

‘A few Insights regarding Time and Dark Energy as it relates to Quantum Gravity.’

Robert Craig Murphy
ORCID# 0000-0002-9057-51440
rcmurphy@safe-mail.net
Newark, Ohio USA

Time, one of the most misunderstood concepts in science. Is it really limited to only being a cyclically measured duration between events, or merely being the parameter of change? Perhaps it has attributes and serves functions that we have not previously considered. Even if Time is just the parameter of change, Energy cannot exist without this continuous change. If $t = 0$, then $E = 0$; in fact Absolute Zero. It is hereby postulated and argued that Time itself is a fundamental form of dimensional energy and therefore it carries its own force; commonly known as Dark Energy. If true, this somewhat radical hypothesis in regards to Time then also elegantly explains Quantum Gravity and Dark Matter, as well as providing further insight into the inner functionality of Black Holes.

1. Introduction

Decades of ongoing research and analysis on the current state of Cosmology has led to some rather stunning insights that the scientific community might find useful. It is initially asserted that Time is Real and just as importantly the Flow of Time is also Real.

2. Time and Dark Energy

Time, as measured by atomic clocks and GPS satellites¹, flows at different rates due to the phenomena known as Gravitational Time Dilation². Using an extension of the Correspondence Principle³, it is argued that anything that flows at different rates, including Time, must also carry a corresponding differential outward pressure. Think water flowing through a pipe, any river, or even the wind. There is one thing in the universe that has such an outward pressure, that is observed to do so at different rates, and is also as pervasive, isotropic, and homogeneous in the universe as Time. This of course is known as Dark Energy^{4,5}. It is hereby claimed that Dark Energy is the Corresponding Force of the Flow of Time; just as Einstein⁶ showed that Matter and Energy are on the opposite sides of the same coin, so too are the Flow of Time and the outward Force of Dark Energy. An aging universe should and does lead to an expanding universe; put simply, more Time leads to more Space.

3. Quantum Gravity

Since that outward pressure is differential, it can and should be measured to verify if it is in direct correlation to the well-known gradient of gravitational time dilation². Think of a submarine that goes too deep. It will implode due to the differential outward barometric pressure of the atmosphere inside the submarine being overwhelmed by the differential hydrostatic outward pressure of the water in the ocean⁷. So too a planet or a star is immersed in a sea of space-time where Time is measured to flow faster in the vacuum of space than it does on the surface of a planet or at the outer edge of a star¹, therefore the outward pressure of Dark Energy is greater in the vacuum than it is on the surface of the planet. Claim two is that the differential outward pressure of Dark Energy follows the gravitational time dilation gradient² and is in fact the true source of what we currently describe as the inward pull of gravity. This view provides insight into why gravity is measured to be so much weaker than the other three fundamental forces. This prediction is measurable and testable.

So how can this be? Time is a dimension and by definition it isotropic-ally and homogeneously intersects with every point in space at the Planck^{8,9} scale and it is asserted that it does so with non-local, non-relativistic, simultaneity. Anywhere those points are occupied by any density of baryonic matter with its intrinsic angular momentum; the outward flowing vectors of Time / Dark Energy are filtered and slightly curved / slowed down. This is as opposed to the vacuum of space, which, for the sake of this argument, is relatively empty and unfiltered; so Time flows from the Planck^{8,9} scale faster in the vacuum with more outward pressure. The most extreme example of this is a rotating Black Hole¹⁰. The singularity inside the

inner event horizon becomes so curved and dense as its angular momentum approaches the speed of light, the ‘filter’ becomes clogged and the Flow of Time stops as does the outward pressure of Dark Energy. Since the Black Hole¹⁰ is also immersed in a sea of space-time, the differential outward pressure of Dark Energy in the rest of the universe becomes so extreme that it pushes the fabric of space inwardly at a rate of flow that is equal to the speed of light at the outer event horizon. The assertion that the dimensionality of the Flow of Time at quantum scales has the attribute of non-local, non-relativistic, faster than the speed of light simultaneity of information, is evidenced by quantum entanglement and superposition¹¹. It is further asserted that all of those additional non-intuitive and illogical quantum phenomena that have been repeatedly observed (e.g. Quantum Tunneling) are an aspect of the dimensionality of Time, not an embedded parameter of the sub-atomic particles themselves. These arguments should yield further insights into the true nature of quantum gravity.

4. Dark Matter

Another consequence of this view is that due to the angular momentum inherent in baryonic matter along with the fact that the volume of every atom and sub-atomic particle is measured to contain 99.9% empty space¹², leads to the realization that from just after the Big Bang when the energy density of the volume of the universe was nearly at saturation; a significant portion of the volume of currently empty space was once contained inside the volume of atoms of every planet, star, and cloud of gas. Through a process called Quantum Frame Dragging; these volumes of space now have extra curvature due to the angular momentum and density of all of those atomic and subatomic particles, and now they are observed as a halo of extra curved space around every galaxy and galaxy cluster. Dark Matter is just extra curved, ‘empty’ space that was once inside the volume of an atom, planet, star, or cloud of gas, but has since been displaced by Dark Energy and the expanding universe. This claim is testable and verifiable.

5. Absolute Zero

Have you ever wondered why we have never been able to experimentally achieve and maintain any object or localized region of space in a state / temperature of Absolute Zero¹³? It is hereby claimed that the Flow of Time along with Dark Energy, because it is pervasive, isotropic, and homogeneous; intrudes upon the localized region of the Absolute Zero¹³ experiment at Planck^{8,9} scales in the form of heat. Any flow, whether it stems from Time or Dark Energy or anything else is motion; and motion is heat. This Latent Heat of the Flow of Time / Dark Energy is what we have really been measuring with every Absolute Zero experiment we have ever run. This claim is testable and verifiable because the relative height of the testing apparatus in a Gravity-well should also follow the Gravitational Time Dilation Gradient². The deeper into the Gravity-well you go, the slower the Flow of Time is and the colder / closer you should get to Absolute Zero¹³; assuming all of the testing apparatus / experiments is equivalent.

6. Linear Cyclical Multiverse

At the end of the Universe at the Big Freeze / Heat Death¹⁴ when a non-localized state of Absolute Zero¹³ is achieved; an instantaneous, isotropic, and homogeneous phase transitional Quantum Fluctuation¹⁵ will occur leading to a Temporal Dimensional Collapse. Space-time dissolves to a singularity leading to a Temporal Domain Wall; which results in a cyclical reset to Big Bang 2.0. This claim implies what might have caused Big Bang 1.0, doesn't it?

7. Unifying Super-Force

Time is not only Real, it is Fundamental. When the Flow of Time is combined with Dark Energy it becomes the single Unifying Super-Force that the science community seeks. All four of the Fundamental Forces, not just Gravity (which is now viewed as a mathematically derived force as argued previously), but also the Weak and Strong Nuclear forces along with Electro-Magnetism are all derived from and can be unified by combining the Flow of Time with Dark Energy into a single Fundamental Super-Force. Just look at the Base Quantities with their respective Base Units of measurement that relates to each Force and you will see that they all have either a temporal or spatial component; or both. Temperature is a measure of Entropy (Arrow of Time), Length is a measure of Space (space-time), Mass is a measure of Gravity (Time

Dilation), and Electric Current is a measure of energy's flow across a length of Space with the Ampere already defined as a (Coulomb / second); even Voltage is differential (Electro-Magnetic) outward pressure. This view should open a path to mathematical unification.

8. Temporal Domains

To clarify the arguments presented above lets adopt the philosophical view that the Heisenberg¹¹ uncertainty and the wave-function of random probabilities inherent in Quantum Mechanics is nothing but a mathematical description of what we commonly refer to as Future. It is asserted that Time exists in at least 2 (if not 3) separate and distinct Temporal Domains; The Temporal Domain State of Quantum Future has it's Domain Wall defined by a wave-function collapse at the moment of observation into a Relative Present point particle. The Relative Past is then reduced to being nothing more than information encoded and carried in the light across the cosmos. The farther outward we look, the farther into the distant Relative Past we see. Conversely, the farther inward we look towards the Planck Scale⁸, the farther into the Quantum Future we see.

This is as opposed to descriptions of Relativity¹⁶ where every clock (and observer) is unique in both spatial coordinates as well as temporal rates of flow dependent on a localized proximity to a gravity-well. Mathematically and philosophically speaking, Relativity¹⁶ is nothing but a complicated description of a unique clock / observer each locked in its own Relative Present. When you mathematically wind the clock backwards you find the Relative Past history of the clock (a Relative Present that has already occurred) and when you mathematically wind the clock forward you get a Relative Future prediction (a Relative Present that has yet to occur); these mathematically / experimentally accurate predictions are merely approximations of causality that are distinctly different from the random probabilities of Quantum wave-functions (i.e. Quantum Future). Einstein¹⁶ took the view that only the present moment is real and everyone's present moment is unique to each observer. Future and Past are just mathematical illusion¹⁷. It is asserted that his view of the Block Universe Model of Time¹⁵ is only valid as it applies to Relativity.

The argument that supports this view is that in order to mathematically construct the Block¹⁶, the Dimension of Time is incorrectly assumed to be equivalent to any of the other 3 Dimensions of Space. Therefore Time can be substituted for one of the dimensions of space, which subsequently allows that spatial dimension to be suppressed and ignored. Time and Space are not equivalent for a multitude of arguments and reasons. The most compelling is a quote by Dr. Merrick Furst¹⁸: "The biggest difference between time and space is that you can't reuse time." Simply mathematically ignoring an entire dimension of space can't be a valid way to model the universe. It's no wonder why this mathematical construct is simply not observed anywhere in Nature. Just because the language of mathematics says an idea or prediction is within the realm of possibility or even probability does not in any way obligate Nature to actually make use of it by providing an example of it somewhere in the Universe. BTW, it is possible make the same argument against the existence of most versions of the multiverse; with the Linear Cyclical Multiverse version described above being the one exception. In regards to the multiverse, it is also argued that Physics seeks that which is fundamental and foundational. Adding the complexity of invoking a limitless number of entire universes is definitely in direct opposition to Occam's razor¹⁹. The preferred definition takes the opposite view that 'Time is motion without distance.' In other words, in regards to Quantum Scales, Time is a dimension without a corresponding geometry. Time mathematically described in the geometry of Relativity is only valid in Relativity¹⁶; it is an accurate, yet incomplete description.

It is asserted and claimed that Quantum Future is in a distinctly different Temporal Domain separated by the Domain Wall of wave-function collapse. In other words, Quantum Mechanics and Relativity are not only separated by a Domain of Spatial Scale, but also by a distinct Domain of Time as well. Quantum Future (a wave-function) collapses to a Relative Present (point particle) at the moment of observation. It is a unique reinterpretation of the double-slit experiment²⁰ with a second sensor in front of the barrier. Leave that sensor off and the sensor behind the barrier records the particles in their initial Quantum Future Temporal Domain State; a wave function. Turn that sensor on and the particles transform into the Temporal Domain State of the Relative Present/Past; a point particle. This view provides a simple, clear, and logical framework for explaining the measurement problem and particle-wave duality without the need for any extra unobserved universes to be invoked. Occam's razor¹⁹ lends credence to this argument. Exactly why

the act of measurement invokes the Temporal Domain Wall at the moment of observation and causes wave function collapse remains a mystery. It seems however that this is just how the universe works. Hopefully these ideas will give the scientific community some fresh insights.

All claims and arguments above is either based on well-known and well tested / verified science or is experimentally testable / verifiable. Hopefully, you are all intrigued by this radical Model of Time that has been presented. One additional intriguing thought that needs to be shared with the scientific community is below.

9. Decimal vs. Qubit

Here is a rather intriguing question. Has anyone ever considered that the reason that all roads in cosmology inevitably lead to division by zero and singularity, is because we use the decimal numbering system to calculate and quantify the universe? Most of us have 10 fingers and 10 toes so it's convenient for us and our hubris. But does the universe really care how many fingers we have? Does it care about our convenience, much less our hubris? Perhaps the universe calculates itself using a fundamentally different numbering system altogether. It's probably quantum based like a qubit (or base 3). The electron is spinning up or down or both simultaneously or something to that effect. Perhaps everything can be reduced to being either a vector (like time) or a scalar (like baryons) or both / neither (thought / consciousness or emotions perhaps)? Perhaps the universe can be quantified by taking the view that all that exists are multiple 'spinning' layers of vectors inside of scalars and scalars inside of more vectors. Maybe when quantum computers become advanced enough we'll get the answers we seek while avoiding all of those pesky singularities?

10. Conclusion

The Model of Time presented above continues to be an ongoing work in progress and as such it may be a little naïve. As the research continues, new information comes to light that often leads to new insights that had not previously been considered. Suffice it to say that like all other scientific theories these ideas are subject to evolve and this radical Model of Time has yet to be completed. So this open letter to the scientific community ends here with that caveat and disclaimer.

I have many more profound questions to ask and radical ideas to share. Please feel free to email me if you are interested or have any questions about any of the ideas presented. Thank you for taking the time to read and consider them. I look forward to hearing from you. RCM.

11. References

1. N. Ashby, *Living Reviews in Relativity* 6, 16 (2003).
2. C. W. Chou, D. B. Hume, T. Rosenband, D. J. Wineland, *Science* 329 (5999), 1630 (2010).
3. Bohr, N. Über die Serienspektren der Elemente. *Z. Physik* 2, 423–469 (1920).
<https://doi.org/10.1007/BF01329978>.
4. A. G. Riess, A. V. Filippenko, P. Challis, A. Clocchiatti, A. Diercks, P. M. Garnavich, R. L. Gilliland, C. J. Hogan, S. Jha, R. P. Kirshner et al., *Astron. J.* 116 (3), 1009 (1998).
5. S. Perlmutter, G. Aldering, G. Goldhaber, R. A. Knop, P. Nugent, P. G. Castro, S. Deustua, S. Fabbro, A. Goobar, D. E. Groom, et al. (The Supernova Cosmology Project), *Astrophys. J.* 517 (2), 565 (1999).
6. A. Einstein, *Ann. Phys. (ser. 4)* 323 (13), 639-641 (1905) (German);
<https://doi.org/10.1002/andp.19053231314>; A. Einstein, *The Collected Papers of Albert Einstein, Volume 2: The Swiss Years: Writings, 1900–1909* (English translation supplement) translated by A. Beck, consultant editor P. Havas (Princeton University Press, New Jersey 1989), Vol. 2, Doc. 47 (1989); Vol. 2, Doc. 24 (1989) (English).

7. "Declassified documents shed new light on notorious sinking of USS Thresher". 23 March 2021, by Stephen J. Thorne. <https://legionmagazine.com/en/2021/03/declassified-documents-shed-new-light-on-notorious-sinking-of-uss-thresher/>.
8. M. Planck, *Sitzungsberichte der Königlich Preußischen Akademie der Wissenschaften (Berlin)*, 5, 440-480 (1899) (German).
9. B. N. Taylor and P. J. Mohr, CODATA Internationally recommended 2014 values of the Fundamental Physical Constants from NIST, edited by M. Douma. (The NIST Reference on Constants, Units, and Uncertainty. US National Institute of Standards and Technology, 2014). Retrieved November. 2015.
10. R. Penrose, *Gen. Relativ. and Gravit.* 34 (7), 1141 (2002).
11. W. Heisenberg, *Z. Phys.* 43, (3-4): 172 (1927).
12. E. Rutherford, *Philos. Mag. Series 6* (21), 669 (1911).
13. C. W. Misner, *Phys. Rev.* 186, 1328 (1969).
14. F. C. Adams and G. Laughlin, *Rev. Mod. Phys.* 69, 337 (1997).
15. J. B. Hartle and S. W. Hawking, *Phys. Rev. D* 28, 2960 (1983).
16. A. Einstein, *Königlich Preußischen Akademie der Wissenschaften (Berlin), Sitzungsberichte*, (part 2), 844-847 (1915) (German); A. Einstein, *The Collected Papers of Albert Einstein, Volume 6: The Berlin Years: Writings, 1914–1917 (English translation supplement)* translated by A. Engel, consultant editor E. Schucking (Princeton University Press, New Jersey 1997), Vol. 6, Doc. 25 (English).
17. Partial paraphrase, the full quote is: "The distinction between the past, present and future is only a stubbornly persistent illusion." - Albert Einstein; Quoted in T. Yeatts, *Albert Einstein: The Miracle Mind (Sterling Biographies, 2007)*, p. 116.
18. Quote widely attributed to Merrick Furst: "The biggest difference between time and space is that you can't reuse time." - Merrick L. Furst PhD., Distinguished Professor, College of Computing, Georgia Institute of Technology (Georgia Tech); Quoted in *Conquering Complexity*, edited by M. Hinchey and L. Coyle, (Springer London, 2012) p. 247.
19. Jonathan Schaffer (2015) What Not to Multiply Without Necessity, *Australasian Journal of Philosophy*, 93:4, 644-664, DOI: 10.1080/00048402.2014.992447.
20. P. G. Merli, G. F. Missiroli, and G. Pozzi, *Am. J. Phys.* 44, 306 (1976).