Abstract

The search for a unified physical theory often called the Theory of Everything remains one of the greatest challenges in modern physics. General Relativity describes gravity as the curvature of spacetime, while Quantum Mechanics governs particle behavior through wavefunctions—yet these frameworks remain incompatible at extreme scales. **Spacetime Compacity** proposes a unifying principle in which all fundamental forces arise from variations in spacetime compression or compaction, rather than mass-induced curvature or force-mediated interactions with String Theory for example.

"Compacity is a measure of the amount of space occupied by an object, substance, or system. It quantifies how tightly packed or dense the constituents of a given entity are and describes the ability of a structure to contain, hold, or store information and energy" - Miriam Webster

In Spacetime Compacity Theory (SCT), compacity refers to intrinsic variations in the density of spacetime itself — variations that govern the behavior of matter, energy, and fundamental forces. Unlike traditional notions of density, which apply to matter within space, this theory proposes that spacetime is itself compressible and dynamically evolves to produce gravitational, electromagnetic, and quantum effects through structured vortices.

As spacetime self-organizes, it naturally compresses, and flow patterns constrict. This focusing of structure plays a critical role, especially in later discussions of the self-organizing properties of spacetime. Keep in mind that **objects follow the path of steepest compacity — the route through spacetime where both distance and time are minimized due to increasing local density.**

In this way, Spacetime Compacity Theory redefines gravity, electromagnetism, and quantum mechanics as emergent effects of a dynamically evolving spacetime vortical density field. It challenges the concept of dark matter, offering a natural explanation for galaxy rotation curves, gravitational lensing, and cosmic structure formation without invoking exotic particles. Additionally, it proposes that wave-particle duality, quantum fluctuations, and entanglement emerge from localized compacity oscillations within spacetime itself.

This work develops SC Theory through both conceptual exploration and rigorous mathematical formulation, deriving compacity-modified forms of the Schrödinger equation and extending Maxwell's equations to incorporate spacetime compression variations, while employing continuum mechanics to describe the dynamic behavior of spacetime flow. Experimental predictions include gravitational wave distortions, speed of light variations in high-density regions, and deviations in nuclear decay rates under compacity shifts. Once validated, SC Theory offers a pathway to unifying the fundamental forces of nature, redefining gravity, and suggesting technological advancements in gravity-based propulsion, energy extraction, and spacetime engineering.

While some emerging theories attempt to recreate fundamental constants through mechanical derivations anchored to assumed scales, this work seeks to reveal the underlying dynamics that *precede* these constants, allowing them to emerge as natural consequences of spacetime behavior itself.

Chapter 1

The Breathing Universe: Complete Theory and Final Thoughts

"The universe is not a single breath, but a cycle of breaths."

As we close this work, it is natural to ask — what is the final fate of the universe? Spacetime Compacity Theory does not end with origins alone. It extends forward, predicting not only how the universe began, but where it is going. In this model, spacetime is not a passive void, but a living field — dynamic, cyclic, and completely self-contained.

1.1 The Full Cycle of Compacity

According to SCT, the universe follows a natural cycle of compacity:

- The universe began in compression, at maximal compacity.
- Expansion followed, as decompression released stored energy with only 0.5 percent expansion in this cycle so far.
- But expansion is not infinite in SCT. It follows a calculable flow.

1.1.1 Calculating the Cycle Time

We can estimate the duration of expansion based on field dynamics.

The compacity decompression rate can be approximated using the Hubble constant H_0, treating it as a proxy for our field decompression rate k.

Given:

$$H_0 \approx 70\,\mathrm{km/s/Mpc} \tag{1.1}$$

1.1.2 Convert to SI units

$$1\,\mathrm{Mpc} = 3.086 \times 10^{19}\,\mathrm{km} \tag{1.2}$$

Thus:

$$k \approx H_0 \approx \frac{70}{3.086 \times 10^{19}}\,\mathrm{s}^{-1} \approx 2.27 \times 10^{-18}\,\mathrm{s}^{-1} \tag{1.3}$$

1.1.3 Next, estimate the compacity ratio

$$\frac{C_0}{C_{\mathrm{external}}} \approx \frac{5.155 \times 10^{96}\,\mathrm{kg/m}^3}{9.9 \times 10^{-27}\,\mathrm{kg/m}^3} \approx 5.21 \times 10^{122} \tag{1.4}$$

1.1.4 Compute the natural logarithm

$$\ln\left(5.21 \times 10^{122}\right) \approx \ln(5.21)+122\times\ln(10) \approx 1.65+122\times2.3026 \approx 283.37 \quad (1.5)$$

1.1.5 Now, compute time to equilibrium

$$t_{\text{eq}} = \frac{1}{k}\ln\left(\frac{C_0}{C_{\text{external}}}\right) \quad (1.6)$$

$$t_{\text{eq}} \approx \frac{1}{2.27 \times 10^{-18}} \times 283.37 \quad (1.7)$$

$$t_{\text{eq}} \approx 1.249 \times 10^{20}\,\text{s} \quad (1.8)$$

1.1.6 Convert to years

$$t_{\text{eq}} \approx \frac{1.249 \times 10^{20}}{3.154 \times 10^{7}} \approx 3.96 \times 10^{12}\,\text{years} \quad (1.9)$$

Thus:

$$t_{\text{expansion}} \approx 4 \times 10^{12}\,\text{years} \quad (1.10)$$

1.1.7 Assuming symmetry, contraction mirrors expansion

$$t_{\text{contraction}} \approx t_{\text{expansion}} \approx 4 \times 10^{12}\,\text{years} \quad (1.11)$$

Therefore, the full cycle:

$$t_{\text{total cycle}} \approx 8 \times 10^{12}\,\text{years} \quad (1.12)$$

1.1.8 Culminating in a cyclical

Big Bang $\Leftrightarrow$ Proto-Universe ∞

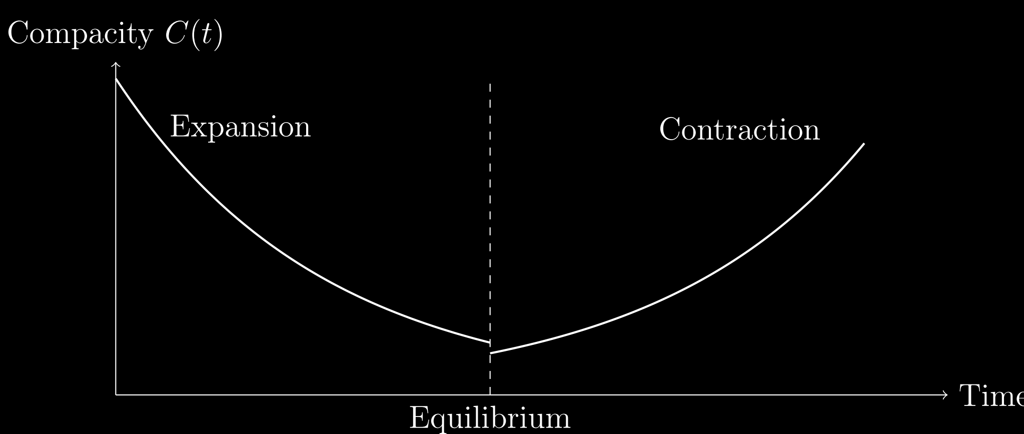
1.1.9 Summary

The cycle is not speculative — it is calculable:

- Expansion: $\sim$ 4 trillion years
- Contraction: $\sim$ 4 trillion years
- Full cycle: $\sim$ 8 trillion years to Big Bang ∞

The universe breathes.

This is not collapse. This is not heat death. This is natural, cyclic renewal.



1.2 Negentropy in the Closed System

A central principle of Spacetime Compacity Theory is that the universe is a closed system.

There is no external environment into which energy is lost. Spacetime compacity itself is the field, the container, and the medium of motion and structure.

Because the universe is closed, the natural flow is not toward disorder, but toward continuous self-renewal.

The cycle of compacity preserves energy and structure internally:

$$\text{Total Energy} = \text{Constant (Conserved Within the Field)}$$

$$\text{System Behavior} = \text{Negentropic}$$

As expansion occurs, field tension is released but not lost. Vortex structures maintain internal order. During contraction, field tension rebuilds, restoring the original compact state naturally.

There is no irreversible loss of order. There is no thermal death.

Instead, the universe exhibits persistent negentropy:

$$\text{Negentropy} = \text{Natural State of the Closed System}$$

Cycles of compacity ensure the continual restoration of usable energy and order, culminating in the next ignition point:

$$\text{Big Bang } \infty$$

Conclusion: SCT presents a closed, negentropic universe, perpetually cycling energy and structure through compression and expansion. The system breathes endlessly, preserving itself without loss to external entropy.

— *Negentropy and the Cycle of Compacity*

1.3 Summary Thoughts

As I write these summary words, I recognize that this book is not only the expression of my theory, but the completion of my own cycle of thought. What began as quiet observation now also breathes in this book — completed and yet just beginning in hope of being integrated into the Astrophysics body of work. The future is written not just in the stars, but in the vortical spacetime between them as well, and ourselves. Still, it remains a wonder: how did that proton-sized proto-universe come to be in the first place? Are there others? Are there universes all around us, just beyond our view? And how do we get there? *Perhaps, to survive — and to understand — we must someday learn to navigate the multiverse.*

It is astonishing that from the faint recession of galaxies, from the observable expansion of the cosmic field, and from our understanding of these fundamentals, we can calculate not just the cycle of the universe, but our place within it — and realize that we are living at the dawn of cosmic expansion, **less than half of one percent into the journey**.

— *Closing words of the author*

I ask myself: if this framework holds and requires no invented scaffolding, why has it not taken center stage in *physics? The answer may be simple: it possibly had not yet been thought of.*