A Theory on the True Nature of Nothing

With an Emphasis on the Unification of General Relativity and Quantum Physics

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Preprint: May 7, 2025

Abstract

This article defines 'Nothing' as the complete absence of matter and energy and then provides a theory on the "True Nature of Nothing." This theory hypothesizes that 'Nothing' does exist but has remained in 'Singularity' and that behind the observable universe of space and time, behind quantum fields and the quantum vacuum, there resides a 'Singularity' where space and time does not exist.

The ramifications of this are then explored to show that, while this postulated dual nature of reality may seem bizarre at first, it does seem to provide an explanation for how entangled quantum particles can seemingly exchange information faster than the speed of light, it provides an explanation as to why quantum particles exhibit a wave function, and it provides a reason for the existence of gravity.

Any theory about the "True Nature of Nothing" should first begin with a definition of what is meant by the concept of 'Nothing.' This is being defined simply as the complete absence of matter and energy.

This article will next describe the thought processes from which this theory was derived. It began with the continued marveling at the weird world of Quantum Mechanics; such as how single photons seem to go through both slits in the double-slit experiment demonstrating the wave-like nature of quantum particles, but when observed, they collapse from a probabilistic wave-function into definite particles at definite locations. However, the obsession with problem solving was centered on one obvious anomaly that appeared to defy Albert Einstein's "Theory of Special Relativity" with respect to the speed of light. This anomaly is "quantum entanglement" (and "quantum tunneling" seems to also exhibit the same faster-than-light phenomenon). If the speed of light is the speed limit of the universe for a very good reason, which is that you can slow time down to a standstill, but faster than light travel would imply time going backward, then this is an anomaly that clearly necessitates some greater understanding. In about 1935, Einstein famously referred to this property of quantum mechanics, where one entangled particle can seemingly affect another entangled particle instantly regardless of how far apart they are

as: "Spooky Action at a Distance" and seeing it as an affront to his own theories, he tried to explain it away, such as being an illusion of predetermined "hidden variables." Einstein similarly rejected the "Copenhagen interpretation" of the wave/particle duality in Quantum Physics (which explains that there is only a probability wave until the particle is observed) with the famous quote that: "God does not play dice." Although Einstein may still be vindicated with this second quote, his explanations for "Spooky Action at a Distance" seem to be false, and quantum entanglement seems to be a genuine anomaly to his "Theory of Special Relativity" as John Stewart Bell's 1964 theorem (and subsequent experiments at the University of California, Berkeley) seemingly proved.[1]

This single anomaly can be used for a constructivist approach to come up with the simplest explanation and then to see if it better explains experimental reality or if it creates more conflicts than it solves. Since the speed of light seems to be the speed limit in our observed world of spacetime around us, it would seem as if entangled particles can somehow interact in some sort of 'behind-the-veil' world (metaphorically speaking) where the laws of physics are different. But what could be 'behind the veil' of reality as we observe it? After some serious pondering, the answer seems to be 'Nothing!'

Well, this further leads to the question of: How can the laws of physics be different for 'Nothing' than in our own observable world of space and time? After some more serious pondering, the answer seems to be that: 'Nothing' has remained in 'Singularity.' This would mean that the 'Big Bang' that created our world of spacetime only acted on energy and matter and did not affect 'Nothing.' This seems plausible, because what could be more inert than 'Nothing!' If true, this would give a profound dualistic nature to our universe. While 'Nothing' seemingly resides inside us, outside us, and distributed across approximately 13.7 billion light years of our observable universe; to 'Nothing,' it is all together in both space and time. While photons from the cosmic microwave background (CMB) seem to us to have been traveling for approximately 13.7 billion years, to the photon traveling at the speed of light (where time has stopped), it resides just on our side of the 'veil,' whereas 'Nothing' in perfect 'Singularity,' is just on the other side.

At first, this dual nature of reality may seem difficult to accept, but compared to the 'multiverse' implied by string theory, the simple notion that 'Singularity' is the ubiquitous basic fabric of reality seems more plausible. This would mean that we live inside a bubble of space and time that is created by the existence of separated energy and matter with gravity not as a force (there are no 'gravitons' in the Standard Model) but rather as a balance that can equate all the energy and matter in our universe back into 'Singularity.' With 'Singularity' on both sides of our universe of time and space, this also leads to the bazaar awakening that somehow 'Everything' and 'Nothing' seem to equate.

The remainder of this article aims at showing that this solution seemingly provides many explanations without raising additional conflicts with what has already been accepted by the majority of the scientific community. The "True Nature of Nothing" as remaining in 'Singularity' seems closer to "Occam's Razor" than any other explanation that has the potential to

[1] Quanta Magazine – How Bell's Theorem Proved 'Spooky Action at a Distance' Is Real. https://www.quantamagazine.org/how-bells-theorem-proved-spooky-action-at-a-distance-is-real-20210720/

resolve the seeming conflicts between General Relativity and Quantum Physics. This explanation does not seemingly replace anything that has already been shown by experimental physics to be true or theories that provide excellent predictive capabilities. Most notably, it embraces the Standard Model of Particle Physics, and it accepts Quantum Field Theory as true with the minor alteration that the Quantum Fields are the 'veil' or the division between our world of spacetime and 'Nothing' in a state of 'Singularity.'

Some physicists may doubt that 'Nothing' (as defined in this paper) exists at all, because it has been shown that the quantum vacuum is filled with energy. This vacuum energy is believed to be a candidate for 'dark energy' and the source of Einstein's 'cosmological constant' (Lambda) that has been put back into his equation(s) to explain the acceleration of our expanding universe. However, energy would be exactly what we should expect to find if we look for 'Nothing' in an area defined by space and time. This paper postulates that true and pure 'Nothing' can only be found in 'Singularity' and not in the portions of our universe that can be defined by coordinates of space and time. Rather than eliminating the 'cosmological constant,' this theory may eventually help to provide clues as how to remedy the 'cosmological constant problem.'

While quantum particles are the building blocks of all matter and energy (with bosons delivering the nuclear strong, nuclear week, and electro-magnetic forces, along with the Higgs boson delivering mass to the other particles), the wave/particle duality seems to simply be the physics of basic particles which are so small that they are approaching 'Nothing,' which is in a state of 'Singularity.' Just as the physics get weird in a black hole that is approaching 'Singularity' with gravity; the quantum weirdness can be explained by quantum particles approaching 'Singularity' without gravity.

First, let's see how this solution provides an explanation of the wave/particle duality in Quantum Mechanics that we know to be true, but, as of yet, cannot explain as to why this is true. As quantum particles get smaller and possess less mass and/or energy, they are approaching 'Nothing,' which is in 'Singularity.' So naturally, these quantum particles begin to exhibit timeless and space-less qualities. To us (firmly in a world of time and space), this appears as if the same particle can be in more than one place at the same time and thus can create an interference pattern with itself (as in the 'double-slit' experiment). This appears to us as a probability-wave function. We do not know where the particle is or when it will be at any specific location, but we can calculate the probabilities of such. With space and time approaching 'Singularity,' the photon (or any other quantum particle) can actually travel through both slits at the same time and provide an interference pattern with itself. When we observe it, we forced it into our world where space and time are more clearly defined, and it appears to us to be a single particle in a specific place at a specific time. If the probability-wave function can be explained in a law-like manner, it would seem that Einstein would approve. God is not "playing dice;" instead, the timeless, spaceless, creative force behind our universe is pantheistically 'behind the veil.'

Quantum particles tend to travel at or near the speed of light. Time slows with increasing speed, and time stops when traveling at the speed of light. The speed of light ('C') is the Constant that it is (299,792,458 meters per second in a vacuum) precisely because this is the

speed where time stands still, and going faster would imply going back in time, which for obvious disruptive reasons seems impossible. Then how could entangled quantum particles seemingly have an information connection at faster-than-light speed? The posited answer is that their connection is through the ubiquitous "Singularity" (behind the veil) where space and time does not exist.

A connection between entangled quantum particles through the 'Singularity' of 'Nothing' takes away the "Spooky action at a distance" that Einstein described, because his speed limit of the universe is never violated. That speed limit only exists for matter and energy traveling through spacetime, but for quantum particles that are approaching 'Nothing,' they are at the edge of a timeless and spaceless world where all space and time is connected through the 'Singularity' of 'Nothing.'

(This separately leads to the question of: Could the fundamental fabric of space-time be different than we experience it, which in turn would lead to a different Constant ('C') for the speed of light? For example, could 'C' have been scripted by the speed of the expanding universe in the aftermath of the 'big bang,' such that it becomes impossible to catch up to the edge of the expanding universe, which would imply that 'C' is at a faster speed nearer to the edge of our expanding universe than it is here? If so, then Einstein's 'Theory of Relativity' could also be 'Relative' in that 'C' may only be a constant in a particle's own region of spacetime, and the speed limit of all information traveling through spacetime may have been set by the speed that spacetime was created.)

It is notable that all quantum particles below the atomic level exhibit a wave-particle duality, yet larger masses do not. Recently, Joris Verstraten and a research team published "In-situ Imaging of a Single-Atom Wave Packet in Continuous Space."[2] Here, a composite particle such as a single atom can exhibit wave-particle duality but not in the way that an electron or other smaller quantum particles seem to do. It also may require the removal of energy by being cooled to near absolute zero to see the wavelike behavior of something as large as an atom.[3]

"A massive particle is associated with a wave-function whose dynamics is governed by the Schrödinger equation."[4] Even molecules have been shown to exhibit wave packets.[5] Yet the relationship seems to be that wavelike behavior increases both with the reduction of size and the removal of energy. At very low temperatures, "... quite a few interesting quantum effects emerge when particles are slowed down."[6] These relationships seem to depict that wavelike behavior is increasing as energy and matter are decreasing and particle(s) are approaching 'Nothing' (the absence of matter and energy), where this paper is positing that a state of spaceless and timeless 'Singularity' exists.

[2] Arxiv.org — "In-situ Imaging of a Single-Atom Wave Packet in Continuous Space" https://arxiv.org/abs/2404.05699

[3] Ibid

[4] Ibid

[5] "Colloquium: Quantum interference of clusters and molecules" by Hornberger et al. Reviews of Modern Physics. Feb 2012. https://journals.aps.org/rmp/abstract/10.1103/RevModPhys.84.157

[6] "Is it possible to reach absolute zero?" by Victoria Atkinson. Live Science; January 13, 2024. https://www.livescience.com/physics-mathematics/is-it-possible-to-reach-absolute-zero

If you tried to perceive reality from the perspective of a photon, you could be in more than one place at the same time as if space is beginning to not exist and while likely imperceptible to you (due to the relative nature of time), time would slow to a near standstill while approaching the speed of light as if time did not exist. If you could completely rid yourself of all mass and energy, then time and space would completely cease to exist, and you would join the 'Singularity' (in the metaphorical 'behind-the-veil' world).

In the absence of mass and energy, there is no gravity. Yet, gravity increases exponentially with the addition of mass or energy. Mass and energy can also be converted into each other with Einstein's now famous exchange ratio of $E = MC^2$. While it is commonly thought that the immense gravitational force of a 'black hole' creates a 'Singularity,' it would seem that it could only be approaching a state of 'Singularity' without ever reaching it. Einstein's "Theory of General Relativity" has gravity as being caused by objects falling toward each other due to the curvature of spacetime. So, it would seem that if a 'Singularity' could ever actually be reached by curving and compressing all the spacetime out of a world with mass and energy, then the monstrous gravitational force that caused this curvature would suddenly cease to exist at the instant that 'Singularity' is reached (like in a 'Big Bang')!

So, a theory of 'Nothing' remaining in 'Singularity' provides an explanation for why the gravitational force cannot be quantized. There is no 'quantum field' for gravity. The field for gravity seems to be spacetime itself (rather than at the boundary between spacetime and the 'Singularity' of 'Nothing' where other quantum fields reside), and gravity is not a force like the other three (electromagnetic, nuclear strong, and nuclear weak) where quantum bosons deliver the force. Rather, gravity is what equates 'Everything' and 'Nothing.' Gravity is what allows spacetime (and all the matter and energy that exists in it) to emerge outside of 'Singularity,' which is the ubiquitous basic fabric of reality.

The creative force of 'Singularity' remaining with us after the 'Big Bang,' where virtual particle and anti-particle pairs can seemingly pop in and out of existence, may provide for a potential explanation of 'dark energy' that seems to be accelerating the expansion of our universe.[7] The creative force of 'Singularity' may also provide randomness to the otherwise ordered law-like realm of spacetime to create a universe that is not entirely law-like and mechanistic but instead a universe that is a complex system that is capable of 'emergence,' which in turn allows for life, evolution, and our own intelligence.

It would be quite easy to observationally and experimentally miss the existence of 'Singularity,' which pantheistically surrounds us, because it is separated from the world of space and time in which all energy and matter resides. The only clues to its existence seem to be in the previously unexplained behavior of quantum particles that we know are governed by quantum mechanics. Therefore, it seems that the likely place to start for designing experimentation that could potentially disprove this hypothesis would be in discovering quantum behavior that does not exhibit increasing spaceless and timeless qualities as 'Nothing' is approached.[8][9]

[7] Also see the "Schwinger Effect" postulated by Julian Schwinger in 1951.

[8] I would like to acknowledge those who provided me with both inspiration and knowledge through YouTube.com and/or other videos. This includes Hannah Fry whose challenge I originally answered for myself in 2019. This also includes Sabine Hossenfelder, Matt O'Dowd, David Tong, Jim Al-Khalili, and many others.