

Reality in the context of physics (RICP): An explanatory framework: Bridging the pitfalls of category error, dispelling paradox and excluding magic from physics

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Abstract

This work provides solutions to a number of long standing problems in physics, by identifying category error as an issue and providing an explanatory framework. Category error is indicated within Einstein's work on relativity. Having addressed that, the associated paradoxes are dispelled. Other quandaries are considered, with the potential for category error and the explanatory framework in mind: Such as; the nature of time, the arrow(s) of time, causality, what is the future? Having proposed the need for an ontic, absolute, foundational reality there is relevant discussion of counterfactual definiteness and the law of non-contradiction. Discussion of true absolute relations in contrast to relations within 'space-time' images follows. A short note of caution on the risk of allowing magic into physics precedes a list giving the facts and problems in physics, demonstrating the need for an explanatory framework. The penultimate section, (before References), is the word definitions and key to abbreviations to be used in conjunction with the accompanying 5 diagrams that illustrate the explanatory framework. The framework impacts on many areas of physics. In particular relativity and QM; providing the ontic foundation necessary for both, allowing them to co-exist without contradiction. It also overlaps with other science areas in particular the biology and neuroscience of sensory perception.

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Key

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I: This explanatory framework (Points in its favour)

J: References

A: About category error

1: Introduction to category error

Category mistake: Wikipedia July 18 2015 "A category mistake, or category error, is a semantic or ontological error in which things belonging to a particular category are presented as if they belong to a different category, [1] or, alternatively, a property is ascribed to a thing that could not possibly have that property. An example is the metaphor "time crawled", which if taken literally is not just false but a category mistake. To show that a category mistake has been committed one must typically show that once the phenomenon in question is properly understood, it becomes clear that the claim being made about it could not possibly be true" ¹.

Einstein is often quoted as having said "Reality is merely an illusion." So it is, if one considers the appearance of reality to be the totality of what is real. Though is reality just the appearance of things? He is actually known to have written, in a letter to the family of a recently deceased friend, "To us believing physicists the distinction between past, present and future has only the significance of a stubborn illusion." (cited in E= Einstein 2006 p34) ². Einstein also said "The justification of the constructs, which represent "reality" for us, lies alone in their quality of making intelligible what is sensorily given." Albert Einstein "reply to Criticisms" in Albert Einstein: Philosopher-Scientist, Vol. II, 1959 ³. Einstein's utterances should be borne in mind while reading the following discussions on category error and magic. If a description requires acceptance of paradox, unreality of all things, quasi reality or supernatural agents or realms, yet is a description that fits with observation, it must be incomplete if not incorrect or non-science.

One can, (given there is no conflict with, or prohibition by physical events), write a sentence that has correct spelling and grammar, is complete and is untrue. The correctness and completeness of the statement does not make it conform to the external reality outside of the correctly formulated statement. Likewise, mathematical completeness and mathematical correctness should not be mistaken for complete veracity of the *idea* the mathematics is taken to represent. Mathematical completeness and correspondence with experiment does not necessarily mean *the context, i.e. meaning attached to it* properly describes reality.

Someone is blindfolded and asked to say what is in front of them. They are given some clues that relate to a dog of a certain breed. That person reaches the conclusion that there is a living dog in front of him. Then the description is tested against the picture of the same breed of dog that is actually there. The description fits because it fits both a living animal dog and a good illustration of the same breed of dog: The same dog type but belonging to different categories of object. Correspondence between the description and the unknown reality does not show that it is as presumed. All that is shown is that the hypothesis is not disproven by the test of correspondence with the description.

Like should be compared with like. In any experiment, whether actual or thought experiment. The method used for each test should be equivalent in order to be fair. That is not so in Einstein's description of measuring rods and clocks in 'On the electrodynamics of moving bodies' A. Einstein June 30, 1905 ⁴. The results are that different things belonging to different categories of reality are measured. Differentiating Image reality from Object reality is important because it gives the source of the paradoxes that are inherent in the work and it identifies the error permeating relativity theory and consequently other areas of physics.

2: Some differences between images and objects

We do not, in the English language, usually differentiate images from objects that are of the same superficial appearance but refer to them by the name of the object. (E.g. A cat on a screen is referred to as 'a cat'.) That lack of differentiation is not good enough for physics. Despite superficial similarity of appearance, they are not equivalent. There are some important differences between an image and source object.

With a simple lens, source object and screen set up producing an image on the screen it possible to demonstrate that the image is qualitatively different from the source object.

1. The source, a substantial object having corporeal or material nature, exists whether the image is produced or not. The cat object has an existence that is independent of the process necessary to produce the image of the cat on the screen. The image relies upon the EM potential sensory data emitted from the source object for its presence, and hence on prior existence of a source from which the EM data was emitted. The EM radiation having been emitted, there is no further requirement for the object to remain as

it was at the moment of emission or to continue to exist at that place in order for the image 'likeness' to be formed when that EM data is focused on the screen. The object plays no further role in image production subsequent to the emission of the EM potential sensory data, from which the image 'likeness' will possibly be formed.

2. Take away the lens and the image ceases to be visible but the object is still visible. Images are emergent reality formed from the receipt and processing of EM potential sensory data". Emergent, in this context, means coming into existence as the result of a physical process or interaction that enables image production. Not having independent existence of itself.

3. The cat object has the characteristics of a living thing. For example, it is respiring and is sensitive to stimuli. Test the composition of the air in proximity to the image and increased CO_2 consistent with exhalation will not be detected. Poke the image with a pencil and it will not respond, demonstrating sensitivity, in the manner of the cat object.

4. The image seen on the screen is 2 dimensional. It has no exterior and interior. The cat object is 3 dimensional. It has volume and hence an interior and exterior. It can be viewed all around and is source of all possible images of it, not merely the image of one surface aspect of its topology. Object and image are not isomorphic.

5. The image, at a particular time, for a particular observer, is a limited fixed state emergent reality. Merely the image of one surface aspect of the substantial object's topology; pertaining to its configuration and properties when emission of the EM information occurred. Whereas the object is an absolute actualized foundational reality. Absolute because it is simultaneously the source of all possible images of it. I.e. with no reference frame applied, all prospective viewpoints of it that might be imposed are equally valid. Actualized meaning a substantial element of Object reality (i.e. having corporeal or material nature), existing independently of observation. The speed of light is so fast, at every day speeds and distances the image seen closely resembles an aspect of the current topology of the absolute, actualized object.

Further differences between images and objects: Factors that affect the potential sensory data from which Images will be formed affect the form or appearance of the output image. Constructive and destructive interference of the EM waves from which an image could be produced, affect the appearance of the image, or whether it is seen or not. These effects occur with images and sounds but not their material source objects. Factors affecting the wave transmission can affect output image, E.g. convection currents in air producing a shimmering image, gravitational fields in space producing gravitational lensing. The action of a substantial body is such that it minimizes potential energy. The action of an image is dependent upon the EM radiation, and affects upon the EM radiation distribution, from which it is formed.

Consider that a 6m tall building can appear to become a 1cm tall building by walking away from it and then looking back at it. Without any change in dimension of the building object itself occurring. That relativity of perception for observers at different distances from the object is taken as normal and is part of

everyday life. That ubiquitous phenomenon alone is sufficient evidence that it is always images of objects that are seen, and not directly substantial (corporeal / material) objects themselves. Also the relevance of projective geometry, allowing representation of perspective can be considered. Observer perspective, not just relative motion reference frame, is also an important part of Image reality formation. Observer position affects the size of the image seen there and then, not just its temporal origin I.e. when the potential sensory data from which it is formed was emitted.

3. About measurements

Here 4 kinds of measurement that are used in 'On the electrodynamics of moving bodies' A. Einstein June 30, 1905 ⁴, will be differentiated.

1. The *measurement* protocol prior to viewing the result involves direct interaction with a substantial object or particle that is the subject of measurement. This will be called object measurement.
2. The *measurement* protocol prior to viewing the result does not involve interaction with a substantial object that is the subject of measurement but does involve an image (manifestation). This will be called image measurement.
3. The viewing of a measurement indicated by a measuring device used to measure the material object at the observer location (or very close proximity). This will be called proximal-measurement
4. The viewing of *an image of a measurement upon an image of a measuring device* (the source of which is distant from the observer.) This will be called distal-measurement.

Measurements are not all equivalent by virtue of being measurement. *They are not one category.* Each involves certain relation to substantial objects or images.

These different methods are allowing comparison only of *what is seen*, observer's output image realities, and **not comparison** of *what substantially exists*.

Only observed proximal object measurements can be assumed equivalent to the magnitude of that dimension of the substantial object's form at the time of measurement. That context allows the barn pole type paradoxes to be intuitive. The order in which the processes of measuring and image production happen matters. The processes are non-commutative.

4: Category error and ON THE ELECTRODYNAMICS OF MOVING BODIES by A. Einstein June 30, 1905 ⁴ See under 2. On the relativity of lengths and times, the two operations (a) and (b)

Quote "(a) The observer moves together with the given measuring-rod and the rod to be measured, and measures the length of the rod directly by superposing the measuring-rod, in just the same way as if all three were at rest."

NB “directly by superposing the measuring-rod, in just the same way as if all three were at rest”

Quote: "In accordance with the principle of relativity the length to be discovered by the operation (a)—we will call it "the length of the rod in the moving system"—must be equal to the length l of the stationary rod."

In scenario (a) it is the substantial object rod that is measured by superimposing measuring rod upon measured object, and the observer's Image reality that is formed comes from observing that superimposition of the measuring rod on the measured rod.

Quote "(b) By means of stationary clocks set up in the stationary system and synchronizing in accordance with § 1, the observer ascertains at what points of the stationary system the two ends of the rod to be measured are located at a definite time. The distance between these two points, measured by the measuring-rod already employed, which in this case is at rest, is also a length which may be designated "the length of the rod. "The length to be discovered by the operation (b) we will call "the length of the (moving) rod in the stationary system."..... Quote "This we shall determine on the basis of our two principles, and we shall find that it differs from l ." A. Einstein June 30, 1905 ⁴.

In scenario (b) the observer is not measuring the substantial object itself. The observer is receiving and processing EM radiation emitted or reflected from the *to be* measured rod object. That is processed into an image. It is where the image starts and ends at a time that is simultaneous for the observer that is determined by this method.

Comparing (a) measurement with (b) measurement is not comparing like with like. In (a) an object is measured and that measurement is observed; in (b) a manifestation (emergent image) is measured. Einstein writes "Current kinematics tacitly assumes that the lengths determined by these two operations are precisely equal, or in other words, that a moving rigid body at the epoch t may in geometrical respects be perfectly represented by the same body at rest in a definite position". Was it true that "Current kinematics tacitly assumes that the lengths determined by these two operations are precisely equal"? He is mistaken because the assumption he mentions requires **that it is the substantial body (the material object) that is compared in both operations** but method (b) does not allow direct measurement of the object. *There is now a category error because both (a) result and (b) result are considered to be comparable measurements because difference of category has not been considered. Whereas by method(a) an object is measured, and by method(b) an image is measured.*

As it is important it is worth restating that those processes occurring in (a) and (b) I.e. measurement and image production are non-commutative. The order in which they are carried out matters. Re.(a) there is proximal object measurement. The measurement is made first, by superimposing the measuring apparatus on the object and *then* forming an Image reality by which the measurement becomes known.

Re. (b) there is image formation first followed by measurement. It is a distal image measurement. The two different procedures cannot be considered comparable, equivalent methods of measurement.

There are different causal orders of events giving the result by each method. The procedures cannot be equivalent and the outcomes are therefore not comparable without incurring category error.

Procedure (a) measurement protocol involves interaction with the object itself by the placing of the substantial measuring rod upon the substantial rod subject itself. That procedure is done *before* EM data from the ensemble is formed into an Image reality. EM sensory data is received together from both measured and measuring rods in juxtaposition. The measurement comes to be known by the production of the Image reality, an image of the scale and image of the measured object juxtaposed.

Procedure (b) the Image reality is formed before use of a measurement scale. Sensory data arriving together, from the selection made at the selected time, is formed into the output image of the seen length. The spatial positions ("points") corresponding to seen front and seen back are noted and then distance between is measured with measuring rod. The length is created from the way in which the sensory data is received and processed and it is the length corresponding to the length of the seen manifestation, not object, that is measured. This is a different nonequivalent causal sequence of events.

It cannot be assumed that the image is necessarily identical to the substantial object. The image displays only an aspect of the topology as it is formed from only the sensory data that is received. Observer reference frame can affect which sensory data is amalgamated into the image. That allows sensory data with different temporal origin (from different configurations of the Object universe) to be amalgamated, giving an image containing temporal spread of information rather than being entirely uni-temporal like the source object.

Proximal object measurement gives an output with close resemblance to an aspect of the topology of the object, given that the optical system is not causing perturbation. With close proximity looking towards the object the EM radiation emitted together from the object is received together by the observer. However, it does not follow that the same is true for image measurement using an image produced from EM emitted from a distant source object. Reference frame of the observer also matters as Einstein showed.

The form of the image depends upon **which** EM radiation is intercepted and processed together into the output; whether there has been perturbation of the EM radiation en route and the optical or radio system used to convert the EM radiation input into visible output. *An extreme example is distortion of image form caused by gravitational lensing.* The form of the galaxy image is not the same as the form of the substantial galaxy that was the source of the EM radiation but remarkably dissimilar. Also for EM radiation that has propagated a very long distance it is not necessary that the source object still has existence either in the form observed or at all. The image viewed is not the object but output from relic M radiation potential sensory data. The example clearly shows that there should be differentiation of image outputs from source objects and not the assumption that there is equivalence. The form of the image is far more

mutable than the substantial objects form that is constrained by its substantial nature. The substantial objects form is due to the relations of the particles that are its substance. That is all of the acting forces including the atomic forces and chemical bonds that hold it together as an object.

Summary

The differences between substantial objects and images are not unimportant. Though they may bear the same object name they are not equivalent. The category error identified within Einstein's paper is not differentiating between externally existing objects, consisting of atoms and particles, and images being perceived (insubstantial manifestations, outputs of sensory data processing). That error has led to a misunderstanding of the physics of relativity, and the associated paradoxes.

There is category error within the interpretation of special relativity, i.e. within the meaning attached to it, indicated by the associated paradoxes. That does not mean that relativity in relation to electromagnetic phenomena, (affecting measurement), is a mistake. It is an important part of physics.

B: The paradoxes of Einstein's relativity

To understand the cause of the paradoxes of relativity theory it is necessary to recognize that it is emergent image manifestations that are being seen and not substantial objects. The source object is absolute, as no reference frame applied, so all prospective viewpoints of it are equally valid, it is the potential source of complete information. It is an actualized element of Object reality. An absolute (as no reference frame applied), actualized element of Object reality is not equivalent to a definite (as reference frame, viewpoint, applied), limited fixed state (as there has been selection of information giving a partial view of apparent topology) manifestation; an output of sensory data processing, an element of Image reality. To confuse them as the same thing is a **category error**.

The Gross Set of potential sensory data in the environment is not a complete set of all possible potential sensory data emitted by the source object but a subset of that. A Gross Set in this context means; all potential data within the environment pertaining to the source object prior to observer selection. Not complete / absolute data because the environmental context of the source object may have prevented EM emission from the entirety of its surface. Some parts may not be exposed, some parts not illuminated. Also some potential sensory data may (or will) have been absorbed by other objects or by interaction with other particles. The amount and distribution of the potential sensory data is thus affected by the environmental context in which the absolute object is situated and the environment in which the potential sensory data is distributed. The manifestation has a singular limited fixed state, produced from the **subset** of sensory data received rather than many possibilities of the absolute object and the Gross Set of pre-selection sensory data.

Reality Interface

$Ab A S E O O R \rightarrow Gross Set A PSD R (E O O R) \rightarrow D L F S PSD R(E O O R) \blacktriangleright D L F S M E O I R$
source object preselection EM info in environment info. selected by observer manifestation

The most commonly discussed paradoxes of relativity will be dispelled here. There are others which can also be understood as occurring because of the nature of image manifestations and how they were formed from the EM information, not to be confused with foundational material reality.

1: The Grandfather paradox

Realizing that different observers experience same events at different times and in different ways led Einstein to consider that *events* exist spread within a space-time continuum. This reasoning leads to the Grandfather paradox. The EM information contained within the Data pool of potential Image realities is distinct from the Object reality of substantial source objects now existing; that co-exist within Object reality with the EM radiation distributed within the environment. The Grandfather paradox is based upon that assumption that non simultaneity of events requires substantial object persistence rather than just persistence of the potential sensory data from which to construct Image reality present experience. It confuses Image reality (emergent output reality from sensory data processing) with Object reality (substantial being independent of observation). It is therefore based upon a category error.

(Ab A E O O R) Grandpa \neq (D L F S M E O I R) Grandpa

Substantial Object Manifestation

That there is non-simultaneity of experienced events, should not be used to suppose that the object sources of the potential sensory data received must remain unchanged. As the Image reality output depends only upon the receipt of potential sensory data **already emitted** into the environment. The pool of EM data allows different observers to receive and process that data in different ways according to location and motion relative to the sensory data. The EM potential sensory data is not the substantial past, present and future; only the potential to form Image realities of former objects and events. The object sources can change, move or cease to exist after the EM radiation is emitted that persists in the environment by which former arrangements, forms and events will be experienced.

The no longer substantially existing, is unambiguously, actually different from that which substantially exists and that which has not existed Sensory data persists in the environment receivable by different observers at same *and different times*, giving non simultaneity of events. There is no need to suppose there is a space-time continuum in which substantial realities persist in form and configurations throughout all time. It is not necessary for physics that substantial events themselves that persist. It is likely they do not persist, as doing so permits paradox. There is also no evidence that they do persist

available to science. Giving no times outside of the current configuration of the material Object universe for a would be time traveler to visit.

2: Examining the light clock argument

In order to correctly extend relativity to light, electricity and magnetism, the concept must be held that those phenomena are unchanged in foundational reality by changing reference frame of observation. As the light within the light clock cannot be travelling further within the clock, because of the way it is looked at, the time period measured by the clock itself is not slowed by the translation of the clock. Even though this means disregarding the logic of the straight line light path argument. Though the period and frequency of the light motion is unaltered (traveling the same wave motion distance in the same time), from the relative perspective of the observer the motion is extended over a longer spatial distance. Having the effect of making the wavelength appear longer and the frequency lower.

Light is a periodic phenomenon. In mathematics, a periodic function is a function that repeats its values in regular intervals or periods. Periodic functions are used throughout science to describe oscillations, waves, and other phenomena that exhibit periodicity. As the period of periodic motion is unaffected by linear translation (mathematical fact), it follows that the period of clocks themselves are unaffected by linear translation (ideal physics; there are variables that can affect timekeeping of clocks in practice that need considering, see below).

Light, considered as a periodic wave phenomenon, can be compared to other kinds of periodic motion. Mathematically the period of an ideal clock is unaffected by lateral translation. It is only a spatial change. So, it follows that the period of the light clock should be unaffected by lateral translation. Illustration: Three observers watch a click wheel with a constant period of rotation. A. is a co-moving observer. B. is an observer moving in the direction of the wheel's motion but at half speed. C. is a stationary observer. According to the three observers the wheel has moved different distances. However, in each case it is the same motion of the material body that is the source of the observations. The speed of rotation of the material wheel is not altering. What is altering during the motion and is different for the different observers is the relation to the potential sensory data emitted from the material object. When the observer moves together with the observed object the distance that the potential sensory data must travel from emission to be received by the observer is remaining constant. When moving at half the speed of the object there is an increase in the distance that must be travelled and when the observer is stationary there is the greatest increase in distance, in this example. This results in three different experiences of the motion via the outputs generated from the received potential sensory data.

Re. Einstein's light clock: The light traveling between the mirrors is not moving in a straight line like a ray, but undergoing wave motion. Following an oscillating path that is the same whether there is relative translation or not. The notion that the light takes a longer path when the clock is moved is based on the straight line assumption. Instead it can be thought of as a fixed length of periodic motion with a fixed

frequency, imagined as extended spring like in the translated reference frame. Following the path along the coils of the spring, the imagined absolute motion, it is the same length whether the spring is extended or not. It is the same source object 'spring' for both reference frames but seen differently because of how the emitted EM potential sensory data is arriving at the observer and being formed into the different relative image realities. This means the speed of light is the same for the clock itself, even though it appears that when the clock is moved the light is travelling further in a straight line at c , making the period of the clock longer.

It is actually the increase in distance between observer and clock that is important as that is what causes the output Image reality to have *the appearance* of a greater distance travelled by the light and a resulting slowing of tick. Simultaneously, for a same speed co-moving observer the tick must be unchanged.

In support of The Twins paradox, human metabolism has been likened to a clock, sometimes reduced to an argument about the oscillation of individual atoms. That argument can now be turned around and used in support of no alteration of metabolism under translation; dispelling the paradox. Firstly, because periodic phenomena are unaffected by linear translation and secondly because clearly the notion that the bodies themselves age differently is due to the category error that confuses the outputs of sensory data receipt and processing for the source material objects themselves.

3: The planes problem

Premise: The substantial objects of Object reality are not formed or directly affected by derived relative reality (including Image reality; this 'what is seen'. Though a living agent might affect substantial objects in reaction to perceived Image reality.)

On the basis of that premise, if there is a permanent alteration to the time shown on two formerly synchronized clocks, that have either been subject to different gravitational potential or travelling at different velocities, making them out of synchronization when brought together, there must be another process or processes occurring that affects substantial matter, rather than only relative perception. As the difference in time shown on the substantial experimental clocks is found to persist when they are reunited it has to be rooted in their substantial, ontic reality not different relative output realities from EM information receipt. It is not necessary to conclude that it must be differences in "time itself", unless "time itself" is given the definition of being (only) what the clock measures.

Quote "Basically a clock consists of four items: something that generates events at a regular interval (the oscillator), a counting mechanism, some method to calibrate the rate of the events, and a time setting mechanism. In a fundamental sense, we do not tell time, but only count events. On a low level, we deal in time intervals, not time. The zero of our time system is arbitrary and set by convention – or some committee. This origin, along with a definition of the second, defines a time frame. The rate that the events occur must be calibrated. This means that there must be standards....." James R. Clynch. 2003 ⁷. Precise Time and Time Interval Clocks, Time Frames and Frequency 2003 Department of Oceanography Naval Postgraduate School

Quote: The principle underlying the cesium clock is that all atoms of cesium-133 are identical and, when they absorb or release energy, produce radiation of exactly the same frequency, which makes the atoms perfect timepieces. Encyclopedia Britannica. Quote: The oscillation frequencies within the atom are determined by the mass of the nucleus and the gravity and electrostatic "spring" between the positive charge on the nucleus and the electron cloud surrounding it. Jason Schanker SCICOM MIT 2005 ⁸.

Requirement: A cause of change in the number of 'events' generated or events measured needs to be investigated. It could be an effect on any of the components that generate the time intervals, regulate them or count them or the system as a whole.

Quote: "Considering the Hafele–Keating experiment in a frame of reference at rest with respect to the center of the earth, a clock aboard the plane moving eastward, in the direction of the Earth's rotation, had a greater velocity (resulting in a relative time loss) than one that remained on the ground, while a clock aboard the plane moving westward, against the Earth's rotation, had a lower velocity than one on the ground." Wikipedia 29 Nov 2015 ⁹.

Consider those two atomic clocks flown in opposite directions around the globe. Plane A travels in the direction of rotation of the Earth, plane B flies against the rotation of the Earth. To the hypothetical accelerated reference frame of an observer at the centre of the Earth (or a distant observer stationary above the spatial co-ordinate of the starting point of the two planes (not geostationary above the start position on the Earth), plane A is seen to fly a greater distance with the movement of the Earth than the plane flying against the rotation of the Earth.

Thought 1: Plane A gets an easier task moving with the mass movement of the atmosphere whereas plane B has to work harder to overcome the inertia of the plane-atmosphere system, both components resisting change.

Quotes: "Unfortunately, an atom or molecule does not vibrate, or-putting it more accurately-emit or absorb energy at one frequency only, but rather over a range of frequencies. The narrower the range, the more accurate the spectrum line will be as a time standard. The range or width of the spectrum covered by the spectrum line is determined by several factors. Among the most important of these are the violent collisions between the atoms or molecules which disturb the vibration, causing a broadening of the spectrum line. The thermal motion of the gas atoms also gives rise to what is called a Doppler broadening..." "...the signal will be absorbed when the frequency or vibration rate of the radio wave is exactly equal to the frequency of vibrations corresponding to the spectrum line..." "This phenomenon can be made use of in making an atomic clock. If the cyclic or vibrating mechanism giving the beat of the clock is made to generate a radio wave, the absorption of this wave by the gas will be at a maximum when the vibration rate of the wave and the clock is at the right frequency, and weaker if it is off frequency; this is the basic mechanism involved in control, although details of execution may vary." Quotes from Harold Lyons, The atomic clock A universal standard of frequency and time, 1950 ¹⁰.

Thought 2: The need to have precise frequency matching to generate an accurate event together with sensitivity to disturbance could tie together a lesser number of events and greater instability of the clock on the anti-rotation journey. The higher frequency for the plane with the greatest velocity, exceeding the Earth rotation, in the Earth rotation direction, also needs mentioning. It could be due to the increase in mass of the atomic nuclei used for time event generation, due to additional inertia (resistance to change of motion) at that higher velocity. That might have a dampening effect on the noise causing imprecise frequency matching. Giving a cleaner faster matched frequency generation and consequent faster rate of the clock. Thought 3. It is possible that there could be an effect produced by different external gravitational potentials on the fundamental time keeping process.

In conclusion: There are two different classes of phenomena occurring both attributed to time dilation. One class of phenomenon is the difference to the derived output reality, seen as difference in the rates of change by comparison; because of the way in which EM information is received in different reference frames. The second class is alteration of timekeeping due to an effect upon the substantial timepiece or timepieces, as discussed above. This class of alteration needs further investigation.

There is no alteration of the passage of Object universal time. The clocks are not differently time travelling. There can be no going into a substantially real future ahead of the Uni-temporal Now as only Uni-temporal Now, the current configuration of the Object universe exists. Nor slipping into a substantial past as there is no substantial past either. That it is so, also prevents the Grandfather paradox. Relic EM radiation from which derived, relative Image reality can be formed when it is received and processed into output allows perception of events that have already occurred. Non simultaneity of events is due to differences in where and thus also in which configuration of the Object universe the EM information is received.

(Variable) psychological time can also be considered (See David Eagleman's FQXi talk 2011 ¹¹) and is mentioned below.

4. The concept of wavelength

Definition: "noun, Physics. The distance, measured in the direction of propagation of a wave, between two successive points in the wave that are characterized by the same phase of oscillation." Dictionary.com
Wavelength is a spatial distribution measurement that combines position due to periodic motion and linear translation in the direction of propagation. Amount of linear translation can vary according to observer reference frame, and observed frequency is inversely proportional to observed wavelength. It can be understood from the earlier investigation into the light clock and planes problem that the periodic phenomenon in Object reality is not altered because of the change in relation of it and the observer. There is no alteration of "time itself" affecting a clock *object* or any other periodic motion in Object reality because of relative motion between it and the observer-object. ***The (unobserved) intrinsic period of a clock or any periodic motion is invariant with change in reference frame;*** so long as there is no

change in the functioning of the system, brought about by physical effects on it, that occur in conjunction with the motion. Further discussion of this idea continues in the next section.

5: Causality

Causality is synonymous with the sequence of the configurations of the Object universe. For that reason, Uni-temporal Now has also been named the Causality front. It belongs to the substantial Object reality of material objects and particles and their relations and interactions and not the Image reality of perception. Causality is less clear in emergent Image reality of observer's as there is non-simultaneity of (experienced) events. That means that different observers can see events occur in different orders due to the way in which the sensory data was obtained. They may ascribe the chain of cause and effect to be consistent with the order in which they saw the images or heard the biologically generated output sounds.

A] A window is smashed, alarm sounds, distant dog barks. It takes longer for dog sensory data to arrive than window sensory data. Observer 'A' says the dog heard the window break and that is why he is barking.

B] Dog next to observer 'B' barks and then in the distance a window is heard to smash and an alarm sound. Takes longer for window sensory data to arrive than dog bark data. 'B' says dog must have heard the intruder before the window was broken and that's why he barked. For a distant observer that is not always how it appears to be, even though cause does always precede effect in the foundational reality that is the source of the sensory data that the distant observer receives.

C] A glass shattered by a high frequency note might be seen to shatter before the sound cause is heard. Though it might be necessary to record sound and picture using recording devices and then play them back slowed down, as the brain can, with a small enough time interval, synchronize the differently timed inputs into a synchronized output (See David Eagleman's FQXi talk ¹¹).

D] Similarly a plane that disintegrates due to an explosion could be seen by a distant observer to fall apart before noise, by which an explosion is identified, is heard. It is likely that the associative cortex of the brain that identifies meaning within the sensory data uses arrival time to give a coherent causal story, which may differ from the causality that produced the sensory data.

The light velocity is always the same as measured by the observer of it and pertains to the observer's Image reality, the output generated from the received EM radiation.

Image reality output depends upon what potential sensory data is received together forming the apparent present and apparent synchronicity of events within that present. Generally potential sensory data received together is processed into same output irrespective of time taken for the data to arrive. Giving a *space-time output* i.e. containing temporal spread. (Although for an organism's sensory system acting as the reality interface there may be some adjustment between input and output affecting apparent synchronicity- See David Eagleman's talk ¹¹). As what potential data is received varies for different

observer positions and reference frames so does the experienced present and experienced synchronicity of events.

6: The Andromeda paradox

The Andromeda paradox is understood simply by realizing there is a significant category difference between experienced events and events in which substantial elements of reality interact, I.E Image reality manifestations formed from received potential sensory data and source events.

EOOR interactions occur in Object reality that is uni-temporal (same time everywhere) and can be considered the causality front. (Not yet received environmental potential sensory data can be named the pre-written future, not to indicate complete determinism within physics, but that the data to form observable manifestations exists prior to their experience. The Object reality or source reality, and Image reality experienced present manifestation are not synchronized. When an event is observed via its manifestations is variable, but when an event happens in the source Object reality is definite, and uni-temporal as that event having happened in Object reality is true for all locations. The observer walking towards Andromeda would receive the potential sensory data sooner than an Earth bound observer. So even though no invasion data is yet received as Andromeda is too far away it can be said that for the walking observer the potential sensory data emitted from the invasion events on Andromeda are nearer to him than the Earth bound observer. This does not however mean the source event occurred sooner. The source event occurs only once, and the time of that occurrence (iteration of the Object universe within the imaginary past sequence of iterations) is unique and unchangeable.

7: Barn / pole, Bug / rivet type paradox

Having clarified the categorical difference between material Object reality and product of information processing Image reality, it is clear that the two different observer's in these kinds of paradox are producing different image realities from the amalgamation of potential sensory data received at their respective vantage points in their own reference frames. The source material objects themselves cannot be seen as sight requires that EM information is transmitted from object to observer and processed into output. That the two observers see different image realities is not paradoxical when it is considered that each has received a different selection of potential sensory data (EM information). Close to the speed of light the sub set of sensory data intercepted causes distortion of the (theorized) output affecting both the length of the observed objects and timing of events from the different observer viewpoints. It should be remembered that what is happening and what exists in Object reality is not identical to what is seen to be happening and what is seen to exist for these observers in these extreme (near light speed motion) scenarios.

As the scenarios are about what is seen, the acuity of the sensory apparatus and manner of processing the information *is* relevant to what would *actually* be seen. It is not only the EM input that affects what is actually observed.

8: Is the moon there when I'm not looking?

That title question fails to distinguish between all of the following: the knowledge / concept of the moon, the substantial moon object, a manifestation of the moon formed by an observer's sensory system or output of a monitoring or recording device, potential sensory data (EM information) pertaining to the moon in the environment, EM information pertaining to the moon input to a device or organism's sensory system. It can be seen by the following argument that the question 'is the moon there when I'm not looking' is inadequate. It is inadequate because *the category* of moon; Moon source object, Moon related potential sensory data, Moon manifestation or Moon-concept *has not been specified*, only an unspecific noun used.

KEY

A- Actualized, a substantial element of reality

Ab- Absolute, no singular reference frame applied

Category error- Failure to correctly identify or discriminate between different kinds of element of reality belonging to the different facets of reality

D- Definite. Certain and un-altering in that respect)

EOIR- Element of Image reality

EOOR- Element of Object reality, not same as objective reality

FS- Fixed state. A selection giving one un-altering state

Gross Set PSD- Total potential sensory data in the environment emitted by an actualized source object

Image reality- Emergent output reality from sensory data / measurement processing, Individual observer specific or objective via shared output or shared sensory data input

L- Limited (partial sample)

MS- Mixed state. A selection containing more than one state

M- Manifestation. Output of sensory data processing

Object reality- Foundational, source reality of substantial objects and particles and potential sensory data

Objective reality- Multi-observer corroborated Image reality

PSD- Potential sensory data

oMoon-Material source object Moon

PSDMoon...EM info. pertaining to oMoon

iMoon...Output of EM processing, image

psyMoon... Concept/idea of Moon in thought and/ or records including memory

(Ab A S EOOR) oMoon ≠ (Goss Set A PSD) Moon

Absolute Actualized source Object Total potential sensory data in environment relating to oMoon

(Ab A S EOOR) oMoon ≠ (D LFS PSD) Moon

Actualized Object Definite Limited fixed state sub set of sensory data, pertaining to oMoon received by observer

(Ab A S EOOR) oMoon ≠ (D LFS M EOIR) iMoon

Actualized Object Definite limited fixed state Output manifestation of Moon I.e. (iMoon)

When not looking: there is no (D LFS PSD) Moon, the sub set of potential sensory data received by the observer (because no receipt is occurring), and there is no (D LFS M EOIR) Moon, output manifestation.

However, within Object reality, there is still (*Ab A S EOOR*) Moon; The Absolute actualized object. There is also still, within Object reality, (*Gross Set A PSD*) Moon. The total potential sensory data in the environment emitted by moon. The substantial actualized object and total sensory data in environment relating to Moon object, are able to exist without their Image reality manifestation counterpart. Likewise, the

concept of the Moon, *PSY*Moon, within brain activity or mind, stored within connected neurons as memories and as information within books and other kinds of records exists independently of a currently observed Image manifestation. The concept of the Moon does not require the formation of the seen image for its continued existence. (*Ab A S EOOR*) Moon and (*D LFSM EOIR*) Moon belong to different categories of elements of reality, belonging to different facets of reality.

C: About time

The mathematical space-time model is a construct giving a mathematical representation that fits well with observations of Image reality but is not a complete model of reality. Though it contains Mc Taggart's "A series of time", past, present and future, as world lines of observer's it does not clearly include "B series time" which is passage of time or change along a sequence spanning earlier to later": As what is earlier and later is a relative perception in that model. Mc Taggart's A and B series of time are ideas presented in The Unreality of Time 1908 cited by Gerald Rochelle 1991 5. Used alone Space-time allows the possibility of time travel and associated paradoxes, is a completely deterministic static model that denies free will and does not allow certain causality due to non-simultaneity of events. Sequential change in configuration of the substantial elements of the foundational source reality provides the missing B series.

1: Kinds of time

There are two different kinds of time that are of prime importance; the passage of time independent of observation, uni-temporal "time" (a temporal expression that is analogous to the changing configuration of the entire material universe), and the time that is measured or experienced by an observer. Important as main components of a framework that resolves many problems in physics.

1] There is a difference between Newtonian absolute time and uni-temporal "time". Uni-temporal time is a unique pattern of the entire (Object) universe, each time corresponds to a different unique pattern or configuration. This description of passage of time is in agreement with J.C.N. Smith 2012 ⁶ It might be said *in this regard* there is no time that is separate from the substantial configuration; and the passage of time is only temporal expression of the sequence of wholly spatial configurations. It is the 'moment' between what has substantially existed and what does not yet exist. It is not between observed past and

future as the content of the present depends upon the sensory data received and processed (varying for each observer) rather than what exists at Uni-temporal Now, external to the subjective experience.

2] The observers present is formed from the sensory data received and processed, and that output seen, the sequence of presents, is a **kind of passage of time, emergent manifest passage of time**. It is not synchronized with the external reality, so also not synchronized with uni-temporal passage of time. There is inbuilt delay that increases with distance from the site of EMR emission from the source object, and the effects of relative reference frames of observers. So it is relative and subjective passage of time.

Both kinds of time can be described as sequences of configurations. Uni-temporal passage of time is the sequence of configurations of the Object universe. Emergent passage of time is the sequence of outputs of the observer's sensory data processing. Giving experience of an ever changing present. Or it is the sequence of outputs of the inorganic reality interface that has received information input, producing another kind of output. Time emergent from the processing of sensory data allows non simultaneity of events and uni-temporal passage of time gives an absolute temporal background for atomic and subatomic events.

If two clocks with excellent timekeeping at position A are synchronized by two observers also at that position and then by slow transport the clocks are separated; though to each observer at each new position the distant clock appears to be telling a different time from his own (distal measurement giving Image reality output) they remain synchronized in Object reality. Both substantial object clocks at a particular proximal time [observed on the clock, matching the measurement by the substantial measuring device], are a part of the same pattern in the sequence of patterns of the Object universe (Configuration of all substantial objects and particles) in which the positions on the clock faces of the hands of the two clocks (made of atoms) are matched to each other, in Object reality.

It is when the output experience of sensory data receipt and processing, including distal measurement of time, is introduced that non simultaneity becomes apparent. The distal measurement relies upon sensory data transmission, receipt and processing; which prevents the output observed from being identical to the measurement now showing on the substantial object clock (proximal measurement). The relative motion of the observer or observed also affects the way in which the sensory data is received and so the appearance of the output. It is the sensory data received and output of sensory data processing that gives the apparent time, an Image reality. *Image reality and Object reality are not equivalent and are not synchronized*. It is important to realize that the measurement is an output of sensory data processing. It is a difference in the appearance of the passage of time and not a difference of "time itself". *Time itself* is a superfluous concept.

2: Two futures

One is the not yet received sensory data that already exists in the environment. In this explanatory model that is called the **pre-written future**. The potential data produced could be from spontaneous emission, reflection of EM waves, the production of pressure waves which will be interpreted as sound, release into the environment of other data such as chemicals in the air that can be detected by artificial detector or organism. The time between production and receipt will depend on the type of data, distance from source and reference frame. EM radiation potential sensory data is important to physics as the distribution of this in space and the relation to an observer gives Einsteinian relativity and non-simultaneity of events for different observer positions or reference frames. This 'relic information' is often (insufficiently) thought of as being the past since the event producing the data has already occurred unobserved. Potential sensory data pertaining to *an event* received and processed into the present of one observer, and already past experience of another, may yet be *to be received* by a more distant observer; and is in that regard his pre-written future,

When ancient information is received and formed into images it must be remembered that although the event in Object reality has occurred the data is only Now being formed into a present Image reality. It is a present Image reality pertaining to an ancient Object reality or pertaining to amalgamated information from Object realities that did not co-exist I.e. containing information derived temporal spread.

The other future (pertaining to material reality) is open and non-existent: The imagined nothingness prior to actualization. That is called the **unwritten future** in this explanatory model. This future is necessary to allow partial non determinism and free will. It can be imagined as what will be but it doesn't have ontic or phenomenal reality. As it does not exist there can be no time travel into that future. Likewise, as the past does not actually exist. (Though there may be evidence of its having been, in records and memory, and structures that persist, experience-able within the observed present.) So there can be no time travel to the past. This understanding of time helps dispel the Twins and Grandfather paradoxes. The time dimension only applies to the informational content of electromagnetic and other sensory data in the environment; not to existing material actualizations outside of the fully simultaneous Uni-temporal Now.

The configuration of Uni-temporal Now need not be **fully** determined by the former arrangement as there may be places where there is more than one possible outcome, only one of which is actualized. This might be said to be the locations where "God plays dice", in an otherwise deterministic unobserved reality. The sequence of former arrangements of the Object universe are giving the actualizations and the open future is an imaginary realm not the source of the existing material reality. Interaction of the actualized objects with the environment are giving the potential sensory data the pre-written future which will, (via receipt and processing), generate the observed, detected or experienced present-now.

3: The arrows of time

The first Premise: There is one ever changing configuration of the (Object) universe that is uni-temporal, that is, the same time everywhere. The temporal expression corresponding to the existing configuration is Uni-temporal Now. Only the youngest configuration has substantial existence. The first premise together with Newton's first law explains the "arrow of time". Each configuration of the Object universe contains the relations between substantial bodies and the 'incumbent forces that act to produce the resultant configuration (with the new incumbent forces, and so on). The direction of imagined vectors representing the motion are irreversible because of Newton's first law.

The second premise: The speed of light is not infinite but finite, measured as 299 792458 m/s. Relating that premise to the given example. Traveling at the speed of light it takes time for light emitted from source substantial object A to get to B. EM information is produced by the interaction of light with substantial matter. The second premise (the extremely high but not infinite speed of light) explains why the image realities formed from received light cannot show time reversal. As that would require travel of the observer to *exceed the speed of light*, in order to receive the EM information in the order younger (more recently produced) to older (less recently produced); rather than the normal -older to younger- order of receipt. Apparent events fabricated from received light are distinct from the configurations of and interactions of substantial bodies; the sources of EM information. Motion of an observer alters the pathway through the light (within the environment), giving image realities corresponding to the EM information received. Different relative motions can produce different apparent simultaneities, due to differences in when and where the EM information is received. When an apparent event is seen to occur is variable. When a substantial body interaction or relation occurs is invariant as it belongs to a particular configuration, or sequence of configurations, of the Object universe.

There are two imaginary arrows of time. The one that is the sequence of change of the Object universe from oldest to youngest iteration. Only the youngest exists. The youngest in the sequence of configurations being where change happens, the causality front. Each material configuration (and new set of associated relations) output becomes the next input upon which the laws of physics, and biology act.

This arrow is the actual changes of the relations between matter (and particles) of the Object universe giving new configurations which is an **irreversible** arrow of time. The Object universe, unobserved, has a configuration and within that properties and relations such as scales, masses, separations, orientations and gradients that accommodate the forces that will act to allow, constrain or prevent change to give the next arrangement, in a continual sequence. This is the traditional direction of the arrow of time. What was to what is. That has traditionally been called 'past to present'. This can now be better understood as Uni-temporal Now becoming the next Uni-temporal Now and so on. This applies to what is happening unobserved and so is non relativistic. It gives the 'preferred foliation' necessary for QM models.

Everything is in (absolute) motion so the Object universe is continually changing, some relations between objects will persist within Uni-temporal Now and others be extinguished. Relations within the configuration at Uni-temporal Now are extant, true relations. The forces that act within each new configuration lead to another new configuration and cannot lead back to the former configuration. That reversal would require stopping of all action throughout the Object universe in order to reverse it. That requiring a universe stopping, simultaneously and universally applied force. Then all of the forces throughout the entire Object universe that caused the last iterated configuration act in reverse.

The other imaginary arrow is the experienced arrow of time which is at its most basic the order of receipt of sensory data from which experience is fabricated, though the brain does adjust the timing of the outputs from the accumulated data to give consistent causality stories. (As described by David Eagleman.¹¹) If the direction of time, with respect to observation, is thought about it is the pre-written future (potential sensory data from events that have already happened in Object reality) that is becoming the present and then becoming evidence of former being in records and memory. This arrow is **theoretically reversible**, if the speed of the observer exceeds the speed of production of the potential sensory data. An experiment using sound and microphone bullets as proof of principle can be considered. With data receipt in reverse the output experienced would be reversed. Of course this is not traveling back in time as the reversal experience happens within the uni-temporal Object universe with unchanging passage of time.

D: Absolute Object reality, counterfactual definiteness, the law of non-contradiction and context

It is the thought that as 'our' perception is definite, showing particular, singular identifiable states that is therefore what macroscopic reality is like, that is also a problem. Prior to observation, without an observer's reference frame applied and no specification of when or where a measurement is to be made the object is in an absolute unmeasured state being all that it is, not any partial aspect: The whole truth. For to be assigned a definite state, observer reference frame and / or measurement protocol is needed. Examples of absolute states without contradiction include both clockwise and anticlockwise spin; a surface that is simultaneously both concave and convex; a state of both heads and tails, simultaneously spinning up and spinning down.

Any viewpoint of a source object gives a representation of a part of the topology of the 3D source object not the whole of the source object. Manifestations of objects have limited fixed states determined by measurement / observation, and are partial representations of absolute Objects. The state observed by any singular observer is limited as the sensory data obtained from which the reality is fabricated is a limited sub set of all data available in the environment. Also measurements condense data into a limited number of detectable outcomes. So a coin's state at measurement can only be seen as heads or tails.

The measurement protocol provides only one of those two outcomes nothing else. A spinning object's state only as clockwise or anti-clockwise spin. The counterfactual is eliminated by the process of forming the Image reality, selecting potential sensory data or making a measurement. This macroscopic Image reality is an impoverished representation of external source reality.

Consider: A concave / convex cup is, in absolute truth, in Object reality both simultaneously. It is when observation is made, that a particular frame of reference is imposed and, it 'becomes' one or the other. It, the observed manifestation, is not the same 'it' as the material source or the sensory data information from which it is fabricated. It, the observed manifestation, is truly just one state, concave or convex, because the information to form the contradictory state cannot be received simultaneously. It is not and so does not form a part of the observer's emergent reality. The emergent reality does not contain the counterfactually definite. That makes it partial truth formed from incomplete information. In contrast to the absolute truth contained within Object reality. This is a switching from thinking about the world in one way, including all possible outcomes to looking at it in one particular way. A cup unseen in absolute space is both concave and convex, the potential sensory data in the environment encodes both concave and convex topology and a wave function of the superposition of states for the cup must allow for the two contradictory outcomes. Thus emergent space time experienced reality of any singular observer, like any singular measurement, excludes the counterfactually definite. The counterfactual possibilities are not within space-time exterior to the observer, as space-time is an emergent reality output of sensory data processing that does not exist externally. The counterfactual possibilities are unseen within the potential sensory data distributed in space and possibly still part of the Object source of the data, both belonging to the Object reality facet of reality, the source side of the reality interface.

An unobserved spinning coin in free fall does not have a recognizable state of orientation relative to the observer but can be thought of as of all states, until the measurement protocol produces a fixed observable. Many observers in different positions relative to the coin could disagree about its state at a particular absolute time and all be correct from their own perspective. The flux of a spinning coin in free fall, how, the way in which, it is moving in relation to its environmental context is inseparable from the substantial object. That is its true nature, how it relates to the Object universe, in contrast to any singular state assigned to it from a singular measurement or observer viewpoint and reference frame.

That 'picture' of what is occurring is pertinent to the question of why systems can be probabilistic rather than fixed and certain prior to measurement. Consider the unobserved free falling spinning coin object again. The object is in all indirectly observable states because there is no reference frame-making all frames equally valid. It is also in flux altering what would be observed from each reference frame, if applied, as time passes. Although the evolution of its relations to the external environment is deterministic, if all variables are taken into account, without choosing and applying the observer's reference frame and selecting the potential sensory data that will give a known designated starting state, relative to the observer, the outcome of any later measurement cannot be predicted. However, there is an

alternative to choosing a starting state as seen by a particular observer. Taking into account the context of the phenomenon. That is the relations to external surroundings that gives a context whereby orientation can be known in relation to the other objects instead. Material objects cannot be said to have orientation of being, or orientation of motion without regard to other external things such as other objects, or forces, or an observer that provide a context. This means that properties of position, orientation and motion are contextual and not merely inherent aspects of objects and particles alone.

The observer's Image reality is impoverished and *does* comply with the Law of non-contradiction. *An unseen substantial object in Object reality, a theoretical superposition in a quantum probability space and the unseen potential sensory data encoding an object in the environmental Data pool are three conditions in which the law of classical logic called the Law of non-contradiction does not apply. That law states: Contradictory statements cannot both be true, in the same sense, at the same time.*

There has traditionally been the idea of a divide between the sub atomic and macroscopic scales, which seems to be the result of the different ways in which we must interact with them. Primarily interacting with the macroscopic scale via our sense of sight and hence with the limited, fixed, definite state output of that sensory processing. Object reality exists at all scales including the astronomic and sub atomic. There is another divide which is between Object reality and Image reality. Object reality is what exists preceding all observed present representations of it. This can be said because experienced presents are fabricated from received data that has been emitted from objects and then processed, which takes time, (iterations of the Object universe). The time taken may be extremely small when objects are in close proximity nevertheless the speed of light is finite. Within the Object reality is the potential sensory data to form image realities of former things and events. This is data spread within uni-temporal space it is not space-time, as space-time is the output generated by processing of the data. Nor is it the space-time continuum as it can only be processed into Image reality outputs not substantial objects and events, and it does not include any potential data from events that have not yet occurred in substantial material reality.

E: True, absolute relations V relations within space-time images

The question of whether there are spatial relations between objects at different times presumes that there can be *Objects* at different times. That is so for a space-time model such as Block time. A uni-temporal Object universe precludes that possibility. There is only one extant time, Uni-temporal Now. That does not mean that Objects cannot be affected by the former action of other objects, and calculations made. Such as a boat rocked now by the wake of a passing of a boat then. The true, absolute relations are those between substantial I.e. material objects within the same configuration of the Object universe.

The question also requires differentiation of Image from Object reality because there can be spatial relations between parts of an image that pertain to different times. The distances shown in the image

could then be measured 'on the ground', giving a concrete measurement of an Image reality or could be estimated for astronomic images, giving the distance between corresponding source Objects; even though the EM radiation from which the different parts of the image is formed was not produced during the same configuration of the Object universe, I.e. not at the same time. The image is real but also a distorted representation of what has existed. The measurement even if concrete pertains to the Image reality.

Any experiment involving observation (using the sense of sight or sound or a device to be proxy for that visual or auditory system such as a camera) is using the output of sensory data collection and processing. That might be emergent sound or images in the case of an organism being the observer or some other output in the case of a device collecting the sensory data. There may be awareness of or evidence of *apparent* interactions of those images (which is not the same phenomenon as interaction of material objects).

F: Magic (a short note of caution)

It is easy to presume that a dog knows, with certainty, that the biscuit obscured from view still exists. Magic is real if material objects only come into existence upon observation. (As has been suggested by for example the participatory universe hypothesis of QM.) Observation produces a manifestation from received data, it does not create substantial objects. Magic is misdirection, distraction and skillful handling / manipulation. Causing a subjective reality to be constructed by the audience based upon incomplete information, playing to the "what you see is all there is" bias, the human tendency to draw strong conclusions from incomplete information. Daniel Kahneman, 2011¹⁶. The difficulties and incomplete information obtained from quantum scale experiments can lead to similar 'magical' misinterpretation. And also the belief that macroscopic reality is of fixed limited states (because that is what is observed) rather than the absolute reality of all possible states that could be observed underlying impoverished perception.

"The question of whether or not when you see something, you see only the light or you see the thing you're looking at, is one of those dopey philosophical things that an ordinary person has no difficulty with. Even the most profound philosopher, sitting eating his dinner, has many difficulties making out that what he looks at perhaps might only be the light from the steak but it still implies the existence of the steak which he is able to lift by the fork to his mouth. The philosophers that were unable to make that analysis and that idea have fallen by the wayside from hunger." Richard Feynman 17.

G: The need for an explanatory framework

The facts

1. a) Einstein's relativity works to describe what will be observed. b) It's a mathematically complete theory in itself. c) It corresponds with experimental results.
2. a) QM works mathematically. b) It corresponds with great accuracy to experimental results.
3. Together they seem to account for the phenomena of physics at all scales. (Although they are seemingly incompatible by reason of mutual contradiction.)

The problems

1. Einstein's relativity is completely deterministic but QM relies upon probabilities and so is non deterministic.
2. QM and classical physics including relativity appear to work at different scales.
3. How the transition from quantum to classical physics occurs has been unclear.
4. Classical physics can't explain; the probabilistic nature of radiation, the photoelectric effect, line spectra, black body radiation, wave properties of the electron. QM can.
5. How gravity fits into Quantum physics has been a long standing problem.
6. There are a number of paradoxes associated with relativity. Used alone Space-time allows the possibility of time travel and associated paradoxes. It does have an unambiguous foundational sequential order that provides causality but with Lorentzian manifold space-times there exists a hierarchy of causality conditions including Space-times with closed time-like curves.
7. There's a problem at the quantum scale that arises from prior assumptions about the nature of what is measured. i.e. that it is a measurement of inherent properties and not produced during the measurement process. Addressed in "An examination of measurement relevant to entanglement and ontology: Answers to some long standing questions." Georgina Woodward July 2016 ¹².
8. There seems to be an arrow of time that is inexplicable by Einstein's relativity or QM.
9. Relativity and QM appear contradictory.
10. Complete determinism is at odds with; concepts of choice, free will, evolution of the ability to think and make decisions and choices, functional morality, altruism and selection through competition. As it implies that all responses and outcomes are predetermined. Therefore, fully automatic, despite the strong feeling that this is not so.

11. Definite alternatives and never super positions are observed. The what, where and how it is decided what an observer shall see needs explanation. The Copenhagen interpretation ¹³. requires a classical domain that will only allow one particular outcome. Many Worlds ¹⁴. has branching of the wave function but an observer who is only aware of one branch. There is no evidence of the other universes that are not the branch being experienced, yet the model requires acceptance of their existence. Neither model is wholly satisfactory.

12. Without an ontological source reality for measurements and observations magic is accepted into the subject of physics.

H: The explanatory framework illustrated

Word List and definitions.

These definitions are given to avoid ambiguity of meaning which can cause the explanatory framework to be misunderstood. It can be used as a reference to check that the same meaning of the word is being used and applied.

In order for this explanatory framework to work in modeling reality, answering questions and overcoming paradoxes it is necessary that the terms are understood and applied only as defined for use in this context.

Alternative definitions cannot be substituted or added, even though they may be perfectly acceptable meanings of the terms in other situations and may be widely accepted to have those meanings. Unless the meaning and its function is entirely unaltered by that substitution. Where the meaning being used is consistent with an English dictionary definition that is often given. Where a dictionary definition has not been given it is important that such a definition is not substituted or used alongside the definition given unless care is taken to ensure the meaning or function is not altered in doing so.

Actualization

1. That which has become actual or real independently of observation. That which has existence unobserved and unobservable, independent of all observer's perspectives and potential observer perspectives. 2. The material / substance / objects / media (ontic things of corporeal or material nature) within foundational space. I.e. That is within / makes up the source (Object) reality

Category error. failure to correctly identify or discriminate between different kinds of element of reality belonging to the different facets of reality.

Causality front

Another name for Uni-temporal Now. Useful when discussing causality within space-time. An event that is observed is not at the causality front as it takes time for data to reach and be interpreted by an observer. The delay depending upon distance from the interacting objects. It is the simultaneous changing of the iteration of the universe according to the forces, gradients and potential differences acting upon the arrangement of objects to allow, constrain or prevent changes, giving a new pattern formation or reiteration of existing pattern.

Change

1. to make or become different; alter. 2. To replace or exchange for another: to change one's name 3, to transform or convert or to be transformed or converted.

The new Collins concise dictionary of the English language.

(Spatial change.)

This term is used to refer to a change of spatial position or location. It could refer to a translation, rotation, scaling transformation or combination of such operations.

Data pool

The totality of all potential sensory data within the uni-temporal environment.

As we are primarily visual creatures so this is used to referring mostly to EM waves, visible and detectable with artificial devices. Though it can also include sound waves, ultra and infra sound, chemicals in the air, chemical dissolved in water, electric fields, magnetic fields, gravitational fields. Detectable by the human organism, other biological organisms, artificial devices, sensitive materials.

D.P =Data Pool

Potential sensory data. That information within the external environment that is potentially accessible to the senses of biological organisms directly or via technology. EM data but also sound waves, chemicals in air and liquid, magnetic data. Potential sensory data passes into the pool from Object reality e.g. by reflection or emission of EM, sound waves or chemicals from objects. (Black arrows on diagram 1.) It is a sub set of Object reality. The potential sensory data is concretely real but cannot be observed except through the Manifestation of it in an Image reality.

Energy

Change of spatial position of an object or objects, particle or particles, material, substance or medium in source reality, which may or may not have related observed manifestation. Or potential for such change. Energy of sufficient magnitude can be observed through the work it performs. Though it must be remembered that if it is relative Image manifestations that are measured, the amount of *seen* change can be different for different reference frames; even though the change within the unobserved Object reality is the same. Change or potential for change can be regarded as energy.

External reality

That which exists externally to the observer but is not the space-time manifestation produced by the observer. Used instead of source reality when talking about its relationship to the observer.

Future

A term that needs further clarification as either Pre-written future (written future) or Unwritten future/ Open future / Future (unwritten). It is important to differentiate unwritten future pertaining to Object reality, and pre-written future pertaining to information in the environment. \cup Future, ρ Future

Gross Set

All Potential sensory data within the environment *pertaining to a particular source object*.

Imaginary historical time line

An imaginary line along which the former iterations of the object universe can be imagined. A line threaded through the iterations would represent the path of an object has taken through space. The former iterations do not exist; they are not an existent past- but can be imagined.

Iteration

Repeatedly solving an equation to obtain a result using the result from the previous calculation, is called '**iteration**'. From iterate to say or do again, repeat. Iteration of the Object universe is production of the

result from all of the processes (constrained and allowed by the existing variables and parameters in the uni-temporal space) [akin to the calculation] using what exists (as the input / ingredients) to form what comes next, the next actualized configuration.

Manifestation

1. The output of an artificial detector or sensitive material when data is input. e.g. photograph, sound recording, click of Geiger counter.

2. That which is seen / experienced by an observer and is *considered* by that observer to exist or to have originated externally to him / her self. Either formed through input and processing of sensory data from outside of the observer, or internally generated, or both.

iM= Manifestation observed. Image reality. Shown as M. and M on some of the RICP diagrams but iM is preferable to distinguish from M used in physics for moment of force and m used for mass

This is the representation produced from the data intercepted. It could be the conscious experience of a higher organism. Or film image produced by a camera or other type of representation produced by an instrument that receives data and gives an output using the input.

Past, present and future

Terms related to space-time both experienced and mathematical. Terms that reflect the experience of the observer from his particular perspective. Which depends upon reference frame and distance from the origin of the potential sensory data intercepted. See the individual word definitions for more information.

Present / present-now / here-now / "now"

All terms for the observed manifestation formed by an observer from received sensory data and formed through internal processing into a representation of external reality. Either referring to just the appearance in space (present), in space-time (present-now / here-now), or in time ("now").

This may be events occurring externally to the observer or reported to him / her in real time such as a live TV show. The temporal delay between the recording of the event and the observation of the show will not alter the perception of it as occurring "now". **Not the same as Uni-temporal Now.**

Past

A former present-now manifestation that was seen by the observer in question, and has been superseded. A former present-now of other observers reported to the observer in question and so known to have happened. (See records), _RPast. It is important to differentiate a formerly existing actualization or event in Object reality from a formerly observed present-now and from records or relics currently existing: _OPast, _IPast, _RPast.

Output (Image) reality

The manifestation(s) output formed by an observer whether a biological organism or artificial detector, or sensitive material. Formed from the receipt of input converted into different output. The universe does not come into existence from many co-existing possibilities when viewed by an observer but the manifestation is created from environmental data emitted or reflected from the *prior* actualization of the Object Universe and received and processed by the observer.

Potential

1. adj. possible but not yet actual, capable of becoming, latent 2. verb expressing possibility 3. latent but unrealized ability. Collins Concise dictionary of the English language.

adj. capable of becoming or of being used or of being developed. noun. an ability or capacity for development or use. The New Zealand Oxford paperback dictionary.

Pre-written future

Potential sensory data within the environment that may later be received by an observer and be processed into an experienced present. ρ Future

Real

adj. 1. Existing or occurring in the physical world, not imaginary, fictitious or theoretical; actual 2. True, actual not false. 3. deserving of the name; rightly so called: a real friend. 4. not artificial or simulated; genuine: real fur. 5. Philosophy. existent or relating to actual existence rather than non-existence, existing. The new Collins concise dictionary of the English language.

Reality

Differentiation between Object reality that is the ontic, absolute and truthful reality and Image reality, that is relative, partial and may present a distorted representation of Object reality, is required. This is somewhat different from the use of the word 'reality' in general parlance. 1. the state of things as they are or appear to be, rather than as one might wish them to be. 2. something that is real. 3. the state of being real. 4. philosophy. a) awareness b) the totality of facts. 5. in reality. actually, in fact. The new Collins concise dictionary of the English language.

-Reality: the quality of being real.: resemblance to an original. 2. All that is real, the real world as opposed to fantasy. NZ Oxford English dictionary

Reality Interface

In this explanatory framework the reality interface is an object, system, material, device or organism's sensory system that converts received EM radiation or other potential sensory data input that is unobserved to different observed / experienced or observable / experience-able output. An interface between the underlying, source reality and perception. Imposing orientation and relative reference frame. It gives a limited fixed state output, that pertains to the information input from the environment.

The Prime reality interface

The human (or higher sentient organism's) sensory system and central nervous system that converts received sensory data input into observed / experienced output reality.

Records

Records clearly are not the past itself but storage of some characteristics / facts / features of a former observed manifestation. Prone to influence of subjective opinion, bias, deliberate or accidental falsification, loss, alteration, or exclusion of data. To avoid ambiguity, it is best not to refer to any of this as the past. If it is there should be a disambiguating R prefix, forming R Past.

That which exists within records both external to the observer such as data stored on disc, tape, vinyl, mp3, paper etc. or internal memory of the former observer of it.

R= Records. Physical records of all kinds.

I.R.= Internal Records i.e. Memories. Storage of information within the biological organism through growth and connection of neurons. Subjective past. Sub set of **R**.

Representation

Representation: 1. the act or an instance of representing or the state of being represented. (re-present) vb. to present again. 2. Anything that represents such as a verbal or pictorial portrait. 3. anything that is represented such as an image brought clearly to mind. The Collins Concise dictionary of the English language.

Representation: n. representing or being represented 2. something that represents another e.g. a picture or diagram. The New Zealand Oxford paperback dictionary.

Source (Object) reality

It is possible to comprehend the existence of a foundational reality separate from experience, which although it cannot be experienced can be theoretically and logically modeled. That is a model of what exists as substantial reality.

Substantial, (6. real, actual, true; 7. relating to the basic or fundamental substance or aspects of a thing (The new Collins concise dictionary of the English language)), rather than interpretation or simulation or image of reality formed from sensory input and internal processing by the brain, artificial device or reaction of a sensitive material or substance. The existing source reality and the observed output reality, are not identical. They can be separated as concepts in the mind and therefore also within a theoretical model to aid comprehension of physics.

1.The source or Object reality is: The actualization of the Object universe. 2.That which exists independently of; the manifestations seen by observers and produced from detections by artificial devices. 3. The origin of sensory data and potential sensory data which is emitted or reflected from it. It includes the source objects for the data in the environment, the data and its medium of transmission, and the observers, living and artificial.

Sequential

Another word for sequent. Sequent: adj.1.following in order or succession .2. Following as a result. 3.Something that follows. The Collins concise dictionary of the English language.

Time dimension

The 4th dimension of space-time within Einstein's relativity. The scalar dimension of time that is used together with 3 spatial vector dimensions giving the geometry of the space-time continuum. Within the RICP explanatory framework it is a dimension relating to *the informational content* of EM radiation within Uni-temporal Now; that is related to the Object Universe configuration (Uni-temporal Now) in which it was emitted.

Uni-temporal Now or Objective-Now

Current time when referring to the temporally homogeneous spatial arrangement of the Object reality universe under consideration. Called Uni-temporal Now, or Objective Now to distinguish it from the present. It spans the whole Object Universe and can be regarded as a single co-existing spatial arrangement and distribution of objects in space, **not** space-time. The current and only existentially real configuration of objects, forming a part of a sequence or continuum of such arrangements (depending on how change is regarded).

Unwritten future / Open future / Future (unwritten)

1. That which has not yet happened in unobserved reality. 2. Imaginary future. 3.A non-existent 'realm', not a part of reality. uFuture

Key

A. Actualized, an ontic, corporeal / material, element of Object reality. Ab. absolute, no singular reference frame applied

D. Definite; Certain and un-altering in that respect

EOIR. Element of Image reality

EOOR. Element of Object reality, not same as objective reality

GS. Gross Set. All Potential sensory data within the environment pertaining to a particular source object

Image reality. Emergent output reality from sensory data /measurement processing, Individual observer specific or objective via shared output or shared sensory data input

L. Limited (partial sample)

FS. Fixed state. A selection giving one un-altering state

MS. Mixed state. A selection containing more than one state

M. Manifestation. Output of EM information processing. Though M. and M are shown on some of the RICP diagrams ,M is preferable; to indicate it is an Image reality and to distinguish from M used in physics for moment of force and m used for mass

O. Observable

Object reality. Foundational, source reality of substantial objects and particles and potential sensory data

Objective reality. Multi-observer corroborated Image reality

PSD. Potential sensory data

R. Related to

Reality interface. Interface between Object reality and Image reality where input sensory data is converted to output manifestations

The Prime reality Interface is the human sensory system including the CNS (central nervous system). That converts input sensory data from Object reality into experienced present manifestation

S. Source. A substantial EOOR that is source of the potential sensory data under consideration.

Subjective reality. Personal experience of Image reality

Pre-written future. PSD. within the environment that may be received by an observer and be processed into experienced present

Uni-temporal. Singular universal time of Object reality. Passage of time being the change in configuration of the Object universe, only the youngest arrangement having substantial existence. The sequence of arrangements is imaginary (it has no substantial reality)

Unwritten future. Imaginary future that has no substantial existence

RICP Diagram 1

RICP Diagram 1 is an older diagram. Note that the future outside of Object reality is designated unwritten, open. This represents the non-existence of a material future in contrast to the concept of the space-time continuum as conceived by Einstein. The unwritten future is distinct from the pre-written futures contained within the Data pool: EM data that is possibly encoding, yet to be experienced, present experience of observers.

There is no material past and no material future in a uni-temporal Object reality, only what exists at Uni-temporal Now (independent of observation). That which has formerly been, no longer existing, an extinct configuration of the Object universe, is unambiguously, different from that which substantially exists and that which has not existed. Though it has no existence in its entirety, some parts of the configuration will materially persist and it will have had lasting effects extant within the Now existing. Object reality 'past' is only evidence of former objects, relations and events stored within memories and records. Distinct from partial information pertaining to objects, relations and events encoded in EM potential sensory data. Events already experienced by one observer thus deemed by him as past -but that might yet be experienced by another. It can also be seen that Uni-temporal Now or the existent configuration of the Object universe is the causality front, where possibility and potential become the physics that happens. Object reality is the actual ever changing position and arrangement of objects particles and waves relative not to any single observer but to the spatial positions of all other constituents of the temporally homogeneous Object universe.

Object reality has no geometric time dimension but the sequence of configurations can be imagined spread along an imaginary time line. Action over time can be depicted diagrammatically but it must be remembered that temporal component does not have metaphysical existence within this framework. Current time when referring to the temporally homogeneous spatial arrangement of the Object (reality) is Uni-temporal Now. The content and configuration of which precedes the Image reality representation of it. Called 'Uni-temporal Now' to distinguish it from the (observed) present. It spans the whole Object Universe and can be regarded as a single co-existing spatial arrangement and distribution of objects in space, not space-time. The current and only existentially real configuration of objects, forming a part of a sequence or continuum of such arrangements (depending on how change is regarded).

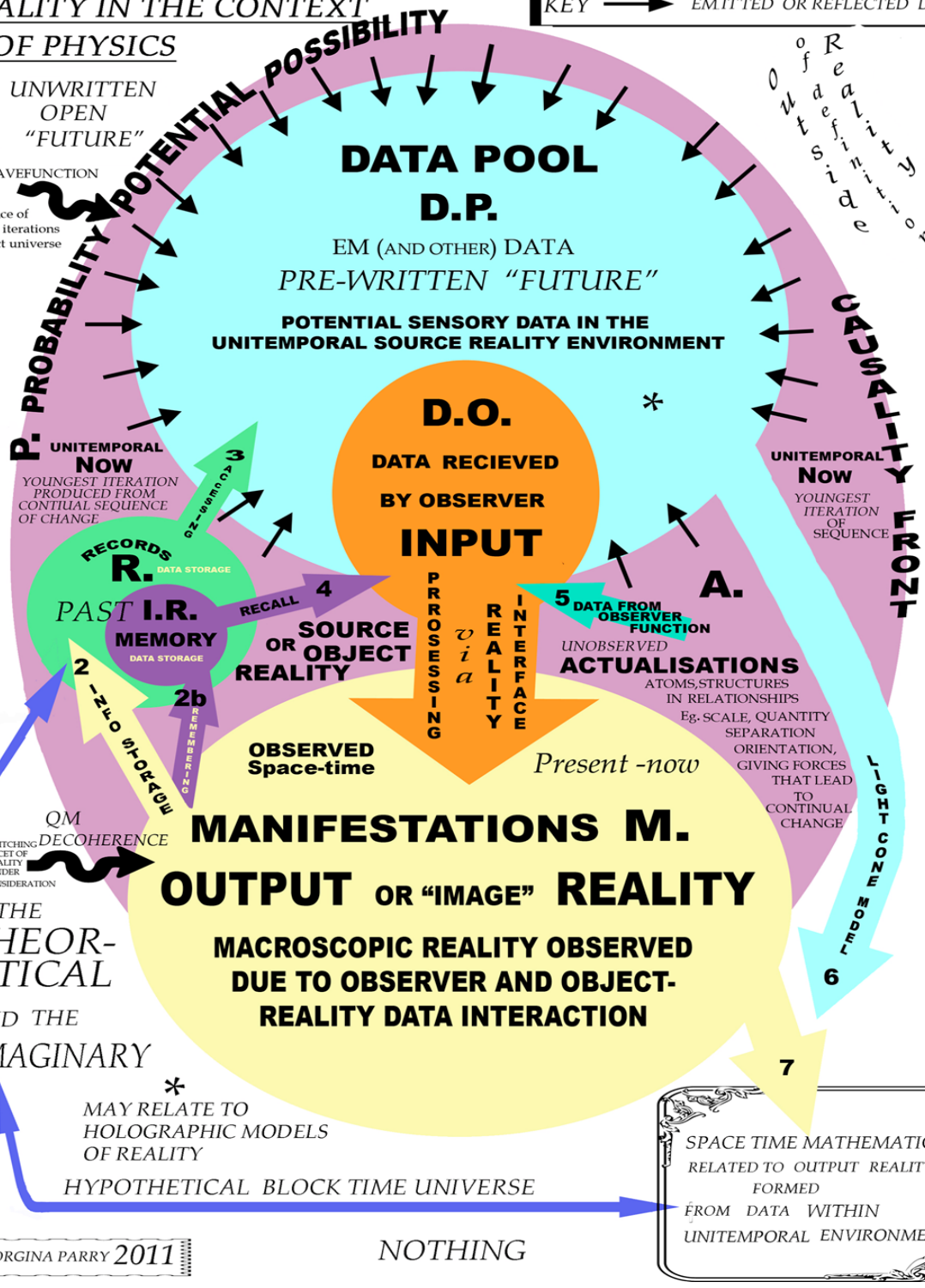
Change or potential for change can be regarded as energy. Energy is never destroyed. Sir Isaac Newton 1687¹⁵. Change is continual and inevitable. Even if a particular structure or particle does not *appear* to change form or position in local space it will still change its universal position when all scales and all relative relations are considered. Every change of configuration of the Object universe leads to further change; giving the incessantly rearranging soup of causation within temporally homogeneous Object reality space. It is the simultaneous changing of the iteration of the universe according to the forces, gradients and potential differences acting upon the arrangement of objects to allow, constrain or prevent changes, giving a new pattern formation or reiteration of existing pattern. Represented on the diagram by the "Causality front" indicated on the boundary of the open, unwritten future and the configuration existing at Uni-temporal Now

REALITY IN THE CONTEXT OF PHYSICS

KEY → EMITTED OR REFLECTED DATA

F. UNWRITTEN OPEN "FUTURE"

QM WAVEFUNCTION
Sequence of Former iterations of object universe



of Reality outside of definition of

P. PROBABILITY FRONT
UNITEMPORAL NOW
YOUNGEST ITERATION PRODUCED FROM CONTIUAL SEQUENCE OF CHANGE

CASUALTY FRONT
UNITEMPORAL NOW
YOUNGEST ITERATION OF SEQUENCE

RECORDS R.
DATA STORAGE
PAST I.R. MEMORY
DATA STORAGE

SOURCE OR OBJECT REALITY

A. UNOBSERVED ACTUALISATIONS
ATOMS, STRUCTURES IN RELATIONSHIPS
Eg. SCALE, QUANTITY SEPARATION ORIENTATION, GIVING FORCES THAT LEAD TO CONTINUAL CHANGE

OBSERVED Space-time

Present -now

MANIFESTATIONS M. OUTPUT OR "IMAGE" REALITY

MACROSCOPIC REALITY OBSERVED DUE TO OBSERVER AND OBJECT-REALITY DATA INTERACTION

SWITCHING DECOHERENCE
THE THEORETICAL AND THE IMAGINARY

* MAY RELATE TO HOLOGRAPHIC MODELS OF REALITY

HYPOTHETICAL BLOCK TIME UNIVERSE

SPACE TIME MATHEMATICS RELATED TO OUTPUT REALITY FORMED FROM DATA WITHIN UNITEMPORAL ENVIRONMENT

GEORGINA PARRY 2011

NOTHING

RICP Diagram 2

More clearly illustrates the truly emergent nature of Image reality. That Image reality is not a part of Object reality without being produced from the EM or other sensory data by means of a reality interface device or organism's sensory system. Object and Image reality are thus shown clearly as different categories of reality. Though it is necessary that the ontic facilitation of Image reality be contained within Object reality. That means for example the EM radiation interaction with screen or retina are substantially real events in Object reality. However, *the meaning* derived from the information input does not have substantial existence in Object reality. It is in this way possible to have a 'known' space-time visible universe contained within the space only Object universe, as the former is an epistemic construct and not substantially real. This can be likened to the fantasy world contained within a book. The dimensions of the story world far exceeding the dimensions of the substantial book. The story world is not the external reality outside of the book, nor the book or any facet of it such as the ink or the symbols drawn with it. It is what is formed from processing of the information, conveyed by the information content, of the book. This is a useful analogy for Image reality. Though experienced as reality and sometimes used as a test of reality (I'll believe it when I see it) Image reality is the product of information processing and not the external reality nor any of the beables necessary for its production.

RICP Diagram 3

This shows Object reality by way of set structure. The largest set being the entirety of Object reality. There are potential sensory data sub sets within. The larger of the sub sets being all potential sensory data within the environment and the smaller the limited selection of potential sensory data received by an observer. Processing of EM information is shown as a transition from ontic Object reality to the reality formed from information processing, relative Image reality, across a reality interface.

There is no clear delineation between the past, present and future across different observer's output Image reality (from processing of received EM radiation). There is non-simultaneity of events because different sensory data is received and processed together by different observers, into the individual reality that is observed by each.

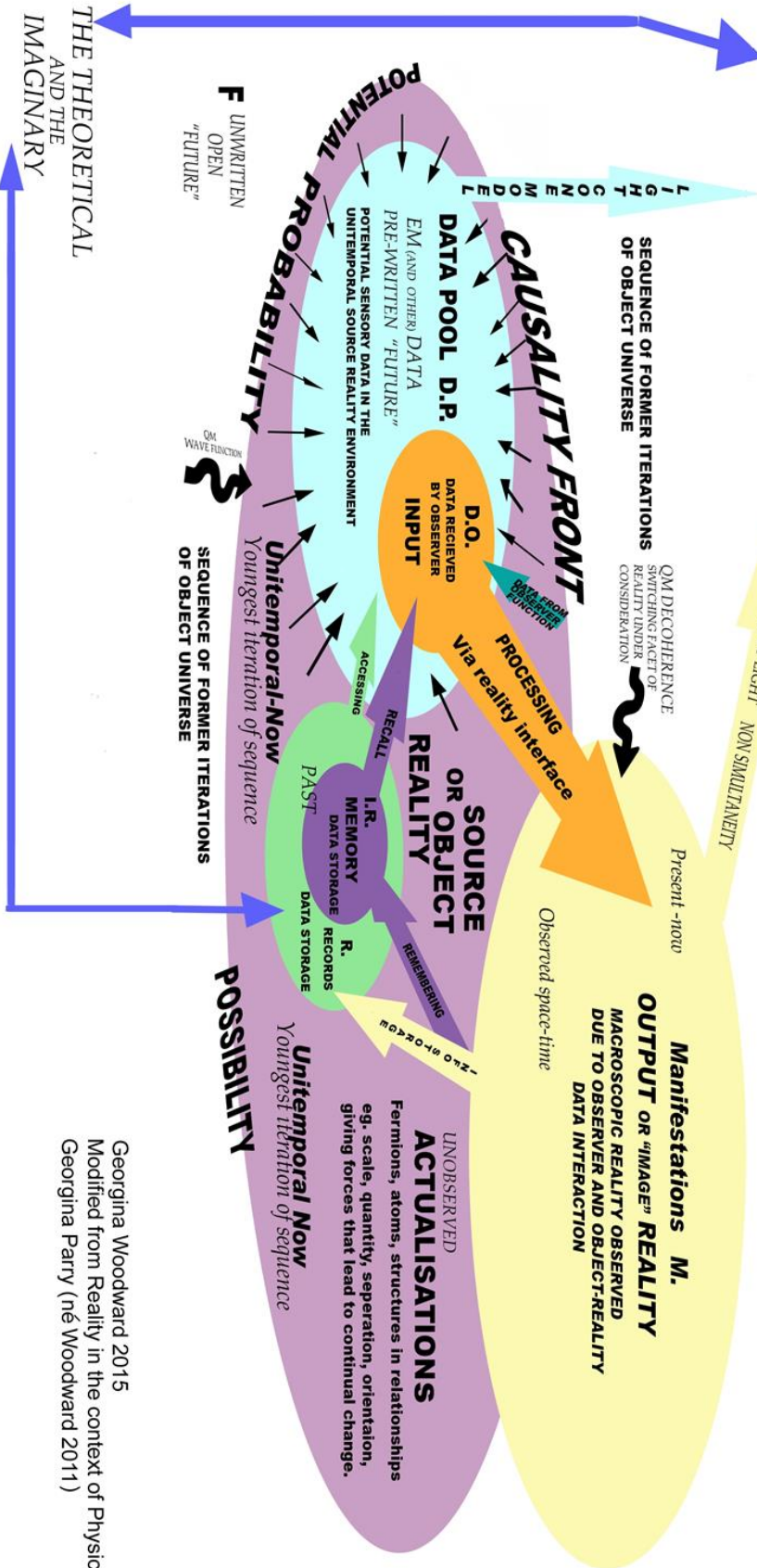
REALITY IN THE CONTEXT OF PHYSICS

KEY —→ EMITTED OR REFLECTED DATA

NOTHING

0
1
2
3
4
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6
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8
9

SPACE-TIME MATHEMATICS RELATED TO OUTPUT REALITY FORMED FROM DATA WITHIN UNITEMPORAL ENVIRONMENT



Georgia Woodward 2015
Modified from Reality in the context of Physics
Georgia Parry (né Woodward 2011)

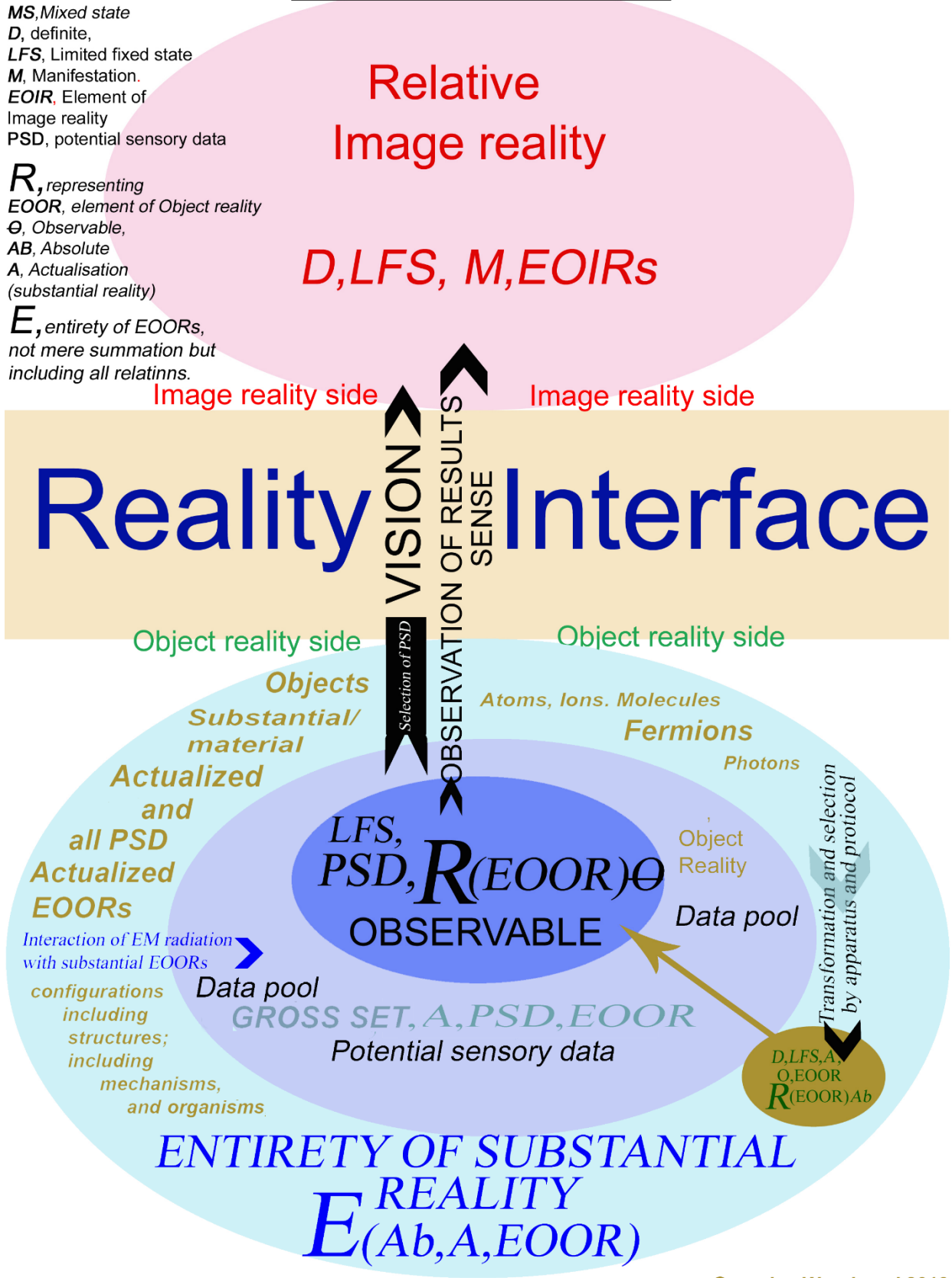
Key

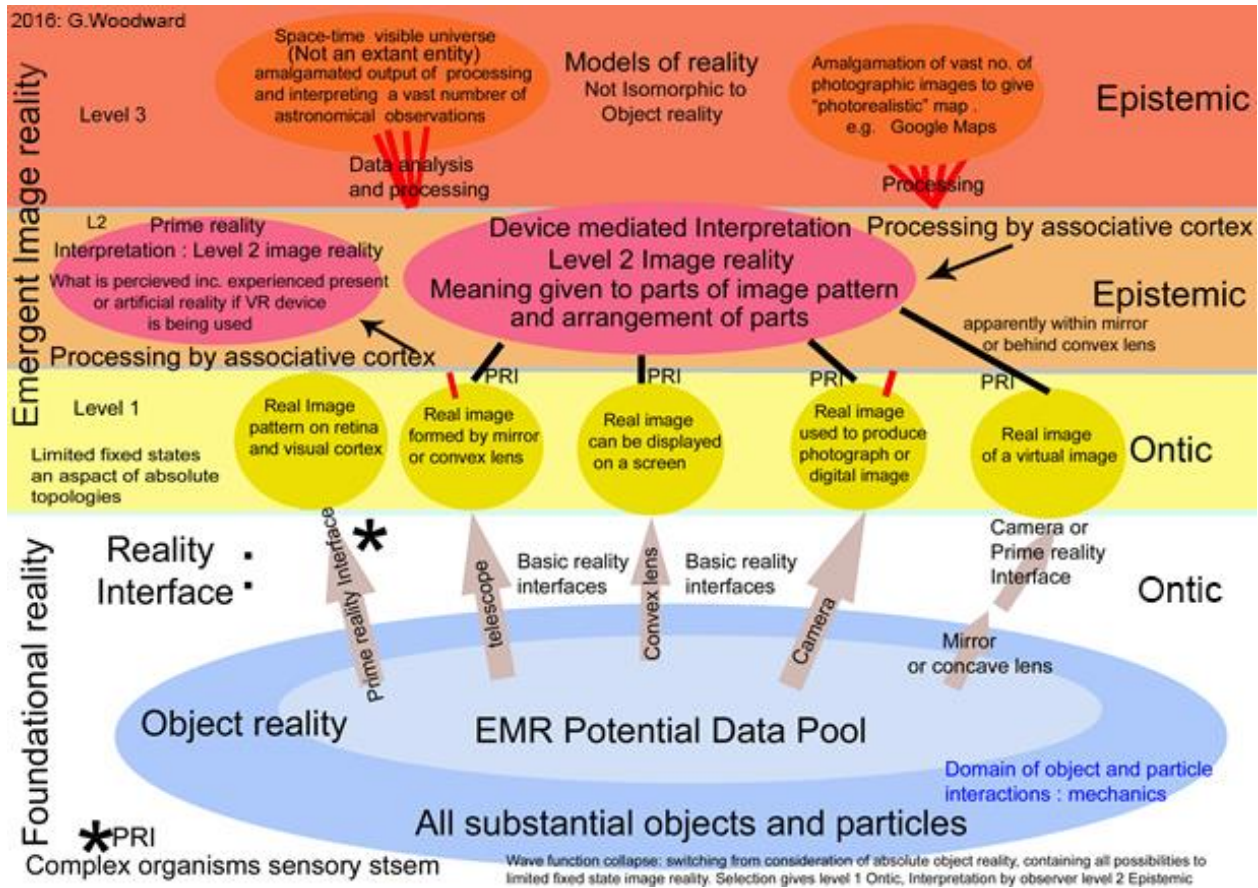
MS, Mixed state
D, definite,
LFS, Limited fixed state
M, Manifestation.
EOIR, Element of
 Image reality
PSD, potential sensory data

R, representing
EOOR, element of Object reality
 Θ , Observable,
AB, Absolute
A, Actualisation
 (substantial reality)

E, entirety of *EOORs*,
 not mere summation but
 including all relatinnns.

The Physics of Reality





RICP Diagram 4

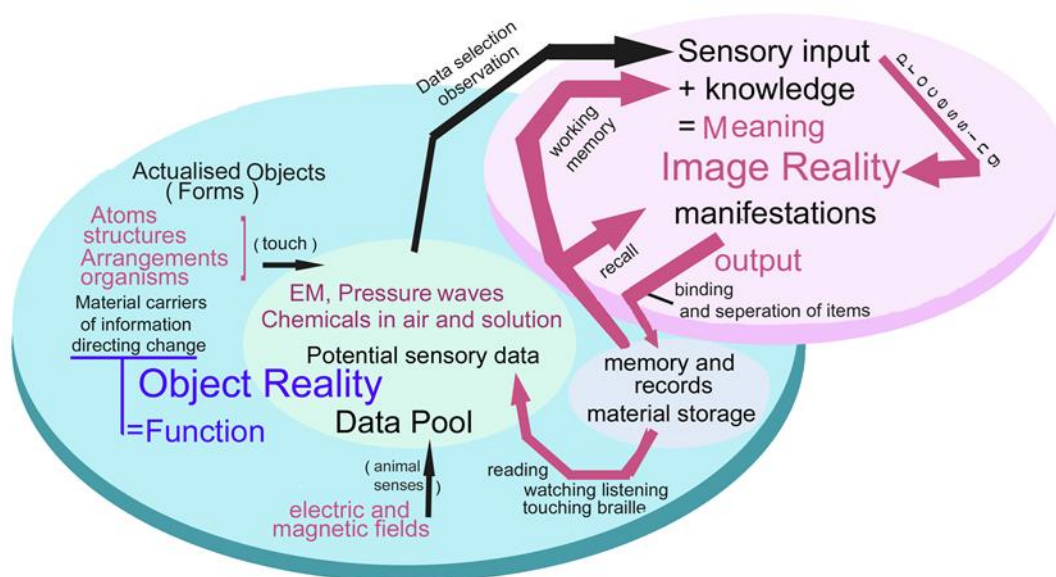
Diagram 4 shows 3 levels of Image reality from simple image production, to interpretation and perception, to model production from image inputs. It seems that relativity, is actually dealing with how objects are seen by observers in different reference frames and the relativity of perception of events. It has the EMR of the data pool of Object reality as input and the level 2 Image reality as output. Relevant to the dispelling of the paradoxes of relativity and space-time continuum model.

Level 2 Image reality: The human experienced present is produced from limited fixed state images of objects 2 x 2D only 'rendered' 3D in appearance by later processing, distinct from the absolute forms of objects in Object reality. Also the temporal spread within the images does not exist within any configuration of the Object universe. Relativity of simultaneity and relativity of observed forms belong to this realm, though the source is the EMR potential sensory data within Object reality. The distribution of the potential sensory data is ontic but what that data is processed into, what it appears to show, is not that ontic reality.

Level 3 Image reality: Amalgamation of many images produced over time and at different times in different locations. E.g. Google Street View. The output of amalgamation is a composite image of the World (or universe)

as it has never existed and never will, in the form shown in the image, incorporating temporal spread, and temporal spread anomalies. Despite apparent similarities it is not isomorphic to any previously existing Object reality. The epistemic content of the image is a separate emergent level of Image reality to the image displayed on a computer screen or paper print out. The composite product can be observed as a level 2 (technology mediated) experience of a level 3 output. Further removed from direct level 2 experience of the World or visible universe.

RICP Diagram 5.



Use of the diagrams: The diagrams provided together with the word list with definitions, and key to abbreviations should be sufficient to allow the explanatory framework to be understood and used within physics. It is most important that physicists avoid category error. It is important to compare like with like. Physics should identify which facet of reality they are working with and whether relativity or simultaneity should apply, or if there is a switching from one to the other. The diagrams can be simplified by removing extraneous or superfluous information to suit a particular purpose or by filling the blank template of the diagram with only that information required for a particular purpose. For teaching and learning Information can be progressively added as the pertinent content is addressed. The diagrams are intended to be highly informative but that should not be a hindrance to comprehension if the information is considered gradually rather than all at once.

I: This explanatory framework (Points in its favour);

- Allows Einstein's relativity and QM to co-exist without contradiction.
- It shows there is a place in physics for substantial, material ontic reality, including atoms and fermion particles. A reality that exists not just at one scale but from the sub atomic scale through to astronomic scale.
- It provides an ontic background for QM. To be complete QM requires that there are beables including the apparatus and its configuration, and observer and not just information modelled by a wavefunction. It is the same background that completes relativity underlying what is observed
- It explains the arrow(s) of time, Due to continual sequential change of the arrangement of Object universe and unidirectional input of data from Object reality to Image reality. That continual sequential iteration gives passage of time and gives the "preferred foliation" necessary for QM models.
- It provides a deep understanding of time in physics.
- It shows there is a home for Absolute truth.
- It gives understanding of the cause of the temporal paradoxes of Einstein's relativity.
- It answers with certainty 'is the moon there when I'm not looking? Which is a demonstration that excludes from physics the magical thinking of objects only coming into existence when seen.
- This explanatory framework, explains the transition of Quantum physics to classical physic as the transition from considering a model of unobserved reality to considering the another facet of reality the output of measurement or observation, Image reality: Rather than there being a wavefunction collapse. So explaining the measurement problem of QM. The experimenter finds just one version of reality because one selection of measurement is made from the possibilities available to him / her
- Fitting gravity into Quantum physics models has been a problem. This explanatory framework allows it to be considered differently. Having its source in the foundational uni-temporal environment of Object reality, the ontic background, rather than in curvature of space-time. It has been shown here, that space-time is an emergent output from EM information processing, a product and not a source reality. The apparent space-time curvature output being due to the alteration of the distribution of EM radiation in proximity to the gravitational mass compared to distribution in open space, not in proximity to large gravitational bodies.
- This explanatory framework allows partial non-determinism. Via an open unwritten material future and the possibility that there can sometimes be more than one equally likely outcome to the

change of a configuration of particular elements of Object reality and associated relations, because of the particular forces and variables acting within the extant configuration. Only one outcome is actualized, overcoming the philosophical and theological problems highlighted earlier. This might be said to be the locations where “God plays dice”.

- This framework overcomes the moral and theological problems that are inherent in the space-time continuum / ‘Block time’ type models in which all occurrences are fully predetermined and persist within the continuum for all time. A fully existing space-time continuum is a merciless universe in which created cruelty and atrocity persists rather than ends. It makes redundant: a) functional morality b) choice and free will c) The Creator, since the job is done. A Many Worlds Multi-verse, where everything that can happen does, is a terrifying fantasy when worse case scenarios are imagined. Worse than a singular, cruel and merciless, fully determined universe.
- Good explanations are difficult to vary while retaining the same explanatory power. The complexity of the explanatory framework is necessary for its function.
- It’s an inclusive outline map that includes territory already explored by physics. It does not require wholesale rejection of major pieces of physics theory but only reconsideration of their foundations and conclusions that have been drawn from them, allowing them to be understood ‘in a new light’.
- This explanatory framework will be invalidated by any conclusive proof of time travel from a material-temporal realm other than Uni-temporal Now. For example, the finding of a ‘Worm hole’ permitting travel to and from another such realm, rather than just travel between regions of electromagnetic information pertaining to temporally very different sources, giving the visual impression of time travel.
- The pathways of particles and objects through the historical sequence of iterations may be imagined as strings. Though they are imaginary as only the youngest (most recent) iteration of the Object universe exists. So they only ever have one extant position **not** a continuum of positions spread over time i.e. over many iterations of the Object universe. Although they do not have concrete existence considering the pathways and interactions through the iterations could still be useful.
- The Entirety of reality, including both Object reality and Image reality outputs that occur within it (but can be differentiated from it), is more complex than a ‘Block time universe’ or a simple branching Multi-verse. So there’s lots for scientists and mathematicians to explore.

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