

# Quantum Substrate Dynamics (QSD)

## Interpretation of the Big Bang and Inflation

### 1 Introduction

In conventional cosmology, the Big Bang is often described as a singular explosive event from an infinitely dense point, followed by rapid inflation of spacetime itself. Despite the success of this narrative in matching observational data, it relies heavily on singularities, hypothetical fields (such as the inflaton), and patches to resolve issues like the horizon and flatness problems.

Quantum Substrate Dynamics (QSD) offers an alternative view: the substrate of reality exists as a coherent quantum fluid, and the Big Bang represents a spontaneous coherence tension collapse followed by a scalar rarefaction shock that unlocked phase degrees of freedom — allowing mass, charge, light, and structure to nucleate across the substrate.

### 2 Pre-Inflation: Silent Substrate Phase

Before inflation, the substrate existed in a silent, hyper-coherent scalar phase:

- No transverse phase oscillations (no light, no charge).
- Uniform scalar coherence tension.
- No distinct mass-phase structures.

This "deep" substrate was not empty but filled with coherent tension — silent and motionless, with no degrees of freedom available for dynamic phenomena.

### 3 Triggering Event: The Substrate Twitch

A spontaneous rarefaction event — a coherence instability or infinitesimal external perturbation — triggered a scalar shockwave across the substrate:

- This shock represented a **Super- $\Psi$  Boom**, a rapid rarefaction wavefront.
- It unlocked transverse coherence degrees of freedom.

- Mass-phase nucleation, light, and charge became possible *after* the wavefront passed.

The substrate did not explode; it breathed.

## 4 The Wavefront: Darkness Ahead, Light Behind

- **Ahead of the wavefront:** pure scalar coherence; darkness; no EM radiation.
- **At the wavefront:** phase unlocking as tension collapsed.
- **Behind the wavefront:** emergence of transverse modes — mass, charge, and light formed *in-situ*.

The universe did not expand from a point; it bloomed everywhere the substrate relaxed.

## 5 Mass and Motion: Inheriting Phase Flow

- Mass-phase seeds formed mid-flow, inheriting small random vector biases from substrate phase gradients.
- Separation of mass occurred naturally — not from spacetime expansion but from memory of substrate motion.
- Large-scale structure arose from slight coherent biases in phase gradients across regions.

## 6 Resolution of Standard Problems

- **Horizon problem:** Phase coherence was global prior to unlocking; no causal disconnect.
- **Flatness problem:** Substrate tension gradients naturally minimized curvature.
- **Structure formation:** Local phase gradient inheritance seeded early mass clumping.
- **Inflation ending:** Inflation ended when transverse coherence stabilized post-rarefaction.

## 7 Conclusion

In the QSD framework, the Big Bang is reinterpreted not as a singularity but as a substrate phase transition:

- A single substrate twitch — a rarefaction of coherence tension — initiated the scalar shock.
- Light, mass, and charge nucleated *in-situ* across the relaxing substrate.
- Large-scale structure emerged naturally from initial coherence memory.
- The universe was not flung outward from a point — it was born everywhere coherence unlocked.

*The substrate twitched — and the universe was born.*