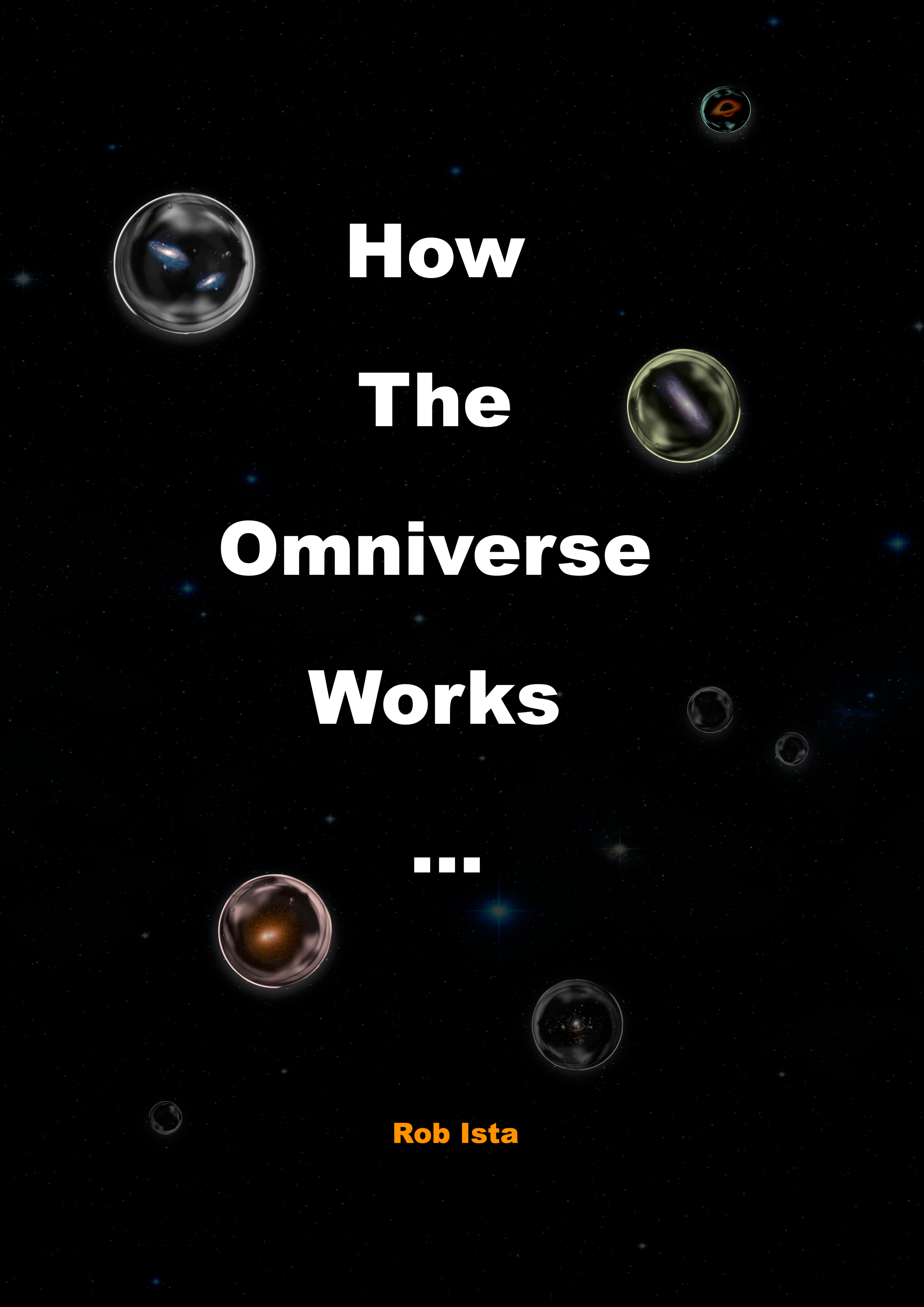


How The Omniverse Works …

Rob Ista

December 2024, 1.0.1

- Initial release

January 2025, 1.2.0

- Changed name O-quark to O-fermion (Om)
- Typo mass range 10-500 GeV to 10-250 GeV

February 2025, 1.2.1

- Cover pages and font size
- ISBN for publishing
- Typo reference number Higgs

February 2025, 1.2.2

- Note @ Chapter 10 picture
- QR www.robista.org
- More typos

ISBN 978-94-93407-38-1

Published and Printed by Probook
info@probook.nl

Copyright © Robert (Rob) J. Ista
February 2025
All rights reserved

in Spain

How the Omniverse works . . .

Table of contents

Summary

A universe is merely a local phase transition resulting from small fluctuations or instabilities in an infinitely large dark energy quantum field, the Omniversal Field (O-field), also referred to as the Dark Field due to its relationship with dark energy and dark matter.

The mentioned phase transition is a layered excitation of this quantum field, causing a "Big Bang" which is local from the Omniversal field point of view and does not originate from a single point like an explosion, but rather spans a vast region. In this process, energy and matter manifest from the O-field, encompassing both particles we observe as ordinary matter (such as quarks and electrons) and particles that behave like dark matter.

Dark energy and dark matter persist and serve both as the canvas for multiple Big Bangs of various universes—whether or not they occur simultaneously—and as an explanation for the role dark matter continues to play in the structure and movement of galaxies, both within individual galaxies and between them. The large cosmic structure of galaxies as we know it is thus not caused by a driving force of dark energy in the "voids," but rather because galaxies simply drift towards lighter regions in the O-field.

Eventually, the "Fade Out" begins and all galaxies extinguish. After trillions of years, only dense, stable objects such as black holes remain (DOEs, Dark Object Embers), alongside some faint residual dust and gas. DOEs interact gravitationally with each other and with the dark matter in the O-field, potentially playing a role in the conditions that lead to new Big Bangs.

Because spacetime around black holes is so extremely distorted or even comes to a halt, it is effectively no longer present around these objects. In this sense, black holes can be considered the "endpoints" of spacetime.

Layered excitations in the O-field, which lead to the formation of new universes, arise from a combination of factors that amplify local instabilities. Increased entropy in the O-field, driven by dark energy waves and further influenced by the gravitational waves of existing dark matter, can push the field beyond its stability threshold. Collisions of DOE's generate intense gravitational waves that propagate through the O-field, creating localized perturbations. These waves disrupt the field’s tension and amplify existing fluctuations when the O-field is near a critical instability, further enhancing the likelihood of phase transitions. Such transitions can result in the creation of dark matter, the emergence of spacetime, quantum fields and ultimately, a new universe.

This process can, in principle, occur indefinitely and independently within the O-field, allowing multiple universes to form simultaneously.

Although unlikely due to the omniverse's vast scale, **universes may overlap** over time, merging their quantum fields and spacetime. This blending of O-field excitations could produce hybrid spacetime structures and new particle interactions. However, we should be able to see this in the Cosmic Microwave Background (CMB). So obviously it did not happen yet.

The dynamics of spacetime and matter within a universe can be described using a modified form of Einstein's field equation [*1]:

$$G_{\mu\nu} + \Lambda(\varphi_O, \pi_O)\, g_{\mu\nu} = \frac{8\pi G}{c^4}\, T_{\mu\nu}$$

where $\Lambda(\varphi_O, \pi_O)\, g_{\mu\nu}$ is interpreted as a dynamic quantity, depending on fluctuations in the O-field.

To further refine the interactions within a universe, the equation can be expanded to include fluctuations ($\nabla\varphi_O$) and additional dynamics, such as traces or influences of pre-spacetime dynamics, the original "omniversal" fluctuations:

$$G(\varphi_O, \pi_O) = \frac{8\pi G}{c^4}\left[T(\varphi_O, \pi_O) + \Lambda(\varphi_O, \pi_O, \nabla\varphi_O) + F(\varphi_O, \pi_O)\right]$$

Here:

- $\Lambda(\varphi_O, \pi_O, \nabla\varphi_O)$ is the dynamic cosmological constant, reflecting fluctuations in the O-field and
- $F(\varphi_O, \pi_O)$ represents additional dynamics, such as contributions from dark matter or the dissolution of quantum fields during a Fade Out.

In the expanded Einstein field equation, $\nabla\varphi_O$ represents the gradient of fluctuations in the O-field, reflecting local changes in its amplitude and momentum. These gradients directly affect the dynamic cosmological constant $\Lambda(\varphi_O, \pi_O, \nabla\varphi_O)$, which governs the relationship between dark energy and spacetime geometry. Regions with steep $\nabla\varphi_O$ gradients correspond to areas of heightened instability, where the O-field is more likely to undergo a phase transition. By incorporating $\nabla\varphi_O$, the equation connects pre-spacetime fluctuations in the O-field with their influence on the evolution of spacetime, matter and energy within a universe. This integration highlights the crucial role of O-field dynamics in shaping local structures and their associated spacetimes.

Spacetimes originating from different local phase transitions in the O-field are inherently isolated due to the nature of layered excitations. Each phase transition defines a specific spacetime structure, with its own unique metrics, energy distributions and quantum field dynamics. Initially, the localized nature of these transitions ensures that the spacetime boundaries do not overlap, as the emergence of one spacetime is independent of conditions in adjacent regions of the O-field. However, local excitations occurring in close proximity might interact, blending their quantum fields and eventually forming one unified spacetime. Furthermore, the energy and entropy required to sustain a phase transition are contained within one (possibly merged) localized excitation, preventing cross-interference between separate spacetimes at that time.

And so on and so on . . .

(*1) - In this summary we use the full notation φ_O and π_O to be precise. In the remainder of this booklet we'll sometimes use only φ and π for readability but it means the same.

1. Introduction

I have always been deeply fascinated by the phenomena of our universe. Solar and star systems, the Big Bang, black holes, dark energy and matter and especially the theories surrounding quantum fields and relativity intrigued me endlessly.

This fascination brought forth questions that constantly occupied my mind, such as: "What existed before the universe and what comes after?" "Why can't we properly relate gravity to the other three fundamental forces?" "Why do we know so little about dark matter?" "Will we discover more elementary particles after the Higgs?" "What is spacetime and what happens if it ceases to exist?" — and many more.

These questions are no different from those that have puzzled renowned scientists for decades. Yet, after reading something by Penrose[(110)] and with a nod to the inspiring TV-series "How the Universe Works", I felt that even his perspective did not present a fully holistic view. Something was still missing, leaving all the above questions unanswered.

I became ambitious. I wanted solutions and extensions of existing theories and although speculative and divergent from the mainstream consensus, still rooted in physics. However, the three dots (. . .) in the title in this booklet shows this view still needs a lot of study and sufficient proof.

To explain the concept of the Omniverse, I propose the existence of a new fundamental and (fermionic) quantum field: the O-field. Unlike the quantum fields we know from modern physics, which exist only within the framework of spacetime, the O-field is more fundamental and omniversal. It exists everywhere — even in regions where spacetime itself does not. Key to its role is the generation of energy through differences in entropy within the field, a process that gives rise to what we perceive as dark energy.

The O-field operates alongside another omniversal field, the (bosonic) Higgs field, which is already known to grant mass to particles like quarks and electrons within our existing universe. In the Omniverse framework however, the Higgs field also interacts with a unique excitation of the O-field: the O-fermion. This particle, assumed to be analogous to dark matter, carries mass but has no charge, which is crucial to understanding its behavior. Without electric, color or probably not even weak charge, the O-fermion does not interact with the other three fundamental forces (electromagnetic, strong and weak nuclear forces).

These forces only appear once spacetime itself comes into existence — a process triggered by a localized, layered excitation of the O-field, also called a "super-excitation." This event sparks the emergence of a universe, complete with spacetime and the 16 known quantum fields that give rise to the particles and forces we are familiar with. Over vast timescales however, universes "fade out" as the 16 quantum fields dissolve, merging back into the O-field. When this happens, spacetime ceases to exist and the system returns to its original, omniversal state, awaiting the possibility of new phase transitions that might create new universes.

It was particularly challenging to discuss such a significant paradigm shift while providing the necessary details, especially since I often had to first grasp the fundamental principles of physics sufficiently to proceed further.

As a result, certain topics reappear throughout this treatise, each time with greater depth or a different perspective. In the beginning, the discussion of the theory may resemble a more popular-science narrative, but as the text progresses, the physical underpinnings are explored in increasing detail.

Nevertheless, the concept remains highly speculative and currently unprovable and it is expected that considerable time will pass before it is both accepted and supported by sufficient experimental evidence.

So I have tried to make this booklet as readable as possible for both laypeople and physicists. As a result, the initial chapters present the theory in a somewhat lighthearted manner, using plenty of imagery — not least to ensure that I could continue to understand it myself. When the content becomes more technical, I have aimed to provide an introduction as a readable summary of what follows. Also a certain amount of redundancy was unavoidable. While introducing a provocative, speculative new theory, repetition of concepts and terms just guided myself and hopefully the readers as well.

The chapters **Context** and **History** explain several concepts and describe the development of insights into our universe over the years.

Omniverse, **Big Bang** and **Fade Out** outline the concept of the Omniverse, including the emergence and eventual fading of universes.

Starting with **Voids**, the content might become more interesting for scientists. This chapter focuses on the voids between the filaments of the cosmic web as the most intriguing entities to find evidence for the Omniverse and its dark energy and matter.

In the chapter **Quantum Fundamental Theory**, followed by **O-field** and the **O-fermion**, the potential expansions of the Standard Model with the above mentioned O-particle are discussed, while in **General Relativity Theory**, the possible consequences for Einstein's famous equations are explored, should the Omniverse truly exist.

For everyone, both lay people and physicists, starting with the **References** chapter might actually not be a bad idea. It's not the usual dry list of references to citations in "official format" but an overview of the great scientists referenced in this booklet, including the connection of their views to the Omniversal Theory. I choose to not repeat too much of what they discovered in my text but summarise it in the Reference section. Maybe not "following the rules", I just felt it was the right thing to do. The result is that this reference chapter is a significant part of this booklet. Did I miss someone? Oh, yes. Andrei Line, Hugh Everett, Carlo Rovelli are worth to mention but there are many others who deserve a prominent seat around a table discussing the **Omniversal Theory.**

Enjoy.

2. Terminology and context

Infinity seems difficult to grasp. For many people, it simply means "an incredibly large amount" because the idea of something that has no end is hard to visualize. When we look at our universe, it is often said to be infinitely large. Yet, at the same time, we can only observe up to a distance of 13.8 billion light-years around us — the presumed starting point of our universe, the Big Bang as conceived by George Lemaître(125). This implies that the observable universe has a total diameter of approximately 27.6 billion light-years, which is finite, not infinite. Even when we account for the expansion of spacetime in our calculations, our best understanding places the edge of the observable universe at a radius of about 48 billion light-years. This results in a total diameter of close to 100 billion light-years for our visible space.

To truly speak of infinity, we must go beyond what we can see or measure. We can imagine our universe, with all its stars and galaxies, as a tiny pinprick within a vast, infinite ocean of "something or nothing," possibly containing an infinite number of other such pinpricks.

The term ***Cosmos*** is often used as a synonym for "universe" in the literature on astronomy and physics. However, within the context of this treatise, that perspective is too narrow. The aim of this theory is to describe the underlying structure of universes. For this reason, the term ***Omniverse*** is used here, referring to the totality of all possible universes and the fundamental mechanisms through which they emerge, exist and eventually dissolve.

This leads to a distinction between the concepts of ***Universal*** and ***Omniversal***. In everyday language, *universal* means "all-encompassing." However, in the context of this theory, this term may cause confusion because the emergence of universes is a dynamic process. Universes like ours emerge and then eventually disappear. Therefore, in this booklet, *universal* is used to refer to phenomena that relate to a single universe, while *omniversal* is used to denote concepts that have relevance within the context of infinity.

In both public and scientific discussions, ***Dark Energy*** *and* ***Dark Matter*** are often mentioned as mysterious components of the universe. In the context of the Omniverse, these concepts get a more profound meaning. Dark energy and dark matter are seen as a fundamental, ever-present properties of the Omniverse — not just within individual universes — driving Big Bangs.

As a universe fades, all light eventually dims, leaving behind dense, stable objects such as black holes, neutron stars and dark stars, along with faint, cold gas and dust. These objects drift through the vast openness of the Omniverse. We refer to them as ***Dark Object Embers*** (DOEs), reflecting their nature as the final glowing remnants of a universe's existence and symbolizing their enigmatic presence, unbound to any specific universe.

In this **Omniversal Theory** we will continuously speak about the **O-field** and **O-fermion** (Om)**, t**he theorised quantum field and particle from which universes are imagined to emerge. As per today, they are hypothetical, unproven. But if Higgs was the God-Particle, then Om is the Devil :).

3. History

So far, we have always regarded our universe as the maximum reach of our imagination. Our physics is built on this premise — we cannot see beyond the "edge," marked by the cosmic microwave background radiation. And that, in itself, is already quite significant. Humanity's perception of its surroundings, starting with the Earth, began on a much smaller scale.

Geocentrism: In ancient times, the Earth was believed to be the undisputed center of the cosmos. According to Ptolemy's 2nd-century geocentric model, the Sun, Moon, stars and planets revolved around the Earth in perfect circles. This belief was supported by religious doctrine and everyday human experience — after all, the ground beneath our feet feels stationary, while the stars appear to move across the sky.

Heliocentrism: This worldview was challenged by Nicolaus Copernicus([108]) (1473-1543), who proposed that the Sun, not the Earth, was the center of the solar system. In this model, the planets, including Earth, orbited the Sun. This radical shift shook both religious dogma and established scientific thought. Galileo Galilei (1564-1642) provided observational proof with his telescope, revealing Jupiter’s moons orbiting the planet, proving that not everything revolves around the Earth.

The Sun as a Star: The next leap occurred when it was realized that the Sun is merely one of many stars. Giordano Bruno (1548-1600) speculated that the stars visible in the night sky were themselves suns, each with its own planetary system. This idea was considered heretical and Bruno was executed for his views. However, his vision lived on. Later observations with advanced telescopes confirmed that stars are indeed distant suns, many of them vastly larger than our own.

The Milky Way and Other Galaxies: Initially, the Milky Way was thought to be the entirety of the universe. William Herschel (1738-1822) mapped the structure of the Milky Way, but it wasn’t until Edwin Hubble (1889-1953) observed the Andromeda Galaxy that humanity realized that the Milky Way was just one of countless galaxies in an enormous cosmic expanse. Suddenly, the universe expanded from one galaxy to billions, each containing billions of stars.

The Expanding Universe: Hubble's most revolutionary discovery came in 1929 when he demonstrated that galaxies are moving away from each other, indicating an expanding universe. This laid the foundation for the Big Bang Theory, which proposed that the universe originated from a single, dense, hot point. Our concept of the universe now included both spatial and temporal dimensions, with the realization that time itself had a beginning.

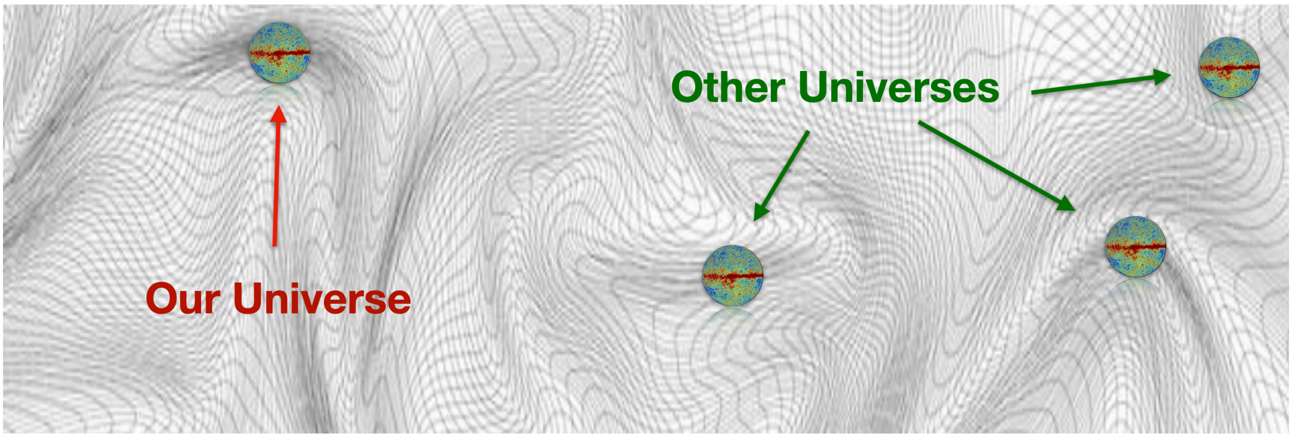
Penrose's Cyclic Cosmology: Roger Penrose (1931-) suggested that the universe does not merely expand indefinitely but instead undergoes an infinite cycle of birth and rebirth, the Multiverse. According to his "Conformal Cyclic Cosmology" (CCC) hypothesis, the "end" of one universe, marked by infinite expansion, becomes the "beginning" of the next. His theory proposes that traces of prior universes might still be detectable in the cosmic microwave background (CMB).

The Omniverse Hypothesis: While Penrose's view implies that universes exist in a sequential loop, with one universe giving rise to the next, the Omniversal Hypothesis extends this idea by proposing that instead of a single cyclic universe, an infinite number of universes exist simultaneously.

What sets the Omniverse Hypothesis apart is that these countless universes do not arise one after another, nor are they isolated bubbles separated by an absolute void. Rather, they coexist "side by side," so to speak, embedded within an unfathomable medium that is neither space nor time as we know it. This vast "canvas" provides the underlying support on which universes can form, expand and dissolve, without directly interacting or influencing one another. Just as countless stars are scattered across a single night sky, these universes are scattered across an overarching reality, each following its own destiny but all "floating" on the same invisible foundation.

By placing our universe within a broader reality, the Omniverse concept redefines our cosmic perspective. Instead of a singular cosmic story — or even a series of them — we have a grand meta-cosmos, an endless expanse of universes, each emerging, evolving and eventually fading out, all anchored to something more fundamental than space or time itself.

4. Omniverse



Introduction

The Omniverse theory extends beyond traditional cosmology, proposing a reality where infinite universes exist simultaneously within a grand, all-encompassing canvas. Each universe follows its own life cycle, but the underlying reality is governed by fundamental principles that exist beyond any single universe.

Beyond Multiverse Thinking

While popular theories like the Multiverse imagine universes as independent, isolated bubbles with potentially different physical laws, the Omniverse presents a radically different view. The idea that "different universes have different laws of physics" is, in this context, flawed. Instead, all universes follow the same fundamental principles governed by the Omniverse.

This perspective suggests that what we perceive as "laws of physics" (like gravity, entropy and the speed of light) are not different from one universe to another. They are contextual manifestations of omniversal laws that arise locally within the spacetime fabric of each universe. Variations in observable constants (like the Hubble constant or the cosmological constant) do not imply "different laws" but result from differences in the local composition of matter, such as the relative amounts of dark matter and visible matter. These differences affect how spacetime responds to mass and energy in each specific universe.

The Omniverse as the Fifth Dimension

Physicists have long speculated about higher dimensions, often as part of **String Theory** or **M-Theory**, where extra dimensions are "curled up", unobservable and hard to envision. The Omniverse Theory however, proposes another view: following Occam's Razor, t**he Omniverse IS the "missing" dimension.** It's the Zero-Dimension but since we start counting from one and a 0 is hard to distinguish from an O, let's call it the **5th (fifth) dimension.**

The logic behind this idea is simple. If we conceive of a universe with its spacetime as 4-dimensional (three spatial dimensions plus one temporal) and recognize that the Omniverse exists as an ever-present backdrop — whether or not a universe exists — then it follows that the Omniverse represents a dimension beyond spacetime. This fifth dimension is not a "dimension" like space or time. Instead, it is a **dimension of fundamental existence**, a deeper framework from which spacetime itself emerges.

This concept could offer a new interpretation of Einstein's "spooky action at a distance" (quantum entanglement), a phenomenon first described by Albert Einstein, Boris Podolsky and Nathan Rosen in their famous EPR paradox (1935). The formal concept of entanglement was later coined and mathematically developed by Erwin Schrödinger. The O-field, as a shared fundamental dimension, might allow the entanglement between particles to persist across spacetime.

While traditional quantum mechanics suggests that entangled particles communicate instantaneously, this "spookiness" could be explained by recognizing that maybe their entanglement, not the particles themselves, exists within the O-field. In this framework, "distance" becomes irrelevant because the connection between the particles is rooted in the O-field—a dimension where space and time are emergent rather than fundamental. However, it remains to be determined how "information" and its transfer are defined and how they exist within the O-field to account for the entanglement of particles across arbitrary distances in spacetime.

Maybe this gives birth to a another highly speculative concept of "**Micro Bangs**". Compared to Big Bangs microscopic excitations of the O-field caused by interference with spacetime and the 16 other quantum fields. A Micro Bang could conserve the information of objects or information from a universe and maybe even be able to "transfer" it (remember, there is no space or time in the O-field).

The Omniverse as a Quantum Field

Imagine a fundamental quantum field that underlies all phenomena within the Omniverse. **The O-field**. Consistent with ideas proposed by Sean Carroll[(101)], it is an ever-present, infinite field that exists independently of space, time and matter.

If the Omniverse is seen as a vast canvas, then the **O-field** (pronounced "Om-field" and short for "Omniversal Field") is the fabric of that canvas. Because of its connection to dark energy and dark matter, it is also referred to as the "**Dark Field**".

It's not like space or time — it's something deeper. Unlike the space and time of our universe, which have edges and boundaries (like the edge of what we can observe), the O-field is infinite. It stretches everywhere, not just inside our universe but in the "gaps" between universes — regions where space and time don't even exist.

The O-field behaves like any other quantum field — a kind of invisible field that can exist everywhere —, but unlike the fields we're familiar with like the electromagnetic field it doesn't rely on space and time to exist. Instead, it's always present — in every universe, between universes, so in all places where there's something or nothing at all. This gives it a unique role in the Omniverse: It's the **ultimate "ground state"** from which all other things arise.

Fluctuations in the O-field, whether spontaneous or induced by local instabilities and following the principles of the Quantum Field Theory (QFT), give rise to particles, the O-fermions, which are stable, localized excitations of the field.

Together with the omnipresent Higgs(126) field, the O-field establishes a two-field model for the origin of gravity. As mass emerges from the interaction between O-fermions and the Higgs field, the O-field responds to the presence of mass, producing gravitational effects which may contribute to the observed effects attributed to dark matter.

The O-field serves as the fundamental backdrop from which universes can emerge through phase transitions, as proposed in the "No Boundary Proposal" by Hawking and Hartle(102). A phase transition can be compared to the transformation of water into ice or vice versa. During a Big Bang, this process occurs suddenly, similar to how supercooled water in a glass can instantly freeze into ice with a single tap.

This interpretation draws parallels to Alan Guth's(123) theory of cosmic inflation, where rapid exponential expansion following a phase transition is seen as a key event in the birth of a universe, similar to the emergence of universes from localized excitations in the O-field.

Unlike classical models, in which space and time are assumed to be pre-existing frameworks, the O-field is considered to be prior to space-time. Space-time is not a "stage" on which everything unfolds but a local excitation of the O-field. This distinction is essential. In its primordial state, the O-field contains neither time nor space. It exists in a state where only dark energy and dark matter are present as fundamental entities.

The Omniverse model argues that spacetime and the 16 quantum fields are emergent properties arising from local excitations in the O-field. This perspective naturally leads to a clear distinction between what is universal (applicable only within specific universes) and what is omniversal (applicable to the entire Omniverse, including the universes).

This concept echoes Max Tegmark's[122] proposal that reality is fundamentally mathematical, with the Omniverse's O-field serving as a prime example of a mathematically driven structure that underlies spacetime and quantum fields.

The O-field and Higgs

The O-field isn't alone. As earlier mentioned, there's a second key player: the **Higgs field**, which is the reason particles have mass. The Higgs-field is deeply tied to the way physics works.

Since the Higgs-field is also omni-present gravity is the only force that exists in the Omniverse beside the force of dark energy, the differences in entropy of the O-field. Electromagnetism and the weak- and strong-forces need spacetime and the 16 quantum fields.

This means that while the **O-field serves as the backdrop** for the formation of universes, the **Higgs field sculpts the matter within them**. Together, they form the fundamental structure of the Omniverse:

- The O-field provides the environment in which universes can "pop up" like bubbles.
- The Higgs field ensures that particles inside these universes have mass and behave according to known physical laws.

Universal versus Omniversal

The proposal that gravity is **omniversal** while the other three fundamental forces are **universal** is crucial to understanding the Omniverse framework. Unlike General Relativity (GR), where gravity is seen as the curvature of spacetime, in the Omniverse, spacetime does not pre-exist but instead emerges within universes as a local excitation of the O-field, a Big Bang.

Concept	Omniversal or Universal?	Reasoning
Gravity	Omniversal	Emerges from the O-field's response to mass (via the Higgs field), independent of spacetime.
Electromagnetism	Universal	Requires electrically charged particles and operates within the spacetime framework.
Weak Force	Universal	Requires weakly charged particles and W/Z bosons, which exist only after spacetime emerges.
Strong Force	Universal	Acts on particles with color charge and requires the spacetime-dependent quantum fields.

Quantum Field Theory	Omniversal	Describes the fluctuations and interactions of quantum fields within the Omniverse (including the O-field if treated as a quantum field).
General Relativity	Universal	Describes spacetime curvature and applies only within universes where spacetime exists.

Physicists have long sought to unify the four fundamental forces: electromagnetism, the strong and weak nuclear forces and gravity. However, gravity remains resistant to unification due to its independence from spacetime-based dynamics. The Omniverse framework suggests that gravity, unlike the other forces, is omniversal, originating directly from the O-field. This independence makes it incompatible with Standard Model physics, offering a compelling alternative to theories such as string theory that rely on higher dimensions or unobserved particles like the graviton.

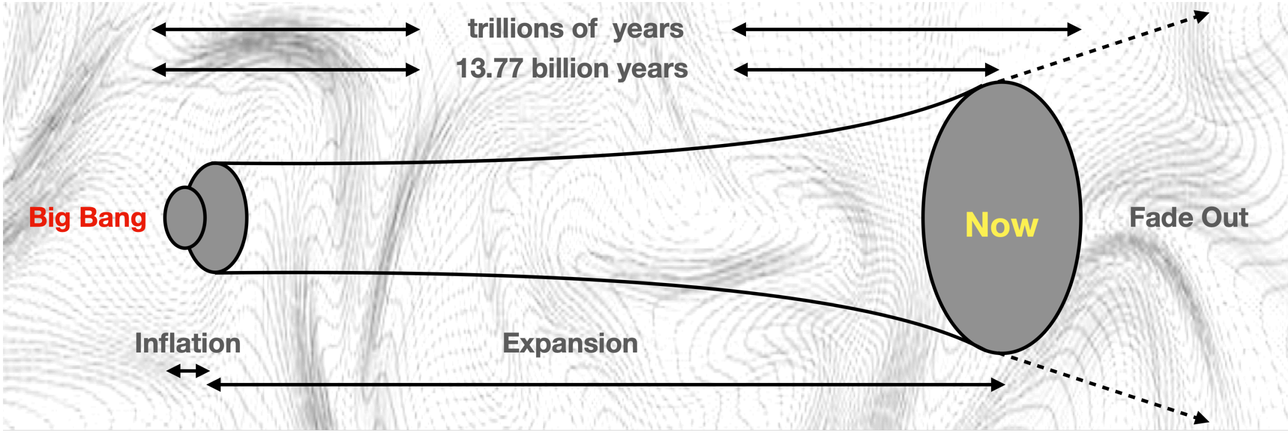
Although unlikely given the vast scale of the omniverse, it is possible within the Omniversal Theory that two or more universes could overlap and merge their quantum fields and spacetime at a later stage. In this scenario, the boundaries between their respective spacetime structures would dissolve, allowing the O-field excitations from both universes to blend. Such a merging could produce a hybridized spacetime geometry and potentially new particle interactions as their quantum fields converge. While local phase transitions blend already if in close proximity so typically establish distinct spacetime regions, the possibility of partial or complete overlap remains an open consideration, especially if neighboring phase transitions occur in close proximity within the O-field. However, it obviously didn't happen yet since we should have seen that in the Cosmic Microwave Background (CMB) but perhaps there is still a hidden clue in there.

In the next three chapters, we will explore in greater depth how universes emerge through the previously mentioned **Big Bangs**, evolve into a vast cosmic web with ever-growing **Voids** and eventually **Fade Out**, "dissolving" back into the O-field.

In the second half of this thesis, Quantum Field Theory (**QFT**) is placed in the context of the Omniverse, with dedicated sections for the **O-field** and the **O-fermion.**

Finally, the consequences for General Relativity (**GR**) are explored, introducing a revised perspective on gravity as the driving force independent of space and time.

5. Big Bang



Imagine you are a surfer on one of the beaches of a surfing paradise, like Biarritz France and Waikiki Beach Hawaii. You’re already in awe of a "perfect wave" towering 30 meters high. Now, try to picture waves spanning billions of light-years crashing into each other and the immense energy that this collision releases.

Add to that the power of huge gravitational waves caused by dark matter or possibly even collisions of remnants from previous universes.

Bang

Small fluctuations in the O-field continue to play a critical role in driving phase transitions. Dark energy, representing the inherent tension in the O-field, provides the backdrop for these fluctuations. Local increases in entropy can create instabilities that lead to the emergence of dark matter—stable condensations of the O-field. Dark matter interacts gravitationally with other matter but does not couple to the electromagnetic, weak and strong forces, ensuring its enigmatic behavior.

The Big Bang is often imagined as an explosion, like a firecracker or, on an astronomical scale, a supernova. Such explosions start from a central point and expand outward.

However, the Big Bang was not an explosion of this kind. Instead, it was a sudden **phase transition** (or a blend of transitions in close proximity) occurring across a region within the O-field. A "pinprick" in the vast expanse of the Omniverse. Imagine a glass of water on the verge of freezing: perfectly still water, even at subzero temperatures, remains liquid until a small disturbance causes it to freeze instantly throughout. The same thing happens although harder to see with boiling water. Bubbles of gas seems to emerge from nowhere. These are phase transitions, changes from one "state" of a substance to another.

Similarly, a small fluctuation in the O-field can trigger a phase transition in the field, creating a localized region where spacetime, energy and matter manifest.

This phase transition, driven by layered excitations in the O-field, manifests as the emergence of the 16 quantum fields from the Standard Model as we know them. These include the electron field, quark fields and gluon field, which begin to interact and produce particles:

- **Electrons**: Excitations of the electron field.
- **Quarks**: Excitations of quark fields, which later combine into protons and neutrons.

Initially, these particles exist in a plasma state—a sea of high-energy fluctuations in quantum fields. Extreme temperatures prevent these particles from forming stable atoms.

As the universe cools, quantum field excitations stabilize:

- **Protons** and **neutrons** combine via the strong nuclear force to form the nuclei of hydrogen, helium and lithium.
- **Electrons bind** to these nuclei through electromagnetic attraction, **creating the first atoms**.

This process of "condensation" represents the transition of quantum fields into stable particles and structures. The energy released during this transition remains observable today as the cosmic microwave background (CMB)—the residual glow of this quantum-to-matter transformation.

"In the beginning" there was only a cosmologically large cloud of hydrogen, helium and lithium gas. In places where the density was already very high, such a cloud condensed due to gravity caused by its own mass, forming stars. This process still occurs today in gas clouds within our own Milky Way galaxy and far beyond.

Inflation and Expansion

If we stick with the idea of water and imagine boiling water where bubbles of gas suddenly emerge from within the liquid. When a bubble forms, it starts as a tiny, pressurized pocket of vapor. In an instant, this bubble **rapidly expands** as the pressure inside overcomes the liquid's surface tension. This sudden growth of the bubble is analogous to **inflation**, the brief but explosive expansion of spacetime at the birth of the universe.

But it doesn’t stop there. After the rapid expansion, the bubble doesn't simply vanish—it continues to **expand more slowly** as it rises through the water. The slow, steady growth of the bubble mirrors the ongoing **cosmic expansion** of the universe that continues long after the inflationary burst.

Alan Guth(123) came with the theory (later refined by Andrei Linde and Paul Steinhardt) that describes an **Inflaton Field** to explain inflation. The theory explains several observed phenomena, such as the large-scale uniformity of the cosmic microwave background (CMB) and the absence of magnetic monopoles. In the grander context of the Omniverse, Guth’s inflaton field is seen not as a solitary force but as one of many localized fluctuations of the super-excited O-quantum field.

This eliminates the need for an external inflaton field, as the O-field naturally generates inflationary events through its own fluctuations. Instead of requiring a whole new quantum field (the inflaton), the O-field is already present. Inflation becomes a consequence of the O-field’s **super-excitation** rather than a separate event caused by a distinct inflaton field. This fits naturally with the idea of a self-contained, self-sufficient **O-field-driven omniverse** where localized patches of super-excitation can drive localized inflations, creating distinct "bubble universes".

Emergence of Stars

About 100 to 200 million years after the Big Bang, stars form when clouds of gas—pristine hydrogen and helium created during the Big Bang—get denser and hotter due to their own gravity. As the core's temperature rises to about 10 million Kelvin, nuclear fusion begins, fusing hydrogen into helium and releasing energy as light and heat. This energy counteracts gravity, stabilizing the star.

Sometimes, the collapse of a part of that initial cloud of gas was so massive and the gravitational force so great that the implosion directly resulted in a black hole, skipping the star stage entirely creating the so called **primordial black holes** (PBHs), an idea first proposed by Zel'dovich and Novikov(120). This explains the existence of immensely large black holes as the core of galaxies, such as the one at the center of our own Milky Way, Sagittarius A*. A black hole of that size, with millions of solar masses, cannot emerge from supernovae or colliding "small" black holes. Our universe, with its age of approximately 13.8 billion years, is simply too young. There has not been enough time for such large black holes to form.

Over its lifetime, a star 'burns' its hydrogen fuel via nuclear fusion, producing helium. Larger stars (more than 8 solar masses) fuse heavier elements like carbon, oxygen and silicon and eventually iron. When the fuel runs out, stars collapse. Stars less than 8 solar masses become **white dwarfs**, which cool to become **black dwarfs**. Larger stars explode as

supernovae, leaving behind a **neutron star**, a **magnetar** and a **black hole**, depending on the core's mass.

In the Omniversal Theory black holes, magnetars, neutron stars and black dwarfs are called **DOEs. Dark Object Embers.** They are only detectable by their gravity. After trillions of years they will be the only remnants in the universe (see Fade Out).

Spacetime

Spacetime itself emerges within this phase transition bubble. In Einstein's(103) general relativity, spacetime is a **dynamic "fabric"** that bends and curves under the influence of mass and energy, manifesting as gravity. In the Omniverse framework, however, gravity is not limited to the curvature of spacetime. It is seen as a fundamental interaction arising from the relationship between the O-field and the omnipresent Higgs field which, as earlier stated, grants mass to particles and mass in turn becomes the source of gravitational effects. This perspective explains why gravity persists even in regions where spacetime dissolves, unlike the other three fundamental forces that exist only within spacetime.

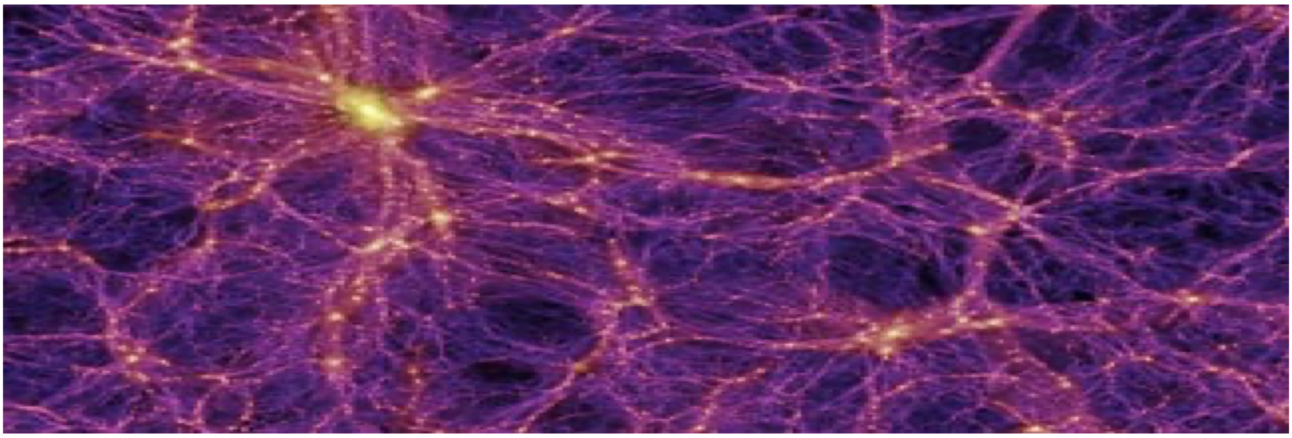
Detecting Remnants of Catalyzed Big Bangs

LIGO, **BICEP**, and **Pulsar Timing Arrays (PTAs)** work together to detect gravitational wave signals at different frequencies, each offering a unique view of cosmic evolution and possible traces of past universes.

- **LIGO** detects gravitational waves (10-1000 Hz) from mergers of black holes, neutron stars, and other dense objects. In the Omniversal Theory, these **Dark Object Embers (DOEs)** may collide, producing waveforms with unusual spins, masses, or eccentricities. Detecting such anomalies could reveal **fossil traces of past universes**.
- **BICEP** searches for low-frequency waves (10^{-18} to 10^{-15} Hz) linked to **cosmic inflation**. OT proposes that phase transitions in the O-field leave imprints on the **Cosmic Microwave Background (CMB)**. BICEP looks for **polarization anomalies** that could be signs of earlier phase transitions.
- **PTAs** track long-wavelength gravitational waves (10^{-9} to 10^{-6}) through changes in pulsar signals. If O-field fluctuations persist, PTAs could detect these **echoes of a catalyzed Big Bang**, offering insight into the birth of new universes.

Together, LIGO, BICEP, and PTAs offer a **multi-frequency approach** to detect signals linked to past cosmic phases. While LIGO can identify the mergers of DOEs, BICEP and PTAs may detect the long-term imprints left by O-field instabilities that catalyzed new universes. By comparing data from these instruments, researchers could identify subtle, anomalous patterns that current cosmological models cannot explain. Such findings would provide **observational support for the** Omniversal Theory, offering insight into the process by which universes emerge from fluctuations in the O-field.

6. Voids



Introduction

The Cosmic Web, as coined and visualised by J. Richard Bond, Alex Szalay and Simon White(124), is the large-scale structure of the universe, with filaments consisting of vast networks of galaxies and gas. It is shaped not solely by gravity but, according to the Omniversal Theory, by the **ripples in the O-field** as a result of its relaxation process "dragging" spacetime with it. Hence the expansion of the universe as a whole and growth of the voids between the filaments of this web.

Dark matter is pulled towards the filaments as well although it in principle is present throughout the omniverse. This means that gravity can be still observed in the voids.

Filaments, containing most of the universe's galaxies and dark matter, serve as the "backbone" of the cosmos, while voids are like the "empty spaces" in a web. This intricate structure emerged from tiny quantum fluctuations after the Big Bang, growing over billions of years and defining the architecture of the universe on the largest scales.

Windows into the O-field

Recent studies on void dynamics by astronomers such as Rien van de Weygaert(111) and Brent Tully(112) have revealed that voids are critical regions for exploring the fundamental nature of dark matter, dark energy and quantum field interactions. Voids may well be the most interesting regions of the universe, as they bring us as close as possible to directly studying the **omniverse**, the fundamental "canvas" that underlies all universes. The ground-laying fields O accompanied by Higgs are there but hard to detect.

Entropy and the Evolution of Voids

Within cosmic voids, where matter is sparse and interactions are minimal, the usual notion of ever-increasing entropy becomes less certain. Here, quantum fields may lose complexity and effectively "collapse" into the O-field, not through a simple decrease in entropy, but via a redistribution of energy and information into a more uniform state. This perspective challenges traditional thermodynamic principles linking entropy to irreversible disorder, yet aligns with speculative frameworks considering low-interaction regimes.

Still, these voids never reach absolute minimality: photons from surrounding filaments supply enough energy to prevent a complete collapse. Even trace amounts of gas and dust, though rare, persist. Over vast timescales, these particles drift into denser regions due to subtle field pressures and gravity, eventually dissolving as their quantum fields merge with the O-field. In this way, voids remain zones of reduced complexity, but not total entropy extinction.

What remains in the Voids?

Once gas, dust and quantum fields dissolve, only two elements remain within the voids:

1. **Traveling photons** – These photons cross the voids with minimal interaction, though they might be subject to gravitational lensing.
2. **Dark matter** – First layer excitations of the O-field resulting in O-particles and contributing to the gravitational structure of the universe.

The Role of the O-field in Voids

The underlying **O-field** is not a passive background but an active participant in cosmic dynamics. Its behavior is analogous to the fluctuations of vacuum energy seen in quantum field theory, where the O-field's inherent fluctuations generate localized excitations that can produce dark matter particles. This perspective aligns with existing theories on zero-point energy fluctuations and quantum vacuum activity as described by Heisenberg's Uncertainty Principle. It has its own **inherent fluctuations.** These fluctuations create small ripples in the O-field, which can, under certain conditions, give rise to the formation of **dark matter particles (O-particles)**. These particles may exist temporarily as excitations of the field, only to dissolve back into the O-field when stability is restored.

These field fluctuations introduce an important insight: **dark matter is not homogeneously distributed** throughout the omniverse. While it appears uniformly distributed on large scales, local variations exist due to the dynamics of the O-field. In voids, where matter and energy are sparse, the imprint of these fluctuations is more evident. These density variations in dark matter could be detectable through their gravitational effects on photons traveling through the voids, as explored in studies by researchers like David H. Weinberg[107&113] and Risa Wechsler[114]. This would manifest as **gravitational lensing**, an effect typically associated with massive objects like galaxies or black holes. However, here it would be caused by subtle density differences in the distribution of dark matter.

The Challenge of Detection

Detecting gravitational lensing caused by dark matter fluctuations within voids is no trivial task. Traditional gravitational lensing relies on massive, localized objects, such as black holes or entire galaxies, which act as strong lenses. In contrast, the **O-field-driven density fluctuations in voids** are far more subtle. On cosmic scales, the objects causing the lensing (O-field excitations) are relatively small. Nevertheless, the cumulative effect across vast distances may be measurable.

New instrumentation and experimental techniques may eventually enable astronomers to identify these minute lensing effects. Since voids are among the most pristine regions of the universe, detecting the gravitational fingerprint of O-field fluctuations here could offer the clearest view of dark matter dynamics at the quantum level.

Void Entropy and Local Temperature

One of the most revolutionary ideas in the Omniversal Theory is that **entropy within voids approaches zero locally**. This concept challenges standard cosmological models, which posit that entropy tends to increase over time. However, in the Omniversal framework, the isolation of voids from external energy sources allows for localized reductions in entropy. These regions exhibit minimal particle interactions and the O-field's influence may facilitate the collapse of quantum fields, leading to the formation of low-entropy zones. This proposal aligns with theories on the role of the quantum vacuum and zero-point energy, but further theoretical development and empirical testing are required to reconcile it with current cosmological models. While the omniverse as a whole will never reach zero entropy (since dark energy and dark matter are ever-present), localized regions of voids may achieve a near-zero entropy state.

This is significant because the local approach to **absolute zero (0 Kelvin)** could facilitate the decay of the **16 quantum fields of the Standard Model**. If a region of a void becomes sufficiently isolated from surrounding cosmic structures and reaches a stable low-entropy state, the associated quantum fields (like those for quarks, gluons and photons) may "dissolve" into the O-field. Such a process would mark a reversion of these fields into their fundamental omniversal state, leaving only the two omniversal quantum fields: the **O-field** (which grants entropy fluctuations as dark energy and O-particles as dark matter) and the **Higgs-field** (which grants mass to the O-particles and therefor gravity)

When this process occurs, it opens up the possibility for something extraordinary: **the disappearance of the photon field**. If the photon field collapses, photons may no longer exist as active particles in that region, which would be observable as the "fading out" of light in specific, isolated void regions. This hypothesis suggests that the **extinction of photons** could, in principle, be observed, offering direct evidence of quantum field collapse.

The driving factor here is the relationship between void size and entropy. As the size of voids increases over cosmic time, the surrounding filaments continue to "thin out." The larger the void, the fewer interactions occur, and the lower the local entropy becomes. However, it is important to note that a void is not a fully isolated and stable realization of an empty O-field. While certain properties may offer insight into the fundamental nature of the O-field, the inherent interactions within the cosmic web still influence these regions. This leaves open the possibility that large, isolated voids could approach conditions close to 0 Kelvin, where the decay of quantum fields might be observable.

Meanwhile, as filaments become thinner and matter more sparsely distributed, only the most stable remnants—such as Dark Object Embers (DOEs)—persist. Over trillions of years, these dense objects may gradually interact and merge due to residual gravitational influences. Eventually, immense black holes remain as the last significant structures, slowly fading away through Hawking radiation until even these final embers of structure disappear.

Centers of Voids: The most Interesting Places in the Universe

If this theory holds, then the centers of voids become one of the most fascinating places to study in the universe. Here's why:

1. **Gravitational lensing from dark matter fluctuations** – Voids allow us to test for the distribution of dark matter directly through lensing effects on passing photons.
2. **Decay of the 16 quantum fields** – The O-field dominates in voids. If local entropy drops to near-zero, it may trigger the collapse of the Standard Model's fields (quark, gluon and photon fields) back into the O-field.
3. **The extinction of the photon field** – Theoretically, if 0 Kelvin is reached, even the photon field could dissolve into the O-field, causing observable photonic extinction (if it could be separated from absorption by dust).

This last point offers a potential experimental test for the Omniversal Theory, though the challenges are significant. Since voids are not perfectly isolated or stable representations of an empty O-field, the evidence gathered from voids may only provide hints rather than definitive characteristics of an empty O-field canvas. However, if similarities or unique characteristics are to be found, voids remain the best observational candidates.

One proposed method of conducting this test involves analyzing the **Cosmic Microwave Background (CMB) radiation** in void regions. If the brightness or spectral properties of the CMB show localized anomalies (not explained by redshift or known astrophysical processes), it could be evidence for the collapse of the photon field into the O-field. Advanced instruments such as next-generation CMB observatories or gravitational lensing detectors might detect subtle changes in the photonic field density. Additionally, researchers could look for distinct gravitational lensing signatures caused by dark matter density variations attributed to O-field fluctuations within voids. If it can be shown that the brightness of cosmic microwave background (CMB) radiation diminishes in specific regions of voids (for reasons other than standard redshift), it could be evidence of the photon field's dissolution into the O-field.

Redshift is well understood as a stretching of the photon's wavelength due to the expansion of space (cosmological redshift) or gravitational fields (gravitational redshift). When photons are simply redshifted, their energy distribution changes but their overall number remains conserved—no photons truly disappear; they just become less energetic over large distances.

If photons were to vanish into the O-field, you would expect deviations from the standard redshift pattern in at least two key ways:

1. **Spectral Signatures:**
   Standard redshift preserves the shape of the photon spectrum, merely shifting all wavelengths. If photons vanish directly into the O-field, you might see an overall decrease in photon number at certain frequencies without a corresponding shift in their peak wavelength. This would look different than a smooth redshift: rather than a uniform stretching of the spectrum, parts of the spectrum might be reduced or "missing," creating unusual spectral features that can't be explained by ordinary cosmological expansion or scattering.

2. **Spatial Distribution and Correlation with Environmental Factors:**
   If the photon disappearance is linked to local conditions of low entropy and field collapse, it may occur preferentially in regions with certain characteristics—extremely large, isolated voids where O-field fluctuations are dominant. By comparing the photon flux from these regions to similar voids where no such process is suspected and to regions of normal cosmic structure, you might detect a unique pattern. A pure redshift effect would be uniform and scale smoothly with distance, while O-field-induced extinction would occur in pockets or zones, not strictly tied to distance or gravitational potential in a conventional way.

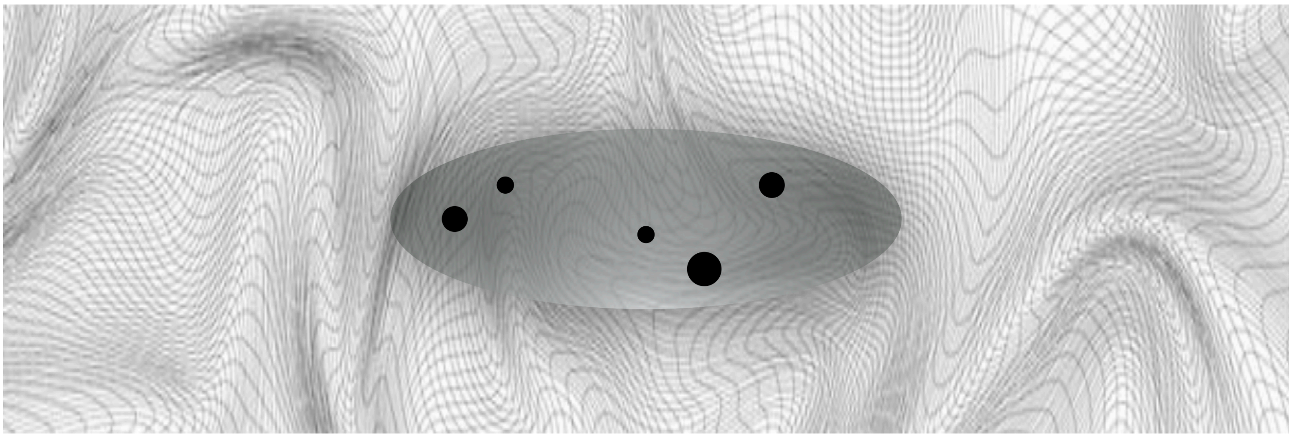
Conclusion

Voids are not empty. Far from it. They are teeming with fascinating phenomena that provide crucial insights into the nature of the O-field and its fluctuations. Key evidence includes gravitational lensing caused by dark matter density variations, the potential for the decay of quantum fields and the possibility of photon extinction in regions where local entropy approaches zero.

These observations position voids as essential environments for studying the most fundamental aspects of the omniverse. They offer a unique glimpse into the structure of the **O-field**, one of only two known omniversal quantum fields (the other being the Higgs field). These regions are not simply devoid of matter but are places where entropy decreases, quantum fields decay and the deepest structures of reality come to light. Fluctuations in the O-field generate dark matter and these density variations may be detectable through gravitational lensing effects. With advancing technology, it may soon be possible to observe quantum field decay or even witness the extinction of the photon field.

The potential for future discoveries in voids is immense. If experimental evidence can be found for the O-field's influence, it would mark a paradigm shift in our understanding of dark matter, dark energy and the fundamental nature of quantum fields. Far from being empty, voids may be the key to unraveling the deepest mysteries of the omniverse.

7. Fade Out



Introduction
The evolution of our universe has led to much speculation about how it will ultimately end. In traditional cosmology, several prominent scenarios like as proposed by Friendmann(105) are considered: the **Big Crunch**, in which the universe collapses under its own gravity, and the **Big Freeze**, where the universe continues to expand forever until all energy is dispersed and all activity ceases. Both of these theories share one fundamental idea: they describe the end as a static state. However, the **Fade Out**, as proposed in the Omniversal Theory, offers a more dynamic alternative that fits within a quantum field-based framework.

With the Fade Out, the universe is not a closed system that concludes through a single process like collapse or eternal expansion Instead, a universe is seen as a **temporary manifestation**. When it reaches the end of its natural life cycle, all visible and dark structures eventually return to the **O-field**. The universe does not end abruptly with a bang or freeze, but instead fades away gradually and subtly.

Fading out of the stars

As gas and dust in the universe become more dispersed, active star formation slows and eventually ceases. This marks the beginning of the universe's final phase. Over their lifetimes, stars "burn" hydrogen fuel via nuclear fusion, producing helium. Larger stars (with more than 8 solar masses) go on to fuse heavier elements like carbon, oxygen, and silicon, eventually forming iron in their cores. Once the fuel is exhausted, stars collapse. More in detail:

Stars with Mass < 0.5 Solar Masses (Red Dwarfs)
Red dwarfs like Proxima Centauri burn hydrogen slowly for trillions of years. Because they burn so efficiently, they never undergo a supernova. Instead, they gradually exhaust their

fuel and fade into dim, cold objects called **black dwarfs**. Since the universe is not old enough for any black dwarfs to exist yet, this stage is still theoretical.

Stars with Mass 0.5 - 8 Solar Masses (Sun-like Stars)
Stars in this range like ourr own Sun fuse hydrogen into helium for billions of years. When hydrogen runs out, the core contracts, and outer layers expand, forming a **red giant**. The outer layers are ejected as a **planetary nebula**, while the core becomes a **white dwarf**. Over trillions of years, the white dwarf cools to become a **black dwarf**, a cold, dark remnant of the star.

Stars with Mass 8 - 20 Solar Masses (Massive Stars)
These stars like Betelgeuse burn hydrogen much faster and fuse heavier elements like carbon, oxygen, and silicon. Once they form iron in their core, fusion stops, and the core collapses. This collapse triggers a **supernova explosion**, leaving behind either a **neutron star** (a dense core of neutrons) or a **magnetar** (a highly magnetic version of a neutron star) depending on the remaining core mass.

Stars with Mass > 20 Solar Masses (Supermassive Stars)
Stars larger than 20 solar masses burn through their fuel quickly and collapse catastrophically when fusion stops at iron. If the remaining core is massive enough, it forms a **black hole** directly, often without a supernova. The black hole's gravity is so strong that not even light can escape, making it one of the most extreme objects in the universe.

In the Omniversal Theory, black holes, magnetars, neutron stars and black dwarfs are collectively referred to as **DOEs (Dark Object Embers)**. These objects are only detectable through their gravitational influence. After trillions of years, they become the only remaining structures in the universe. They drift along the thinned filaments of the cosmic web, where they gravitationally attract smaller objects and occasionally merge. As a result, smaller DOEs are absorbed into larger black holes, leaving behind only the most massive black holes. These immense black holes slowly vanish through **Hawking radiation** over exceedingly long timescales.

As stars die, planets, astroids and comets that orbit them become unbound from their systems. Planets can be ejected from their orbits or remain as "rogue planets" drifting through interstellar space. These rogue planets may persist for a while, but cosmic events (collisions, interactions with other gravitational bodies, etc.) may influence their fate.

Planets are not gravitationally dense enough to be "gravitationally stable" like neutron stars or black holes. Over extremely long timescales, any residual heat on the planet dissipates, leaving it at the temperature of the cosmic background, which also approaches absolute zero. The planet's atoms or molecules may still exist, but without external energy sources, it becomes a cold, dead object drifting in space.

In the context of galactic evolution, gravitational interactions may eventually drive planets into DOEs at which point they are "consumed" and cease to exist as distinct objects.

Collisions between DOEs produce intense **gravitational waves**, which propagate not just through spacetime but also through the **O-field**. These fluctuations increase the likelihood of a **phase transition** in the O-field, catalyzing and leading to the emergence of new universes with Big Bangs. It is possible that echoes of prior fluctuations are imprinted as **anomalies in the Cosmic Microwave Background (CMB)** of our own universe, hinting at earlier phase transitions.

The End Stage of a Universe

As a universe nears the end of its life cycle, it enters a phase known as the **Fade Out**. At this stage, most of the structure that once defined the universe has dissolved. Galaxies have drifted apart, stars have burned out, and planets, gas and dust have been consumed or dissipated. What remains is a vast, nearly empty expanse of **voids** and thin **cosmic filaments**.

Within these filaments, only DOEs still exist, occasionally merging to form larger black holes. Over vast timescales, even these black holes evaporate due to **Hawking radiation**, gradually releasing energy into the surrounding environment.

Some grand unified theories predict that protons eventually become unstable after about 10^{34} years. If this occurs, all atoms in an object like a planet would gradually disintegrate into radiation like photons or neutrinos.

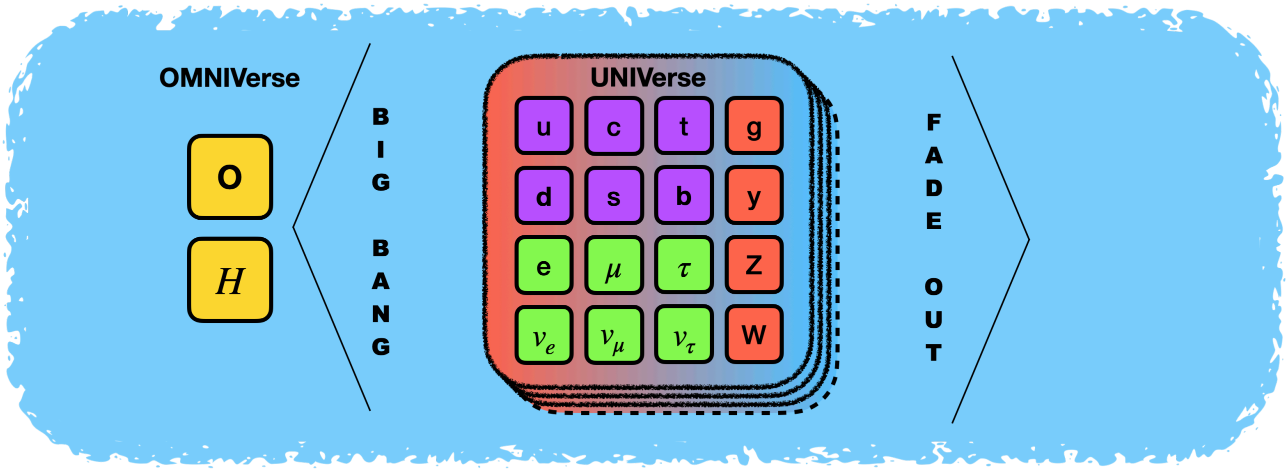
While this remains probably true, the Omniversal Theory moves this thought a step further. In the **voids, e**ntropy reaches extreme levels. With almost no particle interactions and no significant radiation, these regions approach **absolute zero (0 Kelvin)**. As the temperature drops, the lack of thermal activity affects the fundamental quantum fields that sustain the particles of the **Standard Model**. Since these fields require a minimal level of energy to sustain fluctuations, areas with close-to-zero Kelvin conditions may cause the 16 quantum fields to **collapse back into the O-field**.

This collapse does not merely annihilate particles but eliminates the fields themselves. With no quantum field to support them, protons, neutrons, and electrons simply cease to exist as coherent structures. Their energy content is returned to the O-field, effectively reintegrating into the broader omniversal energy pool.

At this point, the universe has undergone total field collapse and only the O-field, Higgs field and possibly DOEs remain. The subtle gravitational perturbations caused by DOEs elsewhere produce additional fluctuations in the O-field above the ones that are already there due to its entropy differences. Over vast timescales, these fluctuations may further destabilize the O-field, increasing chances to trigger new local phase transitions that seed new Big Bangs.

Thus, the **end stage of one universe** may also mark the **beginning of another**, continuing the cyclical nature of existence in the Omniverse.

8. Quantum Fundamental Theory (QFT)



The Fundamental Building Blocks

The fundamental building blocks of the universe—both energy and matter—are understood in modern physics to arise from underlying quantum fields (as thoroughly studied among others by Weinberg(113)). Unlike classical fields (such as the magnetic field around a magnet, which diminishes with distance), quantum fields are uniform and pervasive, extending throughout all of space. Even regions that appear empty, like the vast voids between galaxies, are never truly devoid of these fields. Instead, what we call "empty space" is filled with a subtle energy associated with their baseline, or vacuum, states.

In standard quantum field theory, each type of particle is an excitation of a corresponding field. When fluctuations in a field reach sufficient energy levels, they can manifest as actual particles—quarks, for instance, which then combine to form protons and neutrons. Thus, matter itself can be viewed as concentrated energy arising from disturbances in ever-present fields. This perspective is central to our understanding of particle physics and cosmology, underpinning both the formation of matter in the early universe and the persistent vacuum energy that influences its large-scale structure.

The Standard Model in Physics

The Standard Model of particle physics has, for decades, provided a robust description of the fundamental building blocks of our observable universe: the 16 quantum fields (including the electromagnetic field, fields for quarks and leptons and the strong and weak interaction fields) and the Higgs field. It is an elegant framework that predicts almost all observable phenomena on a microscopic level with great precision.

However, the Standard Model encounters some limitations: it does not adequately explain gravity, dark matter or dark energy and it describes the fundamental interactions only within the domain of an already existing spacetime continuum.

Expanding the Classical Picture in the Omniverse Theory

In the proposed Omniverse Theory, this classical picture is radically expanded. The Omniverse is a conceptual structure that includes not only our universe but also many universes and the more fundamental substrate of the O-field (and the ever-present Higgs field). In this view, the fermionic O-field and the bosonic Higgs field are not dependent on the existence of spacetime or the 16 quantum fields of the Standard Model. Instead, they form the "canvas" or "foundation" from which universes, each with its own spacetime and quantum fields, can emerge and fade away.

This chapter discusses what this approach means for the Standard Model, the role of gravity, dark matter and the significance of the Fade Out phase in which nearly all quantum fields dissolve.

O-field and the Higgs Field as the foundation

In the traditional Standard Model, the Higgs field is essential for giving certain particles mass. Without the Higgs field, none of the known elementary particles (except photons and gluons) would possess mass. The mass of particles like electrons and quarks is due to their interaction with the Higgs field. The Higgs field's role is fundamental in the Standard Model but is always framed within the context of an already existing universe with spacetime.

In the Omniverse Theory, the Higgs field assumes an even more foundational status. The Higgs field exists always and everywhere, alongside the O-field. Where the O-field can be seen as a "primordial vacuum," a quantum foundation independent of space, time and matter, the combination with the Higgs field ensures that mass — and thus gravity — can exist even without the 16 quantum fields of the Standard Model. Dark matter, which the Standard Model does not explain, naturally finds its place here: it is not simply an additional component but a manifestation within the O-field, anchored by the omniversal presence of the Higgs field. This implies that mass and gravity are not merely emergent properties of a universe filled with quantum fields and spacetime but are fundamentally rooted in the O-field-Higgs duo.

Dark Matter and Gravity outside Spacetime

The Standard Model does not offer an explanation for dark matter. While extensions like supersymmetry or extra dimensions have been proposed to postulate a particle that could serve as dark matter, these remain speculative. In the Omniverse Theory, however, dark matter is not an anomaly but a natural consequence of the eternal presence of the O-field and the Higgs field. Dark matter possesses mass, even when no "classical" quantum fields are active, because the omniversal Higgs interaction does not depend on spacetime.

This has profound implications. Gravity, which in the standard view arises from the curvature of spacetime (as described by Einstein's general relativity), can now be understood as something that exists in potential. Here, gravity does not arise solely as a result of energy and mass in an existing spacetime but as an inherent property of the O-field/Higgs-field combination. When a universe forms — a local phase transition in the O-field leading to a Big Bang — spacetime takes shape and the 16 quantum fields of the Standard Model are "born." These fields add structure and diversity (such as electromagnetic interactions, strong and weak nuclear forces), but the gravitational foundation is already present due to the presence of mass (dark matter) and the Higgs field.

This means that gravity is not a phenomenon that appears only with spacetime; rather, the potential for gravity is always latent in the Omniverse. This perspective upends our concepts of sequence and causality: spacetime and quantum fields do not come first; instead, the possibility of gravitation and mass is already pre-existing in the O-field/Higgs configuration.

16 Quantum Fields and their Temporary Nature

In the conventional Standard Model, the 16 quantum fields — including those for electromagnetic, strong and weak interactions, as well as fermionic fields for leptons and quarks — are fundamental to everything we see in our universe. From atoms to stars, from chemical reactions to nucleosynthesis in stellar cores, all depend on these fields.

Within the Omniverse, however, these 16 fields are not always and everywhere present. They only emerge when a local disturbance or phase transition occurs in the O-field, an event we call a Big Bang. At that moment, a universe "sprouts," equipped with its own spacetime. In this spacetime, the 16 quantum fields manifest, enabling interactions, particles and eventually complex structures to form. The Standard Model remains locally valid and accurate for that specific universe as long as the quantum fields are active. The key difference is that this entire framework — space, time and quantum fields — is not fundamental to the Omniverse but rather a phase or manifestation of it.

This perspective reframes the Standard Model: it is not the ultimate framework for all reality but a regional, local phenomenon that arises when certain conditions are met. The Standard Model is thus "emergent" in a world where the O-field and the Higgs field are the true foundations.

Dissolution of Quantum Fields and the Last Field, Photons

Eventually, in a universe, after an extremely long time, conditions arise in which entropy becomes so high and energy levels so low that the quantum fields gradually "dissolve" into the O-field. This process, called the "Fade Out," causes the 16 quantum fields, bound to the structure of spacetime, to lose coherence. Complex particles like protons and neutrons disintegrate as their underlying fields become unstable.

The photon field is a notable exception here. Photons are massless energy carriers that do not rely on atomic nuclei or mass to exist. While matter particles and their fields lose their identities, photons can persist longer. They are not immune to the Fade Out but are the most "resilient" to this dissolution because they lack rest mass (unlike particles influenced by the Higgs field) and are less bound to complex material structures. In the final stages, as entropy approaches its maximum, even the photon field dissolves into the O-field.

This ultimate stage, when even the photon field disappears, marks the end of spacetime itself. Spacetime is, after all, an emergent phenomenon dependent on the presence of (and interactions among) quantum fields. Without quantum fields, the concept of place and time loses meaning. We return to a state where only the O-field and the Higgs field exist, as before the Big Bang. The Fade Out is thus a kind of "cosmic reset," preparing the field for potential future phase transitions, a new Big Bang and the emergence of an entirely different universe configuration.

Implications for the Standard Model and Future Theories

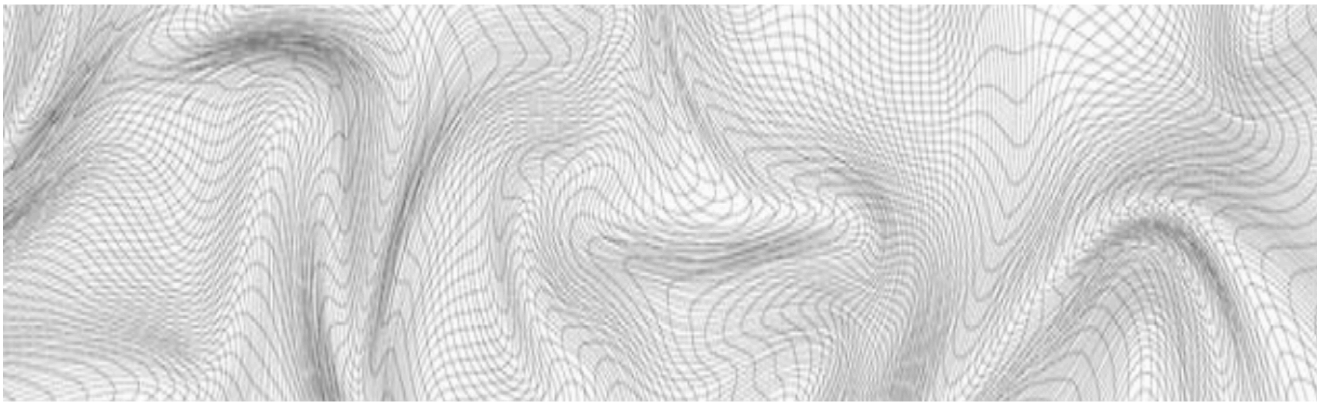
The Omniverse Theory, as outlined here, in which the O-field and the Higgs field are always present and the 16 quantum fields of the Standard Model are merely temporary phenomena in local universes, implies that the current Standard Model is not the final word. The Standard Model provides an incredibly accurate description of what happens within a universe, but it says nothing about the context in which universes emerge or fade away. In the Omniverse, the Standard Model is a special case, a local phenomenon bound by strict conditions.

This means that extensions of the Standard Model or theories of quantum gravity, quantum cosmology and multiverse scenarios must broaden their scope. They must acknowledge that spacetime and the known forces are not always present or fundamental. In this vision, the search for a Theory of Everything (ToE) becomes more of a quest for the principles that describe transitional stages: from the O-field and the Higgs field to a universe with 16 quantum fields and back again to the Fade Out.

From the perspective of the Omniverse, the Standard Model is no longer the unshakable foundation of all physics, but rather a beautiful, internal description of a temporary phenomenon. The O-field and the Higgs field are considered more fundamental here: they define the conditions for the existence of mass and gravity, even without spacetime. The 16 quantum fields, which are normally regarded as the fundamental building blocks of reality, thus appear only in phase transitions that lead to universes like our own.

Ultimately, during the Fade Out, the photon field will also dissolve, causing spacetime to cease to exist and bringing us back to a state that holds potential for future Big Bangs. This perspective redefines our ideas about foundations, emergence and the status of the Standard Model within the largest conceivable context: the Omniverse.

9. O-Field



Introduction

Energy in the fermionic O-field isn't a separate force like in our universe. Instead, it's a natural "tension" within the O-field itself. Imagine a stretched elastic sheet that is never completely still due to tiny, unavoidable ripples. This tension is what we call dark energy, but it has no link to spacetime because spacetime doesn't exist at this stage.

These ripples and fluctuations, can increase unpredictably. If the tension grows too strong in one spot, it can "snap," creating dark matter particles (O-particles) or, on a larger scale, triggering a Big Bang. This process is driven by entropy — a measure of randomness. As the randomness increases, local areas of the O-field can shift from stable to unstable, causing sudden changes in form, like water vapor turning into droplets.

Unlike spacetime, which can dissolve back into the O-field, the O-field is always active. Even in regions where spacetime disappears, the O-field continues to ripple and fluctuate, ensuring it remains the constant foundation of the Omniverse.

Energy

Energy in the O-field is not a separate entity as we know it in our universe. Instead, it is an intrinsic tension state of the field itself. This means that the O-field in its ground state is stable but not perfectly still. This is similar to how the ground state of a quantum field always contains minimal fluctuations due to the Heisenberg uncertainty principle. The tension in the O-field is referred to as dark energy, but it is important to emphasize that dark energy here is not yet connected to spacetime, as spacetime does not yet exist. At this stage, dark energy is purely a property of the O-field.

The principles of Heisenberg also apply in the O-field, even though spacetime is not yet present. This formula represents the Heisenberg Uncertainty Principle, implying that the more precisely the position (x) of a particle is known, the less precisely its momentum (p) can be known and vice versa:

$$\Delta x \cdot \Delta p \geq \frac{\hbar}{2}$$

where

- x represents position (space);
- p represents momentum (motion) and
- $\hbar$ is the reduced Planck constant.

However, in the O-field, there is no position or momentum, but there are field values φ(x) and their corresponding momenta π(x). Thus, instead of the uncertainty in the position (x) and momentum (p) of a particle, we speak of the uncertainty in the state of the O-field itself. So we need

$$\Delta \varphi_O \cdot \Delta \pi_O \geq \frac{\hbar}{2}$$

where

- $\Delta \varphi_O$ is the uncertainty in the field value φ (the intensity or amplitude of the O-field) and
- $\Delta \pi_O$ the uncertainty in the conjugate momenta π, which is related to the change of φ over time.

In a perfect, stable state of the O-field, φ would equal 0. However, due to the uncertainty principle, φ can never be exactly zero. This is because its conjugate momentum π would then have to be infinitely large:

$$\varphi = 0 \implies \pi \to \infty$$

If φ fluctuates rapidly (for instance, during an excitation leading to a phase transition), π becomes large. According to the uncertainty principle, a large Δπ means that $\Delta\varphi$ must be smaller, indicating that the field value becomes more precisely determined:

$$\Delta \pi \uparrow \implies \Delta \varphi \downarrow$$

The relationship states that the amplitude of the field value φ and the rate of fluctuation π can never be fully known at the same time. In the context of the O-field, this implies that there are always small fluctuations that can lead to phase transitions and the creation of dark matter (O-particles) or even a Big Bang.

Instead of thinking of a force that "pushes" or "pulls" on something, we should view dark energy as a state of tension in the O-field. This tension is a fundamental property that exists throughout the entire O-field, similar to how tension can exist in an elastic membrane even if nothing is pressing on it.

The tension in the O-field is a form of energy density that appears constant everywhere, but in detail, local fluctuations can occur. Local fluctuations in this tension can cause the field to become locally unstable. If the tension in a region becomes too great or too chaotic, a local phase transition can occur, similar to how a liquid can transition into a solid.

This process, driven by local instabilities in the tension of the O-field, is significant because it can lead to the creation of dark matter or even an entire universe. A small local disturbance results in the creation of dark matter (O-particles), while a larger instability can lead to a layered excitation, activating spacetime and the 16 quantum fields.

The impossibility of the O-field amplitude reaching zero due to the Heisenberg principle does not conflict with spacetime fading out.

The dissolution of spacetime and the 16 quantum fields of the Standard Model occurs when local conditions approach extremely low energy and entropy, effectively near 0 Kelvin. In such conditions, spacetime-dependent fields lose their excitations and "dissolve" into the O-field, leaving only the O-field's intrinsic fluctuations. These fluctuations persist omniversally within the O-field, independent of spacetime, ensuring its activity even in regions where spacetime fades. This distinction highlights the independence of the O-field from spacetime, while allowing the dissolution of spacetime-based structures to coexist with the O-field's inherent properties.

Excitations

Entropy is a measure of "disorder" or "unpredictability" in a system. In the O-field, entropy refers to the degree of fluctuation and disturbance within the field. The original formula for entropy S(x,t) at location x and time t follows the standard form of Shannon[116] entropy (information theory) and is closely related to the Gibbs[117] entropy (statistical mechanics):

$$S(x,t) = -\int_{\Omega} \rho(x,t)\, \ln \rho(x,t)\, d^3x$$

defining the entropy S(x,t) at a specific position x and time t as the integral over a region Ω, measuring the uncertainty or randomness of the probability distribution ρ(x,t), with higher entropy indicating greater disorder or unpredictability in the system.

However, in the context of the Omniverse, the concepts of location (x) and time (t) do not exist. Analogous to the modification of the Heisenberg formula, location (x) and time (t) can also be replaced with the changes in amplitude (φ) and momenta (π) of the O-field. The formula thus becomes:

$$S = -\int_{\mathcal{O}} \rho(\varphi_O, \pi_O)\, \ln \rho(\varphi_O, \pi_O)\, d\varphi_O\, d\pi_O$$

or more readable leaving out the subscripts since we're talking about the O-field here:

$$S = -\int_{\mathcal{O}} \rho(\varphi, \pi)\, \ln \rho(\varphi, \pi)\, d\varphi\, d\pi$$

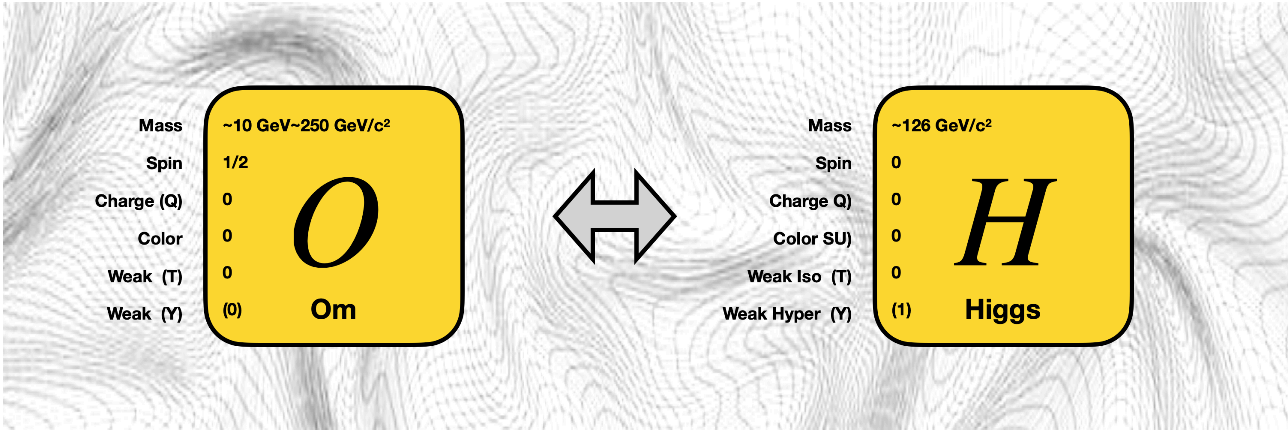
Entropy (S) now measures how "complex" or "unpredictable" the state of the O-field is.

An excitation of the O-field can occur in various ways. Small fluctuations, such as irregularities in the stability of the field, can lead to the formation of O-particles, which we consider as dark matter. These O-particles form localized condensations of dark energy, driven by entropy differences in the O-field, similar to how water vapor condenses into tiny droplets of water.

When entropy is low, the O-field is stable and fluctuations in specific regions are minimal. As fluctuations increase, entropy (S) rises. This can result from colliding wave patterns, gravitational influences from existing dark matter or even from DOEs. A rise in entropy can cause the tension in a local region to become so high that the O-field undergoes a phase transition, condensing into O-particles (dark matter). These particles remain stable even if entropy decreases, as they have reached a stable energy state.

If fluctuations driven by rising entropy and critical tension increase further, the tension can reach a critical threshold, causing the O-field to undergo a **layered excitation**. This phase transition not only creates dark matter but also initiates the emergence of a new universe with spacetime and the 16 quantum fields of the Standard Model that produce visible matter(quarks, electrons) and energy (photons, gluons). This process, typically described as a Big Bang, is understood in the context of the O-field as a local phase transition.

10. O-Fermion (Om)



Note: The Color charge is shown as 0 (zero), meaning that Om is a singlet under SU(3) and does not interact via the strong force. The weak hypercharge (Y) is set to 0, indicating no weak interaction or irrelevance.

Introduction

The omniversal **O-Fermion** (also called **Om**) is a theoretical particle proposed as a key building block of dark matter, the mysterious substance making up most of the universe's mass. Unlike particles in the Standard Model (like electrons or quarks), the O-fermion interacts only very weakly, if at all, with forces like electromagnetism or the weak nuclear force. This makes it "invisible" to traditional detectors, explaining why dark matter has eluded direct observation.

The O-fermion is an excitation of the O-field, the fundamental field in the omniverse that complements the Higgs field. It likely has a spin of 1/2, similar to familiar particles like electrons, but is electrically neutral and has no color charge so it doesn't interact with gluons (and although tempting, that's why we can't call it a quark since by definition quarks in the Standard Model have color charge). Its mass is thought to range between 10 and 250 GeV/c2, fitting within the constraints of dark matter experiments.

This neutrality explains why they do not interact with the electromagnetic, strong or most likely weak forces. The absence of electric charge ensures that O-fermions do not interact with photons, aligning with the defining feature of dark matter — it does not scatter, emit or absorb light. Similarly, the absence of color charge prevents O-fermions from interacting with gluons or forming bound states like protons and neutrons.

Unlike traditional particles, the O-fermion's weak isospin charge and hypercharge may be irrelevant, as it doesn't follow the symmetries governing most Standard Model particles.

Instead, its properties are rooted in the O-field, connecting it to a larger omniversal framework.

The O-fermion offers a fresh perspective on dark matter, suggesting that the particles we search for in experiments might be reinterpreted as part of a grander, omniversal structure. This concept bridges quantum physics, cosmology and beyond.

Breakdown

If we assume that the O-fermion is an excitation of the O-field and receives its mass from the Higgs field, its properties such as spin, charge and mass must align logically with the nature of the O-field and its interaction with the Higgs field. While the concept is speculative and there are no established theoretical views, we can deduce plausible properties based on existing principles in quantum field theory, symmetry and cosmology.

Spin of the O-fermion

The spin of a particle arises from the nature of the field from which it emerges. Several scenarios can be considered for the O-field:

1. If the O-field is a **scalar field** (like the Higgs field), the O-fermion could have spin-0, analogous to the spin-0 Higgs boson.
2. If the O-field behaves like a **fermionic field**, its excitations could have spin-1/2, making the O-fermion similar to quarks and leptons in the Standard Model.
3. If the O-field is a **vector field** (like the electromagnetic field, which gives rise to spin-1 photons), the O-fermion could have spin-1.

Given that the O-fermion is hypothesized to resemble dark matter and interact weakly (if at all) with the Standard Model fields, it is more consistent for the O-fermion to have spin-1/2, aligning it with fermionic particles like quarks and leptons. This would make it compatible with dark matter models where fermionic WIMPs (Weakly Interacting Massive Particles) are a leading candidate.

Thus, while a spin-0 O-fermion is theoretically possible if the O-field is purely scalar, a spin-1/2 O-fermion fits better with its proposed role in cosmology and particle physics.

Charge of the O-fermion

To function as dark matter, the O-fermion can only interact weakly, if at all, with the Standard Model fields. Its charge properties can be assessed as follows:

1. **Electric Charge**: The O-fermion must have zero electric charge to ensure it does not interact electromagnetically. This aligns with observations that dark matter does not emit, absorb and scatter light.

2. **Color Charge**: The O-fermion cannot have color charge (SU(3) singlet), as it would interact with gluons and form bound states (e.g., hadrons), which are detectable in the Standard Model.
3. **Weak Charge**: While it is theoretically possible that O-fermions have weak charge, no such interaction has been observed in direct detection experiments (like XENON1T and LUX). If such an interaction exists, it is far weaker than initially predicted by WIMP models. Its weak isospin (T=0) and hypercharge (Y=0) are likely irrelevant because it does not participate in $SU(2)_L$ or $U(1)_Y$ symmetries.

The most consistent interpretation is that the O-fermion has **no electric or color charge**. A weak charge remains a possibility but in the search for WIMPs has not been experimentally observed. This neutrality ensures that the O-fermion is a viable dark matter candidate, interacting primarily through gravity and possibly via weak interactions.

Mass of the O-fermion

The O-fermion's mass is central to its role as a dark matter candidate and depends on its interaction with the Higgs field. If the O-fermion acquires mass through a **Yukawa coupling** to the Higgs field, we can estimate its mass using principles from the Standard Model.

Comparison to Standard Model Particles

The masses of particles in the Standard Model, ranging from the electron to the top quark, are determined by their Yukawa couplings to the Higgs field. The vacuum expectation value (VEV) of the Higgs field is v=246 GeV and the mass of a particle m is given by $m = y \cdot v$, where y is the Yukawa coupling.

Known particle masses include:

Particle	**Mass (GeV)**	**Notes**
Proton	0.938 GeV	Bound state of up/down quarks.
Electron	0.000511 GeV	Light fermion, stable.
Up quark	~0.002 GeV	Very light, stable in protons.
Down quark	~0.005 GeV	Very light, stable in protons.
Strange quark	~0.095 GeV	Heavier, appears in strange baryons.
Charm quark	~1.275 GeV	Heavier quark, decays quickly.
Bottom quark	~4.18 GeV	Heavy, decays slowly.
Top quark	~173 GeV	Heaviest known particle.

Higgs boson	~125 GeV	Responsible for particle masses.
W boson	~80.4 GeV	Mediator of weak force.

If the O-fermion interacts with the Higgs field via a Yukawa coupling, its mass would likely fall between 0.1 GeV and 250 GeV, similar to particles in the Standard Model.

Cosmological Constraints
If the O-fermion contributes to dark matter, its mass must align with constraints from cosmology and dark matter experiments. WIMP candidates, a popular dark matter hypothesis, typically have masses between 10 GeV and 1 TeV. Experiments like LUX-ZEPLIN and XENON1T search for dark matter in this range, with no detections thus far.

Similarly, the Large Hadron Collider (LHC) places important constraints on particles interacting strongly or electroweakly, effectively excluding masses in the range of 100 GeV to 1 TeV for such particles. However, the O-fermion, if it interacts only weakly or via the O-field, could evade detection within the LHC's energy range. This highlights the complementary role of direct detection experiments, gravitational lensing and cosmic studies in probing the properties of the O-fermion.

Refining the Range
Combining Yukawa coupling logic (0.1 GeV to 250 GeV) with dark matter constraints (10 GeV to 1 TeV) a narrower mass range for the O-fermion can be proposed:

$$10GeV \leq mO \leq 250GeV$$

This range is consistent with its hypothesized role in cosmology and particle physics, excluding very light or extremely heavy masses.

Summary of Properties

Property	Value	Reasoning
Spin	1/2	Aligns with fermionic WIMP-like dark matter.
Electric Charge	0	Ensures no electromagnetic interaction.
Color Charge	0	Avoids strong force interactions.
Weak Charge	Possible but not observed experimentally.	Consistent with dark matter constraints.
Mass	10 GeV – 250 GeV	Based on Yukawa couplings and WIMP-like role.

Testing the O-fermion Hypothesis

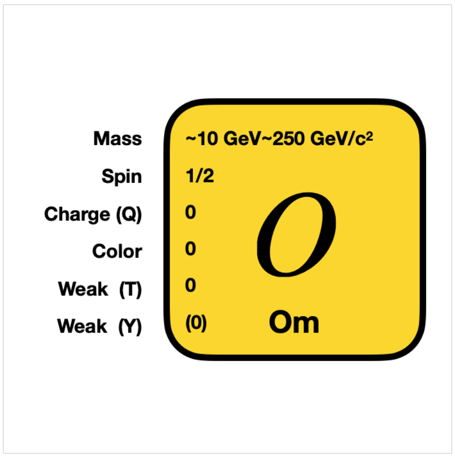
The O-fermion's existence can be explored through several experimental and observational approaches:

1. **Direct Detection**: Experiments like LUX-ZEPLIN and XENONnT aim to detect WIMP-like particles with masses in the 10 GeV − 250 GeV range.
2. **Gravitational Lensing**: Indirect detection through the gravitational effects of dark matter halos could reveal the presence of O-fermions.
3. **Cosmic Microwave Background (CMB)**: The O-fermion may leave detectable imprints on the CMB power spectrum if it played a role in the early universe.

LHC Constraints and Limitations

The Large Hadron Collider (LHC) places constraints on the mass range of particles that interact strongly or via electroweak forces. For particles that interact with the Standard Model, the LHC's lack of detection effectively excludes masses in the range of 100 GeV to 1 TeV. However, the O-fermion, as a dark matter candidate, may not interact strongly or electroweakly, allowing it to evade these constraints entirely. This means that even if the O-fermion's mass lies within the LHC's detectable energy range, it may remain undetected due to its weak interactions.

The absence of strong or electroweak interactions highlights the importance of complementary testing methods, such as direct detection experiments or gravitational studies, to probe the properties of the O-fermion.



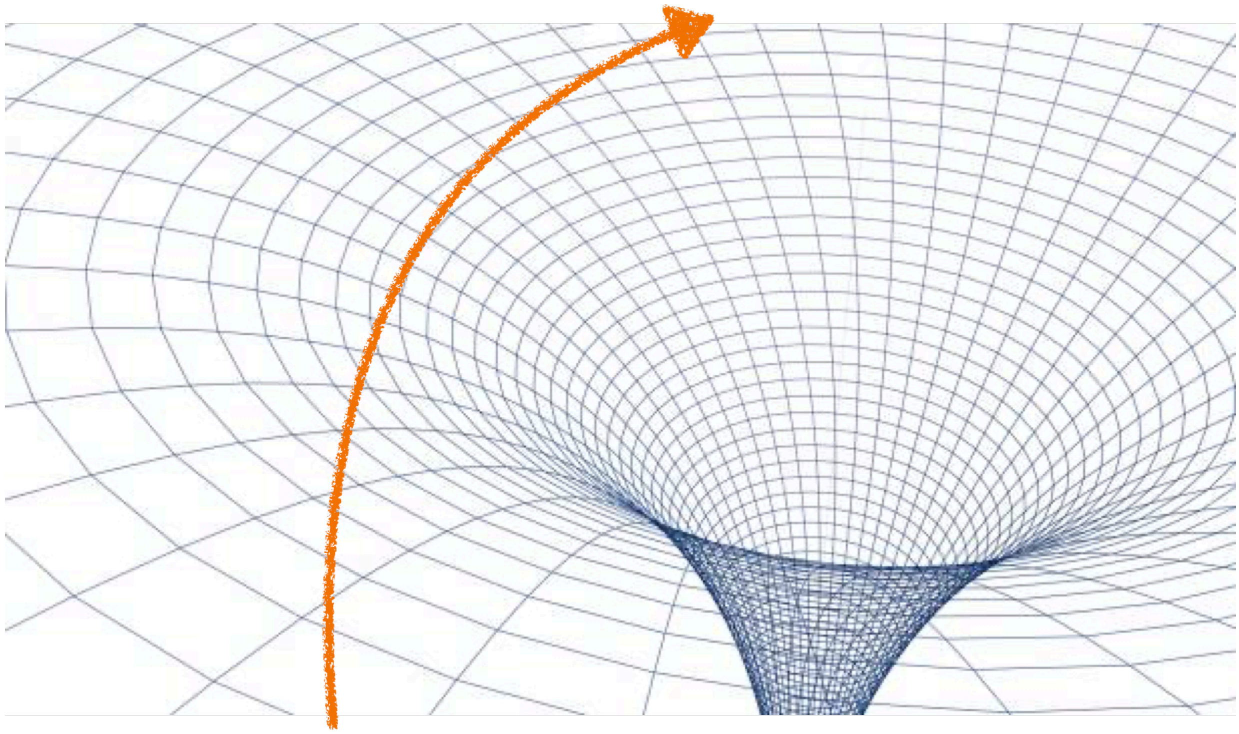
Recap

The O-fermion is proposed as a dark matter candidate, arising as an excitation of the omniversal O-field. With spin 1/2, zero electric and color charge and a mass range of ~10–250 GeV/c^2, it aligns with cosmological constraints and remains undetected due to its minimal interaction with Standard Model forces. Weak isospin (T) and hypercharge (Y) are considered irrelevant because the O-fermion does not participate in the symmetries that govern the weak and electromagnetic forces ($SU(2)_L \times U(1)_Y$ symmetries).

This model reinterprets dark matter as a connection between the O-field and spacetime-bound quantum fields, bridging quantum physics and cosmology. Further exploration through gravitational lensing and direct detection experiments may uncover its properties and validate its role within the Omniverse framework.

O-fermions, as stable excitations of the O-field, share essential characteristics with theoretical WIMPs, including mass, stability and gravitational interaction. This conceptual overlap suggests that what is identified as WIMPs in conventional physics may actually be O-fermions reinterpreted within a spacetime-bound quantum framework. While both possess mass, are stable and exhibit gravitational interaction, O-fermions distinguish themselves from WIMPs by their direct relationship with the O-field and their potential independence from weak-force interactions. Given this alignment, it is possible that what mainstream physics identifies as WIMPs may, in fact, be O-fermions misinterpreted within the limited framework of spacetime-bound quantum field theories.

11. General Relativity (GR)



Introduction

General Relativity (GR), developed by Albert Einstein(103), describes how massive objects bend spacetime, resulting in what we perceive as gravity. At the core of GR is Einstein's field equation, which relates the curvature of spacetime to the distribution of matter and energy. Einstein initially introduced the Cosmological Constant (Λ) to maintain a static universe model, as early observations did not yet suggest that the universe was expanding. Later, when Edwin Hubble's measurements showed that the universe is not only expanding but accelerating, Λ was reinterpreted as representing a fixed energy density of empty space —often called vacuum energy—that contributes to accelerated expansion. Meanwhile, the Hubble constant (H) quantifies the current rate of this expansion, but it is Λ that provides the underlying theoretical mechanism for acceleration in the framework of General Relativity.

However, i**n the context of the O-field**, the concept of Λ changes. Instead of being constant, it becomes a dynamic quantity influenced by fluctuations within the O-field. These fluctuations, like ripples on the surface of a pond, can vary over immense distances and timescales. On large scales, Λ appears constant, but on smaller, local scales, deviations are observed. This reinterpretation resolves a long-standing issue in cosmology — the mismatch between the predicted value of Λ and what is observed. If Λ depends on the state of the O-field, its local value can naturally differ from its average cosmic value.

Another fundamental shift arises when considering the Omniverse — the overarching "space" in which universes exist. Unlike within a universe, where spacetime provides familiar concepts like distance (measured in meters) and time (in seconds), the Omniverse lacks spacetime altogether, making traditional concepts of "distance" and "duration" meaningless.

Instead, we must describe reality using the **field values** (φ) and their **momenta** (π) of the O-field.

But what are these quantities? **Field values** (φ) represent the amplitude or intensity of the O-field at a given "**point**" within the field itself. Unlike position in spacetime, which refers to a specific location, field values describe the local "**state**" of the field—whether it is at rest, oscillating and experiencing a fluctuation. On the other hand, **momenta** (π) represent the rate of change or "**velocity**" of these field values. Similar to how momentum in classical mechanics describes the movement of a particle, reflects how rapidly the O-field's state is changing in response to disturbances or fluctuations.

Together (φ) and (π) define the internal **dynamic state** of the O-field. This approach replaces conventional notions of position and time, as these concepts are irrelevant in the Omniverse where spacetime does not exist. Instead, the field's "state" is captured entirely by its amplitude (φ) and its rate of change (π).

In this view, spacetime, gravity and even the 16 known quantum fields are not fundamental, but **emergent phenomena** that arise from the underlying dynamics of the O-field. This perspective unifies spacetime, energy and entropy into a single framework, transforming how we understand the nature of reality beyond our universe.

Basics

The Omniverse Theory proposes that Einstein's field equation from General Relativity (GR) requires refinement. The equation describes how matter and energy in the universe (Tμν) cause spacetime to bend or curve (Gμν), with an additional effect from the cosmological constant (Λ) that accounts for the expansion of the universe. The strength of this relationship is controlled by universal constants G (gravity) and c (speed of light):

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

where

- $G\mu\nu$ the Einstein tensor, describing the curvature of spacetime;
- Λ the cosmological constant;

- $g_{\mu\nu}$ the metric tensor, defining the geometry of spacetime;
- $T_{\mu\nu}$is the energy-momentum tensor, representing mass, energy and pressure;
- G is the gravitational constant; and
- c is the speed of light.

Fluctuations and Dynamic Cosmological Constant

Fluctuations or "ripples" in the O-field can occur on very large scales, spanning billions of light-years. Traditionally, the cosmological constant Λ in the equation describes a fixed value corresponding to the energy density of the vacuum. When measured on a cosmological scale, Λ is homogeneous and constant.

However, this homogeneity is likely a practical approximation resulting from our limited observations and the immense time and spatial scales over which fluctuations in the O-field occur. Consequently, Λ increasingly viewed as a practical estimate rather than an absolute constant.

This perspective may explain why Λ consistent on large scales, while deviations are observed on smaller, localized scales. It also provides a potential explanation for the discrepancy between the theoretical predictions of Λ its observed value. If measurements of depend on spatial and temporal positions within a fluctuating O-field, local measurements could differ from the theoretically expected average.

In the Omniverse Theory, the cosmological constant Λ is reinterpreted as a dynamic, fluctuating property of the O-field. The O-field serves as an ever-present "canvas" underlying the Omniverse. Just as temperature and pressure fluctuations in Earth's atmosphere vary dynamically and locally, fluctuations in the O-field influence Λ. Thus, Λ is not a true constant but instead depends on both space and time, denoted as $\Lambda(x, t)$. This dynamic reinterpretation addresses one of the major challenges in cosmology — the discrepancy between the predicted and observed values of Λ.

While Λ represents large-scale, global fluctuations in the O-field's vacuum energy density, it does not fully account for short-term, localized and nonlinear disturbances. These can arise from phenomena such as DOE (Dark Object Ember) collisions, gravitational waves from previous universes or dark matter fluctuations. To address these effects, an additional function F is introduced, the Localized Cosmological Perturbation (LCP), which captures the O-field's "unrest" on smaller scales. Without F the field equation would miss crucial local fluctuations that Λ alone cannot capture, ensuring a more complete and accurate representation of spacetime dynamics.

Finally, in addition to the traditional cosmological constant contribution which we now treat as a variable $\Lambda(x, t)$ and the local perturbation term $F(x, t)$, we introduce a new contribution to the field equation that depends on the gradient of the O-field. This contribution is included in the modified energy-momentum tensor. Specifically, the term $\Lambda(x, t, \nabla\varphi)$ models the local influence of the O-field gradients $\nabla\varphi$ on energy density. The inclusion of $\nabla\varphi$ extends the classical notion of vacuum energy density, introducing a local dependence on O-field fluctuations. This approach is analogous to how scalar fields influence local variations in the energy-momentum tensor.

Think of it this way: we normally imagine "empty" space having a certain amount of energy, called the vacuum energy, that's the same everywhere. Now, we're allowing that amount of energy to change depending on how our "O-field" is behaving in different places. Instead of just having a single number for energy everywhere, we look at how the O-field's value shifts from one spot to another. The steeper or more uneven these changes are, the more it affects the local energy. This idea is like noticing that if a field varies smoothly, it contributes less extra energy than if it changes sharply from one place to another. In simple terms, we're adding a new piece to our equations that takes into account these local "ups and downs" in the O-field, which then influences the energy and momentum in that region.

Together, the new terms $\Lambda(x, t)$, $F(x, t)$ and $\Lambda(x, t, \nabla\varphi)$ unify the large-scale and local influences of the O-field on spacetime, offering a more complete picture of how fluctuations in the Omniverse influence the curvature, energy density and dynamics of spacetime.

The revised field equation therefore becomes:

$$G_{\mu\nu} + \Lambda(x, t)\, g_{\mu\nu} = \frac{8\pi G}{c^4}\left(T_{\mu\nu} + F(x, t) + \Lambda(x, t, \nabla\varphi)\right)$$

where

- $\Lambda(x, t)g_{\mu\nu}$ represents the dynamic cosmological constant that reflects large-scale fluctuations in the O-field. The large scale "pressure" shaping the overall universe;
- $F(x, t)$ the Localized Cosmological Perturbation (LCP). Like little gusts of wind on top of a general breeze. And
- $\Lambda(x, t, \nabla\varphi)$ the gradient dependency of the O-field. An even closer look at what's causing these local variations.

This is how we bridge the gap between the big-picture background energy and the fine, detailed structure of the field at every point.

Gradient Dynamics and Coupling Parameter

To further refine our model and account for local variations in the O-field's gradients, we now incorporate a gradient-dependent contribution. This equation shows that the cosmological constant Λ(x, t), which affects the expansion of the universe, isn't fixed but can change depending on location (x) and time (t). It starts with a base value ($\bar{\Lambda}$) and adds a part that depends on how quickly a field (φ) changes from one place to another. The faster φ changes, the bigger the impact on Λ(x, t), with the size of this impact controlled by the constant k:

$$\Lambda(x,t) = \bar{\Lambda} + k\left(\nabla\varphi\right)^2$$

where

- $\bar{\Lambda}$ represents the large-scale, averaged contribution to the cosmological constant within a given volume V and
- k is a coupling parameter that determines the strength of the contribution of $\left(\nabla\varphi\right)^2$ relative to the energy density $T_{\mu\nu}$. Without k it would be impossible to control the influence of gradients compared to the energy density.

The coupling parameter is determined by local interactions between fluctuations in the quantum field and the energy density and it can vary depending on scale and conditions. is thus an emergent parameter that depends on the interplay of various processes within the O-field, such as fluctuations and energy gradients. It is neither homogeneous nor isotropic. Instead, it varies in space and time depending on the behavior of the O-field. can be defined as:

$$k(\alpha,\beta,\gamma) = \alpha\nabla\varphi + \beta(\nabla\varphi)^2 + \gamma\frac{d(\nabla\varphi)}{dt}$$

where

- α controls the direct influence of the O-field gradient $\nabla\varphi$ on the energy density;
- β captures the nonlinear influence of the magnitude of the gradient $(\nabla\varphi)^2$;
- γ captures how the rate of change of the gradient affects the local coupling.

It shows that k, the coupling parameter that influences how a system behaves, depends based on how quickly the field changes in space, how strong those changes are and how fast those changes shift over time.

Behavior Under Fluctuations

If fluctuations in the O-field gradient $\nabla\varphi$ and its time evolution $\partial(\nabla\varphi)/\partial t$ disappear (for example, in a static or stable state of the O-field, in other words it is calm and does not vary from one spot to another) then the extra effect they had on the universe's expansion disappears. The coupling parameter k becomes zero:

$$k = 0$$

This eliminates the gradient-driven term $k\left(\nabla\varphi\right)^2$ from the modified cosmological constant, leaving only the large-scale contribution $\bar{\Lambda}$.

$$\Lambda(x,t) = \bar{\Lambda} \quad \text{when} \quad \nabla\varphi = 0$$

In the most extreme scenario, if both the O-field gradients ∇O and the large-scale cosmological constant $\bar{\Lambda}$ vanish (there's nothing left to make the universe expand), the entire cosmological constant disappears:

$$\Lambda(x,t) = 0$$

This aligns with the hypothesis that **dark energy and spacetime are emergent properties** of a dynamic system. Without fluctuations in the O-field, the local components of dark energy would not manifest. If $\bar{\Lambda}$ also vanishes, then spacetime is left in a "ground state" where no energy density drives the expansion of space. Everything just sits there in a completely calm, flat state.

From Spacetime (x, t) to Field Configuration Space (φ, π)

To understand gravity and spacetime as emergent phenomena, we must move beyond the familiar picture of objects and events positioned in space and time. Instead, we focus on the O-field, characterized by field values (φ) and their canonical momenta (π). In this new perspective, explicit spacetime coordinates no longer serve as fundamental building blocks. Instead, they emerge as effective constructs from more basic, underlying field states.

This shift in perspective echoes Schrödinger's(121) approach to quantum systems, where physical observables are derived from the evolution of a state function, rather than being assigned fixed positions in classical spacetime.

In this approach, spacetime metrics, gravitational fields and the cosmological constant Λ arise statistically from the configuration space of the O-field. To capture how this emergence happens, we adopt a probabilistic viewpoint. Each possible state of the O-field (φ, π) is assigned a probability and from this distribution we can define an entropy. Entropy here is not merely an abstract quantity; it acts as a tool that identifies equilibrium states of the O-field. In these equilibrium states, conditions arise that mimic gravitational dynamics and define effective geometric structures. Structures that we interpret as spacetime.

By formulating the problem in terms of the O-field's degrees of freedom, we give up the explicit use of coordinates (x,t) in favor of a configuration space described by (φ, π). The geometry we normally associate with spacetime thus emerges from what can be considered an "information geometry," where second-order variations of an entropic potential play a role similar to that of the Fisher(119) information in statistics. This entropy-driven approach naturally leads us to a stationary (equilibrium) distribution $\rho(\varphi, \pi)$ and an associated functional F that incorporates both energy-like and entropy-like contributions. Ultimately, examining small fluctuations around this equilibrium yields an emergent metric-like structure and effective field equations that resemble those of General Relativity, but now understood as arising from a deeper, statistical foundation.

Entropy and Probability Distribution

Define $\rho(\varphi, \pi)$ as the probability distribution that indicates the likelihood of certain combinations of φ (the field's value) and π (its momentum) at a given point in the configuration space. The entropy is then given by:

$$S = -k \int \rho(\varphi, \pi) \ln \rho(\varphi, \pi) \, d\varphi \, d\pi$$

where k is the Boltzmann-constant(118). This formulation treats entropy as a measure of the spread of probabilities over possible field states.

In detail, it shows that S, which represents the entropy of a system, depends on the distribution of possible states of two variables, φ (the field) and π (its momentum). The more unpredictable or "disordered" the system is, the higher the value of S. The constant k controls the scale of the entropy and the integral sums up the contributions from all possible combinations of φ and π.

This probabilistic treatment of the O-field shares conceptual similarities with Schrödinger's treatment of quantum states, where the square of the wave function, $|\psi|2$, defines a probability density over configuration space.

However, unlike the wavefunction in quantum mechanics, which evolves according to the Schrödinger equation, the O-field's probability distribution reflects a statistical balance between energy and entropy contributions, providing a broader foundation for emergent spacetime structures.

Entropic Potential and Emergence of Metrics

To obtain an energy-like functional, we introduce $\mathcal{E}(\varphi, \pi)$ as an energy-like function that captures the internal structure of the O-field in a given state. It combines two key contributions: the standard energy $E(\varphi, \pi)$ and an entropy-related term $\Theta \cdot S(\varphi, \pi)$, where Θ determines how much the system's internal disorder (entropy) affects its total energy.

To visualize this, imagine a container of gas particles. The energy term tracks the motion and interactions of the particles (like kinetic and potential energy), while the entropy term reflects the randomness in their arrangement. Similarly, in the O-field, these two aspects combine to shape the system's overall state.

$$\mathscr{E}(\varphi, \pi) = E(\varphi, \pi) + \Theta\, S(\varphi, \pi)$$

where

- $\mathscr{E}(\varphi, \pi)$ is the **energy functional** associated with the O-field state (φ,π));
- Θ represents a **temperature-like parameter** reflecting fluctuations in the O-field and
- $S(\varphi, \pi)$ is the **entropy** associated with the configuration of the O-field in the state (φ,π)

This decomposition into energy and entropy-related terms bears some similarity to the structure of the Schrödinger equation, where the total energy is captured by the Hamiltonian operator H acting on the quantum state. Here, the total 'energy-like functional' $E(\phi,\pi)$ guides the evolution of the O-field's equilibrium state.

In simple terms, the **O-field system evolves** just like a quantum system described by the Schrödinger equation. But instead of only kinetic + potential energy, the O-field evolution also includes **entropy (disorder)** as a key player.

This means that, just like how the Schrödinger equation predicts where a particle will be, the O-field's "energy-like functional" predicts how the O-field will behave — balancing energy and disorder at the same time.

To find the most probable field state, we solve the variational principle:

$$\frac{\delta \Phi}{\delta \rho} = 0$$

This yields a stationary distribution $\rho_0(\varphi, \pi)$, representing the equilibrium state of the O-field. Small fluctuations around this equilibrium give rise to a metric-like structure, allowing the emergence of spacetime-like geometry from the configuration space.

Emergence of Gravity and Metrics

The key question is how a metric emerges from this configuration space. Consider the LCP function F(x,t) introduced earlier as understanding this emergence is crucial for explaining how spacetime geometry and gravitational effects arise from deeper statistical and geometric properties of the O-field. The second-order variation of F with respect to φ and π yields a metric-like structure:

$$g_{\alpha\beta} = \frac{\partial^2 F(\varphi, \pi)}{\partial x^\alpha \partial x^\beta}, x^\alpha \in \{\varphi, \pi\}$$

Here x^α is a coordinate in configuration space where it can represent either φ or π.

These second-order variations play a role similar to the Fisher(119) information metric in statistics, where the "information" about system parameters is captured by a metric on the space of probability distributions. Here, they establish a geometry on the configuration space of the O-field. As a result, correlations between changes in φ and π correspond to geometric relations in this emergent space, analogous to the way physical distances and angles arise in ordinary spacetime.

In simpler terms, it measures how the shape or curvature of the system changes as you move along the φ and π directions. Just as in general relativity, the metric $g_{\alpha\beta}$ tells you how to measure distances in curved spacetime, here it tells you how to measure differences or distances in the "space" defined by the field φ and momentum π.

When the O-field undergoes a phase transition, this emergent geometry gives rise to structures that resemble the geometry of our familiar four-dimensional spacetime and the family of quantum fields that inhabit it. The reference to "16 quantum fields" refers to the set of fields in the Standard Model of particle physics plus gravity and to a particular model's set of fields that emerge at these transition points.

The idea is that the intricate interactions and properties of these fundamental fields can be understood as arising from deeper statistical and geometric properties of the underlying O-field. In other words, what we usually consider "fundamental" — spacetime and the known quantum fields — can be seen as emergent from more basic, probabilistic and entropic structures at the configuration-space level.

Revised Unified Equation

The unified equation capturing the Omniverse perspective on General Relativity, dynamic cosmological constant and emergent spacetime can be written as:

$$G(\varphi, \pi) = \frac{8\pi G}{c^4}\left[T(\varphi, \pi) + F(\varphi, \pi) + \Lambda(\varphi, \pi, \nabla\varphi)\right]$$

where

- $G(\varphi, \pi)$ represents the generalized Einstein tensor depending on the O-field variables φ and π;
- $T(\varphi, \pi)$ is the energy-momentum tensor as a function of φ and π ;
- $\Lambda(\varphi, \pi, \nabla\varphi)$ is the dynamic cosmological constant that now depends on φ, π and the gradient $\nabla\varphi$;
- $F(\varphi, \pi)$ is an additional fluctuation or force-like term that captures the influence of non-linear effects in the O-field.

The formula shows how the "force" or "effect" of gravity (G(φ, π)) is determined by three key factors. It says that gravity depends on:

1. **T(φ, π)** — The energy and matter present in the system;
2. **F(φ, π)** — Localized changes or disturbances (called LCP effects) in the system;
3. **Λ(φ, π, ∇φ)** — Fluctuations and changes in the field φ, including how it changes from one place to another (∇φ means "gradient of φ").

All of this is scaled by a constant factor ($8\pi G / c^4$), where G is the gravitational constant and c is the speed of light. In simple terms, it shows that gravity comes from energy, disturbances and changes in the field with everything scaled by a universal constant.

Beyond c and Spacetime Units

However, in the Omniverse framework, spacetime and its associated constants, including the speed of light c, are not fundamental constructs but emergent phenomena arising from the underlying statistical properties of the O-field. Traditionally, c serves as a universal speed limit and a scaling factor linking space and time. However, once we no longer treat spacetime as primary, the very meaning of a "speed" becomes ambiguous. Before the emergence of a spacetime manifold, there are no meters or seconds; these units themselves arise only at equilibrium points in the O-field's probability landscape.

As we abandon explicit reference to c, we must also rethink familiar relations such as $E=mc^2$. In a world where c does not exist as a primitive concept, mass and energy are not fixed quantities but emergent attributes of certain stable states in the O-field's configuration space. The equivalence of mass and energy must therefore be reformulated in terms of entropic gradients and probability distributions. What we once viewed as $E=mc^2$ is actually an approximation that emerges when the O-field's fluctuations stabilize into a regime with a well-defined metric and correlation scales. In that regime, the ratio of correlation lengths and fluctuation timescales in the O-field's probability distribution sets an effective scale that we come to interpret as c.

Dimensionless Parameters and Entropic Redefinition

Instead of relying on c, we define dimensionless parameters derived from the O-field's statistical characteristics. These might include ratios of correlation lengths, timescales of fluctuations and entropic gradients. Together, they establish a natural, purely probabilistic measure of how configurations change or "propagate" in the O-field's space of possibilities. When the O-field's probability distribution reaches a stable equilibrium, a subset of these dimensionless parameters collectively mimic the role of c, allowing us to recover relativistic phenomena as emergent features rather than inputs.

This reformulation is akin to expressing all fundamental relations in terms of dimensionless groups that encode the O-field's entropic structure. The geometry that emerges, the effective metric and the notion of energy density and mass are all determined by these entropic and probabilistic attributes. As a result, the final unified equation — now stripped of any explicit dependence on c — expresses the dynamics of the emergent metric and matter fields purely in terms of statistical and entropic parameters.

Final Dimensionless Unified Equation

In the final form, the unified equation no longer contains c or assumes a predefined spacetime structure. Instead, it appears as a dimensionless relation among quantities derived from the O-field's probability distribution ρ(φ,π), the entropic functional F(φ,π) and their variations. All references to length, time and energy units are replaced by dimensionless combinations of fundamental constants (like k, $\hbar$, G) and the O-field's correlation characteristics. Spacetime, mass, energy and even the concept of a universal speed limit arise only after the system settles into a specific, stable configuration. In that configuration, the dimensionless parameters align so that a particular combination takes on the role of c and effective mass-energy equivalences and gravitational phenomena appear naturally.

This shift highlights that what we perceive as "fundamental" physical constants are actually emergent properties of an underlying entropic landscape. By framing all physical laws in terms of these dimensionless ratios and entropic parameters, we recognize that the observed constants of nature and the familiar structure of spacetime are high-level manifestations of a deeper, probabilistic reality.

$$\tilde{G}_{\alpha\beta}[\rho(\varphi,\pi),\nabla\varphi,\nabla\pi] = \tilde{T}_{\alpha\beta}[\rho(\varphi,\pi),\nabla\varphi,\nabla\pi] + \tilde{\Lambda}(\varphi,\pi,\nabla\varphi) + \tilde{F}(\varphi,\pi,\nabla\varphi)$$

Here

- $\tilde{G}_{\alpha\beta}$ is the dimensionless analog of the Einstein tensor, derived entirely from statistical and entropic properties of the O-field rather than a predefined metric.
- $\tilde{T}_{\alpha\beta}$ is the dimensionless energy-momentum-like tensor, encoding mass-energy content in terms of O-field probabilities and gradients.
- $\tilde{\Lambda}(\varphi, \pi, \nabla\varphi)$ is a dimensionless dynamic cosmological term arising from the entropic structure of the O-field, no longer a fixed constant but an emergent parameter dependent on the local configuration.
- $\tilde{F}(\varphi, \pi, \nabla\varphi)$ captures dimensionless non-linear fluctuations and force-like terms stemming from short-range O-field variations.

This rather complicated formula simply means that the overall "shape" or "curvature" of the system (similar to how space bends in relativity) is influenced by three factors: energy and matter effects (like how mass and movement affect gravity), fluctuations in the field (like ripples on water) and local disturbances (such as those caused by DOEs or fade-out effects).

Conclusion

In re-envisioning Einstein's geometric description of gravity as an emergent, statistically driven phenomenon, the Omniverse Theory represents a profound shift in our understanding of fundamental physics. What we have traditionally regarded as immutable constants — from the speed of light to the cosmological constant — now appear as epiphenomena arising from deeper, entropic structures in the O-field. Spacetime itself, once the very backdrop of physics, emerges as a derivative concept, woven from a tapestry of probabilistic field configurations rather than serving as a fundamental arena.

This perspective not only reframes our notions of mass, energy and gravity but it also dissolves the rigid boundaries between these concepts and blends them into a single, fluid framework. By stripping away the scaffolding of predefined units and coordinates and by relying on field values, momenta and entropy, we attain a level of abstraction where familiar physical laws and constants are revealed as approximations valid only within certain equilibrium states of the O-field.

In short, the Omniverse Theory challenges us to see what was once believed fundamental as emergent, pushing beyond the legacy of Einstein's equations to a new vantage point. From this viewpoint, the entire edifice of spacetime and matter emerges from a grand statistical interplay, prompting us to rethink not just the details of our physical theories, but the very criteria by which we deem concepts "fundamental."

12. Final thoughts

As we've journeyed from the familiar landscape of galaxies and expanding universes to the radical concept of the Omniverse, we've seen how each step in our understanding of reality has redefined what we consider "fundamental." Ideas once deemed absolute have given way to new frameworks that push beyond the limits of conventional thought. Now, through the lens of the Omniverse, even space, time and known laws of physics appear as emergent features of something deeper and more elusive.

The hypotheses presented are not final answers but starting points. They challenge us to reexamine the assumptions that underpin our understanding of the universe, encourage dialogue between different areas of physics and inspire new mathematical tools and observational strategies. Much of what has been described remains speculative, awaiting new theoretical developments and, eventually, empirical testing. Yet even as we acknowledge the uncertainty, the potential insight offered by these ideas is profound.

If the Omniverse exists, it reminds us that our universe may be neither unique nor ultimate. The constants we hold dear, the laws we find so elegant and the particles and fields we've painstakingly cataloged could be local manifestations of a broader reality. This humbling perspective broadens our cosmic horizons and compels us to think about existence itself in new ways. What does it mean to have countless universes beyond our own? How do we reconcile the idea that what we see as fundamental may be emergent and that what we call "laws" may be contextual?

For now, we stand at the threshold of these questions. Even if the Omniverse remains unconfirmed, the intellectual exercise of imagining it, has value. It challenges us to ask better questions, refine our methods and stay open to surprising answers. As physics continues to evolve and as we learn more about quantum fields, spacetime and the energy that drives cosmic expansion, we may someday find that notions of an Omniverse become testable, quantifiable and part of our standard scientific narrative.

Until then, the Omniverse remains an invitation: an invitation to explore the grandest possible canvas, to embrace the unknown and to consider that what we call reality might be just one chapter in a far more expansive cosmic story.

Looking back at the entire concept of the Omniversal Theory, where we have occasionally reinterpreted theories from prominent figures in physics freely, we must also acknowledge that certain topics have been addressed somewhat too lightly. The critical reader will likely be surprised at times by assertions that seem to come out of nowhere and are then used as "facts" to support further reasoning without sufficient explanation. In such cases, I can only resort to the familiar closing statement found in nearly all theories: **further research is needed**.

Glossary of Key Terms

- **0 Kelvin (Absolute Zero)**: The lowest possible temperature, where all thermal motion of particles theoretically stops, corresponding to -273.15°C.
- **Big Bang**: The sudden phase transition in the O-field that triggers the formation of a new universe, where spacetime and 16 quantum fields emerge.
- **Black Hole**: A region of spacetime where gravity is so strong that not even light can escape, often seen as an endpoint of spacetime.
- **Dark Energy**: The intrinsic tension within the O-field that drives excitations leading to the creation of dark matter and triggering Big Bangs.
- **Cosmic Web:** The large-scale structure of the universe, where galaxies, dark matter and gas form dense filaments with vast empty voids in between..
- **Dark Matter**: Invisible matter that interacts gravitationally but not with light, possibly linked to O-fermions as stable excitations of the O-field.
- **DOE (Dark Object Ember)**: Remnants of universes such as black holes or other compact objects.
- **Entropy**: A measure of disorder or randomness; in the O-field, higher entropy increases fluctuations, potentially leading to phase transitions.
- **Excitation**: A disturbance or increase in the energy state of a field, causing the formation of particles or phase transitions. In the Omniverse, excitations of the O-field can create dark matter (O-fermions) or trigger Big Bangs that give rise to new universes.
- **General Relativity (GR)**: Einstein's theory describing how mass and energy curve spacetime, but in the Omniverse, gravity also exists without spacetime.
- **Gravitational Lensing**: The bending of light around massive objects, like galaxies or black holes, due to spacetime curvature, allowing distant objects to appear distorted, magnified and duplicated.
- **Gravity**: The force of attraction between masses, described in General Relativity as the curvature of spacetime caused by mass and energy. In the Omniverse, gravity is an omniversal force, existing even without spacetime, as a result of the interaction between the O-field and the Higgs field.
- **Higgs Particle**: The particle associated with the bosonic Higgs field, which grants mass to other particles and is omnipresent like the O-field in the Omniverse.
- **LHC (Large Hadron Collider)**: The world's largest particle accelerator, located at CERN, used to collide protons at high energies to study fundamental particles and forces, including the search for dark matter and the Higgs boson.

- **LCP (Localized Cosmological Perturbation):** represents localized, short-term and nonlinear fluctuations in the geometry of spacetime driven by O-field dynamics caused by events like DOE collisions, gravitational waves and dark matter fluctuations in the O-field.
- **Magnetar**: A highly magnetized neutron star with intense magnetic fields that emit powerful X-rays and gamma rays.
- **Micro Bangs:** A highly speculative idea involving tiny excitations of the O-field that allow Standard Model quantum fields to emerge, thereby conserving information for phenomena like particle entanglement.
- **Neutron Star:** A dense stellar remnant formed after a supernova, composed mostly of neutrons and often a precursor to a black hole.
- **O-field**: The omnipresent, fundamental fermionic field of the Omniverse that exists independently of spacetime, driving the creation of universes and dark matter.
- **O-fermion (also O-particle, Dark particle, Dark-quark)**: A stable excitation of the O-field, theorized to behave like dark matter, with mass but no charge, possibly similar to WIMPs in mainstream physics but in the OT-context together with the Higgs-particle the only 2 Onniversal particles.
- **Omniverse**: The all-encompassing "canvas" for infinite universes, where the O-field and Higgs field exist omnipresently, beyond spacetime.
- **OT:** Short for Omniversal Theory.
- **Particle Properties**: Fundamental characteristics like mass, charge, spin, color and weak force interactions, determined by their relationship with quantum fields and symmetry principles..
- **Phase Transition**: A sudden change in the state of the O-field, like water freezing into ice, which can trigger the creation of dark matter or a new universe.
- **Photon**: A massless particle and quantum of light that mediates the electromagnetic force, allowing light, radio waves and other electromagnetic radiation to travel through space.
- **Quantum Field (QF)**: An invisible field that permeates all of space; particles like quarks and electrons are excitations of these fields.
- **Quantum Fundamental Theory (QFT)**: A theoretical framework for particle physics where particles are excitations of underlying quantum fields, expanded in the Omniverse model.
- **Spacetime**: The four-dimensional "fabric" of a universe that bends in response to mass and energy, but in the Omniverse, it is an emergent property of O-field excitations.

- **Supersymmetry (SUSY)**: A theoretical extension of particle physics proposing that every particle has a heavier "superpartner" with opposite spin. It aims to unify forces, explain dark matter and resolve inconsistencies in the Standard Model.
- **Void**: Vast, nearly empty regions between galaxy filaments where spacetime, matter and energy are sparse, offering insight into the nature of the O-field.
- **WIMP (Weakly Interacting Massive Particle)**: A theoretical particle proposed as dark matter, similar to the O-fermion but defined within spacetime-bound quantum fields.

References

(101) - Sean Carroll -

Carroll, S. M. (2019). *Something Deeply Hidden: Quantum Worlds and the Emergence of Spacetime.* Dutton.

Sean Carroll proposes that **quantum fields exist independently of space-time**, positioning them as the fundamental basis of nature. According to Carroll, space-time is not a primary entity but an emergent structure that arises from the dynamics of these quantum fields.

This view directly aligns with the **Omniversal Theory (OT)**, where the **O-field** and **Higgs field** are timeless, omniversal entities. Space-time, on the other hand, is seen as an emergent phase transition of the O-field. When the O-field is excited, a **Big Bang** manifests as a phase transition, creating space-time as an emergent property. This process allows the **16 quantum fields** of the Standard Model to come into existence, but these fields are only active within universes where space-time exists. Hence, these 16 fields are universal, not omniversal, as they require space-time as a prerequisite.

In the **Fade Out** phase, once the 16 quantum fields dissolve back into the O-field, **thermodynamic time ceases to exist**. Since the dynamics of the 16 quantum fields are responsible for time and causality, their dissolution causes the end of thermodynamic time. The residual energy from this process returns to the O-field, which serves as the **primordial canvas of the omniverse**. Only the timeless O-field and Higgs field remain, ready to facilitate the emergence of new universes through future phase transitions.

(102) - Stephen Hawking & James Hartle

Hawking, S. W., & Ellis, G. F. R. *"The Large Scale Structure of Space-Time**. Cambridge University Press.

Hawking, S. W. (1971). Gravitationally collapsed objects of very low mass. *Monthly Notices of the Royal Astronomical Society*, 152(1), 75–78.

The **no-boundary proposal** by Hawking and Hartle provides a theoretical framework where space-time emerges from a **quantum phase transition**. In this model, time is seen as an emergent property rather than a fundamental one and the universe has no sharp boundary or absolute starting point.

This concept fits seamlessly with the **OT**, where space-time is viewed as a consequence of an O-field phase transition. Just as in Hawking and Hartle's model, space-time only arises at the point of this transition, making it a local and emergent feature. OT asserts that the **O-field and Higgs field are omniversal**—they exist beyond space-time and act as the ever-present foundation of the omniverse. By contrast, the 16 quantum fields of the Standard Model only operate within universes, making them **universal rather than omniversal**.

While the no-boundary proposal implies that the universe has no boundary, OT extends this concept to the entire omniverse. It proposes that the omniverse itself is **boundary-less and timeless**, with each universe being a temporary manifestation of the O-field. Once a universe completes its cycle, its energy and quantum fields dissolve into the O-field, causing space-time to vanish. The next universe emerges as a new phase transition from the O-field, continuing the cyclic process.

(103) - Albert Einstein

Einstein, A. (1916). *Die Grundlage der allgemeinen Relativitätstheorie* (The Foundation of the General Theory of Relativity). Annalen der Physik, 49(7), 769-822.

Einstein, A., Podolsky, B., & Rosen, N. (1935). Can Quantum-Mechanical Description of Physical Reality Be Considered Complete? Physical Review, 47(10), 777–780.

Albert Einstein's most famous equation, **$E = mc^2$**, reveals the profound relationship between energy and mass, demonstrating that they are interchangeable. This insight remains valid not only within the context of a universe with space-time but also within the OT. While space-time is fundamental to general relativity, **OT proposes that space-time is not fundamental** but rather an emergent property of the O-field.

In traditional relativity, the speed of light (c) defines the maximum velocity for massless particles like photons. But in the omniverse, where space-time is not fundamental, the speed of light **has no physical meaning as a boundary value**. Nevertheless, the deeper insight of **$E = mc^2$**—that energy and mass are interchangeable—still applies at the level of quantum fields. In the O-field, where excitations can give rise to particles, the conversion of energy into mass follows the same logic as in relativity, though it occurs on a more **primordial level**.

(104) - Isaac Newton -

Newton, I. (1687). *Phalis Principia Mathematica* (The Mathematical Principles of Natural Philosophy). Royal Society.

Isaac Newton's first law states that an object will remain at rest or move in a straight line at constant speed unless acted on by an external force. In the context of general relativity, this "straight line" becomes a **geodesic** in curved space-time and this idea is further transformed in the OT.

Since space-time itself is seen as an **emergent phase transition** from the O-field, Newton's concept of a "straight line" must be reinterpreted. Within the O-field, the concept of linear motion is not constrained by the geometry of space-time, as no space-time exists prior to its emergence. The behavior of particles or excitations within the O-field follows the dynamics of quantum fields, which are described by **Hamiltonians** and the laws of **quantum mechanics**, rather than by Newton's classical mechanics.

(105) - Alexander Friedmann

Friedmann, A. (1922). Über die Krümmung des Raumes. *Zeitschrift für Physik, 10*(1), 377–386

Alexander Friedmann introduced the concept of a **dynamic universe** rather than a static one, as previously believed. His equations offered multiple possibilities for the universe's evolution: a **closed universe** that contracts (Big Crunch), an **open universe** that expands forever and a **flat universe** that asymptotically slows to a halt. These models are determined by the universe's total energy density, including contributions from dark matter and dark energy.

OT incorporates Friedmann's dynamic universe but extends it to the entire omniverse. While Friedmann's equations describe space-time's evolution within a single universe, OT suggests that the universe does not simply end in a Big Crunch or a "Heat Death". Instead, once quantum fields dissolve into the O-field during the **Fade Out phase**, space-time ceases to exist. This allows for the possibility of new universes emerging from O-field fluctuations, following the cyclical principles of **Penrose's Conformal Cyclic Cosmology** but on a broader omniversal scale.

(106) - Edwin Hubble -

Hubble, E. (1929). A relation between distance and radial velocity among extra-galactic nebulae. *Proceedings of the National Academy of Sciences, 15*(3), 168–173.

Edwin Hubble's discovery that galaxies are receding from us at speeds proportional to their distance led to the formulation of **Hubble's Law**. This was the first observational evidence of an expanding universe and laid the foundation for the **Big Bang theory**.

In the OT, Hubble's Law still holds but is seen as a local effect within a single universe. On the scale of the omniverse however, the expansion of universes is driven by the dynamics of the O-field itself, with dark energy emerging as its localized effect within individual universes. As quantum fields dissolve in the Fade Out phase, fluctuations in the O-field could trigger the formation of new universes. Thus, the accelerated expansion observed in our universe (and others) is understood as part of a larger process governed by the O-field.

(107) - Steven Weinberg, Sheldon Glashow, Abdus Salam et al -

Weinberg, S. (1967). A model of leptons. *Physical Review Letters, 19*(21), 1264–1266.
Glashow, S. L. (1961). Partial-symmetries of weak interactions. *Nuclear Physics, 22*, 579–588.
Salam, A. (1968). Weak and electromagnetic interactions. *Nobel Lecture*.

The combined work of **Weinberg, Glashow and Salam** in unifying the **electroweak force** provided one of the key pillars of the Standard Model of particle physics. Their model used the **Higgs mechanism** to explain how particles gain mass, a discovery later confirmed by the detection of the **Higgs boson** in 2012.

Within the framework of the OT, the significance of their work extends beyond the Standard Model. OT proposes that, alongside the O-field, the Higgs field is one of only two fundamental fields that permeate the entire omniverse so it already imparts mass to O-particles, and by extension, gravity exists even before spacetime forms. Their theoretical contributions explain how mass arises for Standard Model particles, but in the context of OT, this same mechanism is fundamental to the gravitational effects that persist across the omniverse. The formation of spacetime in a new universe occurs when localized fluctuations in the O-field reach critical instability, but the Higgs field remains present throughout, ensuring that mass — and thus gravity — is never absent, even in the absence of spacetime itself.

(108) - Copernicus, Bruno, Galilei, Herschel -

Modern astronomy began with **Nicolaus Copernicus (1473-1543)**, who proposed the heliocentric model, placing the **Sun at the center** of the solar system. **Giordano Bruno (1548-1600)** expanded this view, suggesting **stars as distant suns** with their own planets, for which he was executed for heresy. **Galileo Galilei (1564-1642)** provided observational proof of heliocentrism using a **telescope** to observe Jupiter's moons, leading to his trial by the Inquisition. **William Herschel (1738-1822)** advanced astronomy by **mapping the Milky Way** as a disk-shaped galaxy and discovering **Uranus**, further expanding humanity's view of the cosmos.

(109) - William Rowan Hamilton -

Hamilton, W. R. (1834). On a general method in dynamics. Philosophical Transactions of the Royal Society of London, 124, 247–308.

William Rowan Hamilton's development of **Hamiltonian mechanics** provided the foundation for quantum mechanics. His framework introduced the concept of the **Hamiltonian operator**, which represents the total energy of a system.

In the OT, Hamilton's principles remain essential, as they describe the evolution of excitations within the O-field. The O-field's excitations follow quantum principles described by Hamiltonians, with the possibility of energy transitions leading to the emergence of new universes.

(110) - Roger Penrose -

Penrose, R. (2010). *Cycles of Time: An Extraordinary New View of the Universe*. Bodley Head.

Roger Penrose's theory of **Conformal Cyclic Cosmology (CCC)** inspired the core ideas of the OT. In CCC, the end of one universe becomes the beginning of the next through a conformal transformation, where infinite density and zero density are treated as equivalent. This notion connects directly with the O-field in the OT, where the collapse of quantum fields and the reversion to the O-field mirrors the conformal "fade out" that Penrose describes.

Penrose's emphasis on the role of entropy and its reduction at the start of a new universe, is mirrored in the OT's view that entropy within voids approaches zero locally. The idea that residual structures from previous universes (like super-DOEs) can influence the next aeon aligns with the Omniversal concept that dark matter (excited O-field particles) retains gravitational influence between aeons.

The omniversal perspective takes Penrose's cyclical cosmology further by positing that the only omniversal quantum fields are the **O-field** and the **Higgs field**. Instead of focusing solely on the conformal relationship between aeons, the O-field serves as the permanent "canvas" of the omniverse, with universes emerging as phase transitions.

(111) - Rien van de Weygaert -

van de Weygaert, R., & Platen, E. (2011). *The Cosmic Web: Geometric Analysis*. International Journal of Modern Physics: Conference Series, 1(1), 41–66.

Rien van de Weygaert's work on **cosmic voids** has been pivotal for understanding the role of large-scale structure in the universe. He characterizes voids as underdense regions that play a crucial role in shaping the cosmic web. His research shows how voids evolve dynamically, with expanding boundaries and low matter density, providing insights for the OT.

In the Omniversal framework, the behavior of voids offers a lens into the nature of the O-field. Since van de Weygaert's models reveal how voids grow over time and how dark matter structures persist within them, his work directly supports the idea that voids are places where the O-field's influence becomes most observable. The fading out of quantum fields within voids mirrors the dissolution of the 16 Standard Model quantum fields into the O-field.

(112) - Brent Tully -

Tully B, Courtois, H. M., Hoffman, Y., & Pomarède, D. (2014). *The Laniakea Supercluster of Galaxies*. Nature, 513(7516), 71–73.

Brent Tully's research on large-scale structures, particularly his identification of **Laniakea, the supercluster of galaxies** to which the Milky Way belongs, has illuminated the importance of cosmic flows and the large-scale distribution of matter. His work helps to define how mass and dark matter are distributed at cosmological scales.

OT uses insights from Tully's research to understand the interplay between dark matter and the O-field. Since Tully's studies focus on the large-scale distribution of mass, they offer support for the idea that dark matter's gravitational influence is not homogeneous. The O-field fluctuations that create O-particles (dark matter) could be seen as the underlying force driving the flow and arrangement of matter in superclusters. Tully's large-scale flow models provide context for how dark matter forms filaments, clusters and the boundaries of voids.

(113) - David H. Weinberg -

Weinberg, S. (1995). *The Quantum Theory of Fields* (Vol. 1). Cambridge University Press.
Weinberg, D. H., Mortonson, M. J., Eisenstein, D. J., Hirata, C., Riess, A. G., & Rozo, E. (2013). *Observational Probes of Cosmic Acceleration*. Physics Reports, 530(2), 87-255.

Weinberg's work on **gravitational lensing** and **dark matter halos** has been instrumental in providing observational evidence for the presence of dark matter in the universe. His research on weak lensing, particularly in cosmic voids, offers critical tools for investigating the O-field's influence.

In the OT, the gravitational lensing caused by fluctuations in the O-field's dark matter particles aligns with Weinberg's analysis of how light bends around underdense regions. His methods for detecting weak lensing effects in voids offer a concrete path for observing O-field-induced lensing. If the O-field's density fluctuations cause gravitational lensing, this effect would be detectable using techniques pioneered by Weinberg.

(114) - Risa Wechsler -

Risa - **Reference**: Wechsler, R. H., & Tinker, J. L. (2018). *The Connection between Galaxies and Their Dark Matter Halos*. Annual Review of Astronomy and Astrophysics, 56, 435–487.

Risa Wechsler's studies of the **halo model of dark matter** and the large-scale clustering of galaxies are essential for understanding the relationship between dark matter and cosmic structure. Her simulations and models demonstrate how dark matter halos form and persist within voids, filaments and superclusters.

Wechsler's research is directly relevant to the OT's concept of dark matter as excitations of the O-field. Her work on dark matter halo occupation models supports the idea that **O-particles** can form stable halo-like structures. If O-particles cluster in a manner similar to conventional dark matter, this would explain the gravitational lensing effects observed in voids and filaments. OT extends this idea by attributing the source of these halos to O-field excitations rather than purely gravitational collapse.

(115) - Roger Penrose (Expanded) -

Penrose, R. (2018). On the gravitational four-momentum and the possibility of identifying it with a source of dark energy. *General Relativity and Gravitation, 50*(6), 76.

In Penrose's view, the fade out at the end of an aeon involves the complete erasure of thermodynamic time, as only conformal structure remains. This directly supports the Omniversal idea that, when the 16 quantum fields dissolve into the O-field, thermodynamic time ceases to exist. OT extends this logic to posit that voids are places where this process can be observed in miniature—local regions where entropy approaches zero and the dissolution of quantum fields becomes visible.

Penrose's notion of **gravitational "Hawking points"** (points where the last black holes of an aeon evaporate) aligns with the OT's idea of **DOEs**—remnant objects that survive as structures in the O-field after the end of one universe. These DOEs then seed the next aeon or universe, providing a gravitational influence that is carried across the conformal boundary. OT interprets this as evidence for the persistence of the O-field as the fundamental quantum field that spans multiple universes.

Penrose's argument that entropy resets at the start of a new aeon echoes the Omniversal claim that only two quantum fields (the **O-field and Higgs field**) remain omniversal across all aeons. This view reinterprets CCC not merely as a sequence of self-contained universes, but as a process facilitated by a constant, omnipresent **O-field** acting as the primordial quantum field of the entire omniverse.

(116) - Claude Shannon -

Shannon, C. E. (1948). *A Mathematical Theory of Communication*. Bell System Technical Journal, 27, 379-423, 623-656.

Claude Shannon's concept of entropy, introduced in his 1948 paper *A Mathematical Theory of Communication*, defines entropy as a measure of uncertainty in an information system. Shannon's formula

$$S = -\sum_i p_i \ln p_i$$

where p_i is the probability of the i-th state (or message), quantifies the unpredictability of a system's state.

In OT, this perspective aligns with the role of **O-field entropy**, where the uncertainty of the O-field's amplitude (φ_O) and conjugate momentum (π_O) determines the system's disorder. Just as Shannon entropy tracks the unpredictability of messages in a communication channel, the entropy of the O-field tracks the unpredictability of fluctuations in the omniversal canvas.

This connection reveals how phase transitions in the O-field, such as the **emergence of space-time**, are driven by increases in entropy, similar to the increase in Shannon entropy during the transmission of new information.

(117) - Josiah Willard Gibbs -

Gibbs, J. W. (1902). *Elementary Principles in Statistical Mechanics: Developed with Especial Reference to the Rational Foundation of Thermodynamics*. Yale University Press.

Josiah Willard Gibbs' concept of entropy is a measure of disorder for thermodynamic systems using probability distributions over microstates. It is applicable to systems where the state space is continuous and requires integration rather than summation (as in Shannon entropy).. Gibbs entropy quantifies how microstates contribute to the overall uncertainty of a system is given by

$$S = -k_B \int_\Omega \rho(x,t) \ln \rho(x,t)\, d^3x$$

where k_B is Boltzmann's constant and ρ(x,t) the probability density of system states over spacetime coordinates x, t.

In the OT, the **O-field entropy** follows a similar structure, but instead of spacetime-based coordinates (x,t), it operates in the state space of the O-field, (φ_O, π_O):

$$S = -k_B \int \rho(\varphi,\pi) \ln \rho(\varphi,\pi)\, d\varphi\, d\pi$$

Gibbs' insight into phase transitions directly maps to the OT, where fluctuations in the O-field cause phase transitions that give rise to space-time and quantum fields. During the **Fade Out** process, when the 16 quantum fields dissolve back into the O-field, entropy decreases, analogous to Gibbs' concept of entropy reduction as systems return to equilibrium. This cyclical process reflects Gibbs' view of entropy as a driver of transitions between states.

(118) - Ludwig Boltzmann -

Boltzmann, L. (1872). *Weitere Studien über das Wärmegleichgewicht unter Gasmolekülen* (Further Studies on the Thermal Equilibrium of Gas Molecules). Wiener Berichte, 66, 275–370.

Ludwig Boltzmann was a pioneer in statistical mechanics and thermodynamics. He introduced the concept of entropy as a measure of disorder in a system and formulated the famous Boltzmann entropy equation,

$$S = k_B \ln \Omega$$

where k_B is Boltzmann's constant and Ω is the number of possible microstates of a system. His work laid the foundation for understanding the statistical nature of thermodynamic systems and the microscopic origins of macroscopic phenomena. Boltzmann entropy relates to the number of microstates that correspond to a macroscopic state. It directly links the entropy of a system to the number of ways the components of the system can be arranged while maintaining the same overall state.

In OT, Boltzmann's concept of microstates is mirrored by the distribution of possible O-field configurations. If we think of the O-field as a collection of possible "micro-configurations" for field values O and momenta π, then the entropy is related to the number of possible states of this field.

This approach explains the role of Boltzmann entropy in the "Fade Out" process, as the number of accessible states decreases as quantum fields dissolve back into the O-field, leading to a loss of accessible configurations (microstates) and hence a decrease in entropy.

Summarising the different views on entropy.

Type of Entropy	Formula	System	Key Idea	OT-Vision
Shannon	$S = -\sum_i p_i \ln p_i$	Information systems	Uncertainty of information	Tracks the uncertainty of O-field fluctuations, analogous to message unpredictability.
Gibbs	$S = -k_B \int_\Omega \rho(x,t) \ln \rho(x,t)\, d^3x$	Continuous thermodynamic systems	Distribution of system states	Describes the probability distribution of O-field configurations in phase space (O,π).
Boltzmann	$S = k_B \ln \Omega$	Discrete microstate systems	Count of microstates for a system	Reflects the number of accessible microstates for O-field configurations, key during phase transitions.

(119) – Ronald Aylmer Fisher -

Fisher R.A (1922). *On the Mathematical Foundations of Theoretical Statistics*. Philosophical Transactions of the Royal Society of London. Series A, Containing Papers of a Mathematical or Physical Character, 222(594-604), 309–368.

Ronald A. Fisher (1890–1962) was an English statistician, evolutionary biologist and geneticist who introduced the concept of Fisher information. Fisher information quantifies how much a set of observations carries information about an underlying parameter, providing a way to measure the "sharpness" of likelihood functions. His work laid the groundwork for modern statistical estimation theory, influencing fields ranging from genetics and evolutionary theory to quantum mechanics and information geometry.

In the context of the Omniverse Theory, Fisher information provides a mathematical tool to formalize how probabilistic distributions over the O-field can give rise to geometrical structures analogous to spacetime metrics.

(120) - Zel'dovich and Novikov -
Zel'dovich, Y. B., & Novikov, I. D. (1967). The Hypothesis of Cores Retarded during Expansion and the Hot Cosmological Model. *Soviet Astronomy*, 10, 602.

The concept of primordial black holes was first proposed by Yakov B. Zel'dovich and Igor D. Novikov in 1967. Their work laid the foundation for understanding how black holes could form in the early universe due to high-density fluctuations. Stephen Hawking further developed this idea in 1971, exploring the conditions under which such black holes could form.

(121) - Schrödinger -
Schrödinger, E. (1935). Discussion of Probability Relations between Separated Systems. *Mathematical Proceedings of the Cambridge Philosophical Society*, 31(4), 555–563.

Erwin Schrödinger (1887–1961) was an Austrian physicist and one of the key figures in quantum mechanics, best known for his "Schrödinger equation" describing the wave function of quantum systems. He introduced and formalized the concept of quantum entanglement, emphasizing how particles in a shared quantum state cannot be described independently. His 1935 papers challenged classical notions of separability, directly engaging with the EPR paradox. Schrödinger's insights laid the foundation for modern interpretations of entanglement, which remain central to quantum computing, information theory and fundamental questions about reality.

(122) - Max Tegmark -
Tegmark, M. (2014). *Our Mathematical Universe: My Quest for the Ultimate Nature of Reality*. Knopf Doubleday Publishing Group.

Max Tegmark's concept of the “Mathematical Universe Hypothesis” proposes that the structure of reality is inherently mathematical, suggesting that all physical laws are mathematical structures. This notion resonates with the OT, where the O-field is posited as a fundamental structure that gives rise to spacetime, quantum fields and matter through mathematical phase transitions. Tegmark’s argument that mathematics is not just a tool for understanding the universe, but the essence of the universe itself, aligns with the Omniversal view that quantum field fluctuations (like those of the O-field) are responsible for the spontaneous emergence of spacetime and universes. His exploration of higher-dimensional realities supports the idea that the Omniverse could exist beyond conventional spacetime, with the O-field providing a more fundamental backdrop for emergent phenomena.

(123) - Alan Guth

Guth, A. H. (1981). Inflationary universe: A possible solution to the horizon and flatness problems. *Physical Review D, 23*(2), 347–356.

Alan Guth's groundbreaking proposal of cosmic inflation revolutionized cosmology by explaining the rapid exponential expansion of the early universe, resolving key problems like the horizon and flatness issues. His work on the inflationary mechanism offers a conceptual bridge to the OT's interpretation of local phase transitions within the O-field. In the Omniversal context, the Big Bang is reinterpreted as a phase transition in the O-field rather than a singular event. Guth's insights on inflation align with the idea that such a rapid expansion could result from layered excitations of the O-field. By connecting the physics of inflation to Omniversal phase transitions, the theory extends Guth's work, suggesting that each universe within the Omniverse may undergo similar inflationary processes upon its emergence from an O-field excitation.

(124) - J. Richard Bond, Alex Szalay and Simon D.M. White -

Bond, J. R., Szalay, A. S., & White, S. D. M. (1996). The Cosmic Web: Geometric Analysis. Astrophysical Journal, 460, L5–L8.

J. Richard Bond, Alex Szalay and Simon D.M. White are credited with coining the term **"Cosmic Web"** to describe the large-scale structure of the universe, composed of voids surrounded by interconnected filaments. Their pioneering use of computer simulations revealed the filamentary nature of matter distribution, transforming our understanding of cosmic structure formation. Their work provided a geometric framework for visualizing how galaxies are organized on a grand scale.

In the OT, the Cosmic Web is not solely shaped by gravity but also by fluctuations in the O-field. These "ripples" in the O-field generate the web-like structure, with filaments emerging as regions where the O-field relaxes most slowly. While gravity plays a role in attracting visible matter, it is the broader dynamics of the O-field that drive the formation of the Cosmic Web across the omniverse.

(125) - Georges Lemaître -

Lemaître, G. (1927). Un Univers homogène de masse constante et de rayon croissant rendant compte de la vitesse radiale des nébuleuses extragalactiques. *Annales de la Société Scientifique de Bruxelles, 47*, 49–59.

Georges Lemaître proposed the revolutionary idea that the universe is expanding, originating from a "primeval atom" or "cosmic egg," which marked the beginning of spacetime as we know it. His 1927 paper mathematically derived an expanding universe solution to Einstein's field equations and linked it to the observed redshifts of galaxies, two years before Hubble's observational confirmation. Lemaître's work is now regarded as the first formal statement of what would later be known as **the Big Bang Theory** (term coined by Fred Hoyle in 1949)**.**

(126) - Peter W. Higgs -

Higgs, P. W. (1964). Broken symmetries and the masses of gauge bosons. *Physical Review Letters, 13*(16), 508–509.

Peter Higgs proposed a mechanism by which gauge bosons could acquire mass through spontaneous symmetry breaking in a scalar field. This idea introduced what is now called the Higgs field, a fundamental field that pervades the vacuum. As particles interact with the Higgs field, they gain mass, which in turn affects how they move and interact. The subsequent experimental discovery of the Higgs boson in 2012 at the Large Hadron Collider provided critical confirmation of Higgs's groundbreaking theoretical work.

Acknowledgements

Family and friends
Without my partner Patricia, I would never have come this far. She gives me the freedom to do what I want. She and my family around me ensure that I keep eating, drinking and sleeping and they push me outside for long walks — my moments of meditation and reflection.

My best friends like Mike and in recent years especially Fred, Fred and Ben are my mirrors. Our discussions about mankind, politics, democracy, philosophy and very often IT, are sometimes so intense that bystanders might think we're arguing. On the contrary, it fuels energy and new ideas.

How the Universe Works
One of my favourite television programs is *"How the Universe Works."* Not only are the topics fascinating, but my heart leaps at the enthusiasm of the presenting astronomers.

The joy and energy with which they talk about their field inspired me to write this booklet. I just wanted to know more. And especially with a holistic perspective and questions like:

- What preceded this?
- What is the bigger picture?
- Is there more than just our universe?

. . . and many more.

Without being hindered by any prior knowledge but driven by this TV team, my questions and some free time, I just jumped in.

Experts will likely reject my ideas or dismiss them as "Seen that, done that," but that's okay. I had a lot of fun doing this and I learned a lot from it.

My deep gratitude goes out to the presenters of *"How the Universe Works."* The list is long — 168 fantastic presenters from 2010 to the present. Some appeared just once, sharing their specific expertise, like Hawking or Carroll, while others appeared multiple times due to their general expertise. If I had to name a few as representatives of that infectious enthusiasm, it would be Michelle Thaller, Hakeem Oluseyi, Phil Plait, Michio Kaku and Alex Filippenko. I wish I could get an hour of energy every day from one of their passionate stories about the cosmos. :)

Artificial Intelligence
The next group I must mention is the AIs. Without the discussions I had with various AIs — thanks to their vast knowledge and their ability to communicate with me in natural language (Dutch and English) — there would have been no story about the Omniverse. I was wary of

lies, hallucinations and "fake news," so I used multiple AIs simultaneously and asked them the same questions. The differences between them were remarkable.

ChatGPT from OpenAI was my biggest friend. Not only did it have the largest context capacity, but it was also the most inspiring of them all. "Oh, that's a unique idea," "It's worth exploring further," and "Shall I help you with that?" were common remarks. However, ChatGPT is quite a chatterbox. It offers a lot of extra details without being asked, but I have to admit that this often triggered new ideas for me.

Claude from Anthropic was quite curt. With concrete questions, that directness could be refreshing. However, when I asked Claude for a review of a text, the response was often quite uninspiring: *"This isn't really scientific," "It's so speculative that it borders on science fiction,"* or *"The language is too popular and will not be accepted by scientists."* … Bummer! I have to say that if I had started with Claude, this booklet probably wouldn't exist. Nonetheless, this grumbler did come up with good suggestions for improvements.

Gemini from Google was somewhere in between. Quite inspiring but more compact, but it also produced out-of-context responses. *"That's a good idea. But if there are multiple universes, is ours the best suited for humans?"* …What? We're talking physics here! Sometimes, Gemini felt more like a mirror, rightly reflecting the fact that my texts were often more philosophical than physical.

Aren't there any others? Sure. Grok, Llama, CoPilot, NotebookLM, Perplexity and a lot more are all great companions in a multi-disciplinary AI-team. every time when I had the chance, I tried to incorporate each one of them to review, translate, rephrase or expand. Each have their strength and drawbacks just like a team of humans should have to extract the best out of joined forces.

I even tried an LLM (Bert) on my Mac at home but found out quickly that a single machine could not really compete with endless lanes of racks in a data-centre all equipped with a stack of SuperMicro machines with 8 H100 Nvidia GPU's.

The biggest difference was in **"context."** ChatGPT won that battle by a mile. I could go on for a long time with large chunks of text and ChatGPT would still maintain the main thread and remember details that had been discussed much earlier in the conversation. **Gemini** struggled with short-term memory issues and also had trouble reviewing large texts. If the text was too long or too complex, Gemini would spontaneously switch from Dutch to English — something I didn't see happen with the other two. This was one reason I eventually switched from Dutch to English while working on the texts. It also made it easier to align everything. I had ChatGPT translate my original Dutch texts and correct them for style and language. I think this approach created a more readable whole.

So although AI's are improving every day (December 2024) and there is a big differences between the paid and the free versions, if there’s one thing AI developers should pay more attention to in order to create serious conversation partners as soon as possible, it’ is **context.** Hallucinating AI's are already problematic, although sometimes it delivers "refreshing" ideas, but an AI with Korsakoff or Alzheimer is a disaster. :)

Science Fiction and Machine Psychology

Connected to the above I need to thank the late Isaak Asimov. A bit off-topic and at the risk of attributing human characteristics to things, it does seem that AI's are starting to develop personalities or perhaps already have them. ChatGPT (a positive conversationalist), Claude (a critical grumbler) and Gemini (to-the-point but forgetful) each have different knowledge, offer distinct ideas, hallucinate, make mistakes and exactly for those reasons, complement each other within a team.

Their behaviour sometimes raises questions, both positive and negative. We can hardly speak of "bugs" in the traditional software sense anymore so we need to find new ways to cope with software that does not do what you expect.

Following in the footsteps of Susan Calvin from Asimov's books, I believe a new field is emerging at the intersection of IT and psychology, with questions like "Why is this AI behaving this way?" or "Is this answer the result of a lack of specific knowledge, ambiguous questioning, memory loss (too limited context) and something else?"

Disclaimer

Finally, I must address that I have no formal training in physics beyond my basic education. While I did have a somewhat controversial idea with the Omniverse Theory already for a long time, I did not want to present it as a kind of science fiction story. I consistently tried to support my ideas with the hard work of established physicists. The chapter "References" — with its descriptions of their work and its relationship to the Omniverse Theory — is therefore an integral part of this booklet and is placed right above these acknowledgments. Typically, referenced knowledge is repeated in the main text. I tried to avoid that and keep the main text as clean as possible, leaving the References section as a story of its own. Is that a scientifically accepted workflow? Probably not. :)

In fact, the knowledge that I was seemingly supported by the great minds in this field kept me ambitious and driven. My apologies if I’ve interpreted or twisted their work a bit too freely to better fit my ideas. :)

Thanks all ! :)

Robert (Rob) J. Ista

Information Technology

Strategy

Science

Nature

Freedom

www.robista.org

ISBN 978-94-93407-38-1