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

Michael Prince

June 11, 2024

Abstract

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, the 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 lead to gravitational collapse making space-time curve infinitely, leading to the formation of the big bang' singularity.

Comparison to Other Theories:

- Like Eternal Inflation, it uses quantum effects but doesn't require pre-existing space.
- Unlike Cyclic Models, it doesn't need a previous universe's collapse.
- Similar to some string theory models in using the quantum vacuum but without extra dimensions.

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:

1) 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.

a. 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:

1. Coherence preserves the quantum nature and energy of the fluctuations.

2. Non-equilibrium dynamics sustain their creation and collision.

3. Together, this could allow high-energy fluctuations to "live longer" and travel further.

OTHER CHALLENGES:

4) 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.

5) Before the Vacuum?

You start with the quantum vacuum, which is more fundamental than spacetime.

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 $t \to 0$, Volume $\to 0$

   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 $t \to 0$, 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:

a. 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

b. 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

c. 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

d. 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

e. 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 universeś 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.

REFERENCES

1. Peskin, M. E., and Schroeder, D. V. (1995). *An Introduction to Quantum Field Theory*. Westview Press.
2. Weinberg, S. (1995). *The Quantum Theory of Fields* (Vol. 1). Cambridge University Press.
3. Milonni, P. W. (1994). *The Quantum Vacuum: An Introduction to Quantum Electrodynamics*. Academic Press.
4. Guth, A. H. (1997). *The Inflationary Universe: The Quest for a New Theory of Cosmic Origins*. Addison-Wesley.
5. Linde, A. D. (2008). *Particle Physics and Inflationary Cosmology*. CRC Press.
6. Mukhanov, V. (2005). *Physical Foundations of Cosmology*. Cambridge University Press.
7. Hawking, S. W., and Ellis, G. F. R. (1973). *The Large Scale Structure of Space-Time*. Cambridge University Press.
8. Penrose, R. (2004). *The Road to Reality: A Complete Guide to the Laws of the Universe*. Alfred A. Knopf.
9. Living Reviews in Relativity. (n.d.). Retrieved from `https://livingreviews.org/`
10. Annual Review of Astronomy and Astrophysics. (n.d.). Retrieved from `https://www.annualreviews.org/journal/astro`
11. Planck Collaboration. (2020). Planck 2018 results. *Astronomy and Astrophysics*, 641, A1-A12.
12. BICEP2 Collaboration. (2018). Constraints on Primordial Gravitational Waves Using Planck, WMAP, and BICEP/Keck Data. *Physical Review Letters*, 121(22), 221301.