Result: Space-time bends infinitely, forming the singularity.

My Model: The quantum collision's energy causes this infinite curvature.

3. Zero Volume:

All matter/energy of the universe in a point.

Mathematically: As $t \rightarrow 0$, Volume $\rightarrow 0$

Think of it as the universe's entire "stuff" squeezed to no size.

My Model: Fluctuations' energy focused to a dimensionless point.

4. Time's Beginning ($t = 0$):

Singularity represents the start of time itself.

Before this, time concepts are meaningless.

No notion of "before" the singularity in classical GR.

My Model: Time emerges from the timeless quantum vacuum at collision.

5. Classical vs. Quantum:

GR (classical) predicts the singularity.

But we expect quantum gravity to modify this.

The singularity is where these theories clash.

My Model: I START with quantum theory to approach this limit.

6. No Event Horizon:

Unlike black holes, Big Bang has no event horizon.

All points were once part of the singularity.

There's no "outside" to hide behind.

My Model: Consistent. The singularity affects all space-time.

7. Isotropy at the Brink:

Even with inhomogeneities later, at $t \rightarrow 0$, everything converges.

This perfect symmetry is part of the singularity.

My Model: Symmetrical collision ensure this.

8. Unbroken Symmetries:

At singularity, all forces might unify.

Quantum vacuum should be in a highly symmetric state.

My Model: Quantum vacuum state has these symmetries.

Predictions of My Hypothesis:

My model implicitly makes several testable predictions:

1. Vacuum Energy Signature: My hypothesis suggests the Big Bang resulted from a massive energy transfer from the quantum vacuum. This implies the early universe's energy had a distinct "vacuum fluctuation" signature. We might see this in:
 - Fine-structure of the Cosmic Microwave Background power spectrum
 - Specific patterns in primordial gravitational waves
2. Photon-Like Remnants: Since my model uses photon-like fluctuations, it predicts:
 - A higher proportion of high-energy photons in the early universe
 - Possibly detectable in the high-frequency tail of the Cosmic Microwave Background or in the cosmic neutrino background
3. Directional Anisotropy: The head-on collision suggests a preferred axis in the very early universe:
 - This could lead to subtle large-scale anisotropies in the Cosmic Microwave Background
 - Or in the distribution of the oldest galaxies
4. Quantum Entanglement: The fluctuations originate as entangled pairs:
 - This predicts long-range quantum correlations in the early universe
 - Potentially observable in Cosmic Microwave Background polarization patterns
5. Non-Gaussianity: The extreme event (collision) could produce non-Gaussian features in the Cosmic Microwave Background, differing from those in inflationary models.

CONCLUSION:

From this primordial seed, our universe unfurls, adhering to the established pathways of cosmic evolution – the rapid inflation that stretches microscopic quantum variations to grand scales, the intricate dance of fundamental forces that forges the first subatomic particles, and the gradual hierarchical assembly of stars, galaxies, and the vast tapestry we inhabit today. Yet, the Entangled Dawn casts these familiar processes in a new light, revealing their roots in a singular quantum accident – a less probable, yet inexorably real, collision that sparked the universe’s first moment.

This model’s power lies not only in its scientific rigor but also in its philosophical depth. By grounding the universe’s origin in the stochastic undulations of the quantum vacuum, it challenges the notion of cosmic inevitability, offering a perspective where our existence emerges from the interplay of random fluctuations and immutable physical principles. Alternatively, for those inclined toward a teleological worldview, the model’s initial conditions can be interpreted as the manifestation of an Intelligent Designer.

Regardless of one’s metaphysical inclinations, the Entangled Dawn demands a profound reconceptualization of our cosmic origins. No longer is the universe’s birth shrouded in the obscurity of an inexplicable singularity or the asymmetry of a spontaneously appearing field. Instead, it emerges as an organic consequence of the deepest truths we’ve uncovered about the subatomic realm – the incessant quantum churning that defies the stillness of empty space.

This paradigm shift is not without its challenges. The model’s mathematical formalism remains nascent, awaiting the precise quantification of the collision dynamics and the rigorous melding of quantum field theory with the geometrical language of general relativity. Furthermore, the model’s unique predictions – from the subtle signatures of the vacuum’s energy infusion to the intricate quantum correlations that may have seeded the universe’s large-scale architecture – beckon for novel observational and experimental probes.

Yet, these challenges are not obstacles but clarion calls for a new era of theoretical and empirical exploration. For in unveiling the Entangled Dawn, we have caught our first glimpse of the quantum roots from which the cosmos bloomed. The universe’s birth is no longer an opaque singularity but a physical event, governed by the same fundamental principles that permeate all of reality. And in this realization, we find not an end to our cosmic quest but the beginning of a new journey – one that promises to unearth the

deepest harmonies between the vast and the infinitesimal, the random and the deterministic, the transient and the eternal.

It is a profound privilege to participate in this scientific renaissance, to stand at the threshold of a new understanding that challenges our conventional wisdom while resonating with the timeless human yearning to unravel the mysteries of our cosmic origins. *The Entangled Dawn* is more than a model; it is an invitation to reimagine the universe's birth – an opportunity to recognize our existence as an exquisite confluence of quantum happenstance and universal law. May we embrace this paradigm shift with the awe, humility, and intellectual courage it demands, for in doing so, we honor the deepest essence of the scientific quest: to glimpse the hidden harmonies that underlie our reality's vastness.

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