In Search of Reality

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Abstract

In this paper I will discuss the underlying philosophy of physics. A new definition of observer is presented, then the meaning of two words, existence and reality, will be re-examined. With changes made for these three items a new philosophy emerges that allows an examination of the concepts of cause and effect, time, space and how mathematics enters into physics. The new philosophy suggests a structure of the universe that indicates both an understanding of the double slit experiment and a new approach to the quantization and root cause of gravitation.

KEYWORDS [Philosophy of Physics, Observers, Existence, Reality, Space, Time, Causality, Gravitation, Quantum Theory].

1 Introduction

There are many outstanding problems in modern physics. Quantum theory provides a very accurate means to study the micro scale universe, but we have no idea why it works.

Feynman[Rosenblum, 2011],

> *The two slit experiment contains the only mystery. We cannot make the mystery go away by explaning how it works.*

Gravitation theory provides a very accurate means to study the macro scale universe, but what is its root cause and how does it fit with the other

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three fundamental forces. Many attempts have been made to quantize gravity but none have yet succeeded.

In this paper I will take a close look at the two words, existence and reality, and the human creature that invented and defined them. I will attempt to follow Einstein's advice[Einstein,1916]

look beyond the multitude of trees and examine the forest,

to show how these three items, the human creature and the two words, impact physics. I will not discuss its history or add to the common pool of theoretical knowledge. When we speak of reality it generally means the state of the universe as it actually exists. Thus reality and existence are intimately entwined. The meaning of words in many ways sets the direction of philosophy, physics and science, as well as all other human interactions. Words often derive from the past and often have their roots in antiquity. Human beings invent words and use them, in part, to build models and theories of the universe.

The concept of observer permeates modern theoretical physics, but is never fully defined. How is it defined and how does it fits into reality. In theoretical physics the precise meaning of an observer varies with application. In classical physics, a hypothetical non-accelerating observer exists in an inertial system.

In Newton's laws of motion and the Special Theory of Relativity apply to measurements made by such observers. The term observer refers most commonly to the "infinite" inertial reference frame. This use differs from the common meaning of "observer", so it is not necessary to speak further of an observer: the reference frame is sufficient.

In the General Theory of Relativity the term "observer" refers more commonly to a person (or apparatus) making passive local measurements, a usage closer to the common meaning of the word: A person who watches or notices something.

In Quantum Mechanics, "observation" means a quantum measurement. An "observer" creates a measurement apparatus and selects observables that can be measured. It is recognized that an observer making measurements fixes the outcome from the many possible outcomes presented by the quantum world. There is much discussion about the connection of quantum

measurements and consciousness.

Many of the physicists that contributed to the development of modern physics have had much to say in this regard. I shall include some of their quotes[Rosenblum, 2011]

Martin Rees;

> *In the beginning there were only probabilities. The universe could only come into existence if someone observed it. It does not matter that the observers turned up several billion years later. The universe exists because we are aware of it.*

Albert Einstein;

> *I think that a particle must have a separate reality independent of the measurements. That is, an electron has spin, location and so forth even when it is not being measured. I like to think the moon is there even if I am not looking at it.*

John Bell;

> *Is it not good to know what follows from what, even if it is not necessary "for all practical purposes". Suppose for example that quantum mechanics were found to resist precise formulation. Suppose that when formulation beyond "for all practical purposes"is attempted, we find an unmovable finger obstinately pointing outside the subject, to the mind of the observer, to the Hindu scriptures, to God, or even only Gravitation? Would that not be very, very interesting?*

Eugene Wigner;

> *When the province of physical theory was extended to encompass microscopic phenomena through the creation of quantum mechanics, the concept of consciousness came to the fore again. It was not possible to formulate the laws of quantum mechanics in a fully consistent way without reference to the consciousness.*

Werner Heisenberg;

The atoms or elementary particles themselves are not real; they form a world of potentialities or possibilities rather than one of things or facts.

Sir James Jeans;

The universe begins to look more like a great thought than a great machine.?

Roger Penrose;

It is a striking fact that almost all the interpretations of quantum mechanics...depend to some degree on the presence of consciousness for providing the "observer"that is required for...the emergence of a classical-like world.

Bernard d'Espagnat;

The doctrine that the world is made up of objects whose existence is independent of human consciousness turns out to be in conflict with quantum mechanics and with facts established by experiment.

David Chalmers;

Consciousness poses the most baffling problems in the science of the mind. There is nothing that we know more intimately than conscious experience, but there is nothing that is harder to explain.

J. M. Jauch;

The interpretation of quantum mechanics has remained a source of conflict from its inception. For many thoughtful physicists, it has remained a kind of "skeleton in the closet".

From the forgoing quotes, I sense confusion among the creators of modern physics as to the true meaning of the observer and reality of the universe.

Various theories of the universe define observers in different ways but ultimately it must come back to the human observers for its interpretation. There are three things that are to be explored: a modified definition of the human observer and two words this creature has created. We will make a change to the definition of both existence and reality, and in doing so modify the underlying philosophy of physics.

2 Part I: The Basics

2.1 The Observer

First, and most important, all observers are made of matter and energy, the entities of the physical universe, and all live totally within the universe. Consider for clarity the human being. Imagine the birth of a human infant. At the instant of birth the infant's brain is void of information about what we call the physical world into which it has emerged. There are parts of the brain that are genetically present but those parts do not provide much information about the world into which it has been thrust. There may be some weak information acquired from within the womb, but for the most part the brain knows nothing of the physical world. From the moment of birth the brain is flooded with electrical impulses from the external physical world through the five senses. The information contained in these impulses at first have no meaning, but as they continue to stream in, patterns begin to form. Memories of these patterns in the brain and central nervous system begin to build an "internal model" of the external world. The interpretation of this internal model begins with the elders responsible for the infants care. As the individual grows all forms of physical and social interaction strengthen the model. This process of internal model building continues throughout life and becomes a better and better representation of the external world in which the individual lives, and ultimately represents the sum total of life's interactions with its environment. Every individual has a unique "subjective" internal model.

The brain has the ability to record memory and can recall and analyze those memories with respect to the already existing internal model. This I call *dynamic memory*. All life forms possessing a nervous system are suspected to have dynamic memory. Dynamic memory might be thought of as consciousness, however we need not define consciousness.

David Chalmers;

Consciousness poses the most baffling problems in the science of the mind. There is nothing that we know more intimately than conscious experience, but there is nothing that is harder to explain.

Other things in existence have memory, such as geological features, fossils, books, computers and DVDs, but these are static memories and they have no ability to recall and analyze. The internal model acts as the ultimate interpreter of all incoming information from the senses.

From this we can begin to define an observer: an observer is any entity that exists and has dynamic memory. To speculate in a meaningful way about the structure of the universe, two other properties are needed. The ability to communicate, thus the internal model of individuals become "entangled", thus converting subjective models to collective internal models. Finally, to advance knowledge one further property is needed, the ability to manipulate its environment. Lower animals might have dynamic memory but lack communication skills necessary to transfer abstract analysis between individuals, only humans have this skill to any extent[1].

Thus a complete definition of an observer is:

Any entity constructed entirely of matter and energy, (the attributes of the universe) with dynamic memory and advanced communication skills, as well as the ability to manipulate its environment.[2]

John Bell noted;

Is it not good to know what follows from what, even if it is not necessary "for all practical purposes". Suppose for example that quantum mechanics were found to resist precise formulation. Suppose that when formulation beyond "for all practical

[1]Dolphins may have dynamic memory and the ability to communicate but lack the ability to manipulate their environment.

[2]It seems quite reasonable that with a powerful enough computer, left to run continuously and programmed to search for patterns within its memory that are fed by external sensors, might develop dynamic memory. Such a perpetual running computer system already exists, the internet. If this system were structured to recognize patterns within its memories and with the aid of robots take actions upon those patterns, an "artificial observer"might be built.

purposes"is attempted, we find an unmovable finger obstinately pointing outside the subject, to the mind of the observer, to the Hindu scriptures, to God, or even only Gravitation? Would that not be very, very interesting?

2.2 Existence and Reality

With the human observer defined, the two words, existence and reality, created by this human can be re-examined.

The standard dictionary definitions are :

Existence;

The fact or state of living or having objective reality[3].

Reality;

The world or the state of things as they actually exist.

The Thesaurus suggests in some ways both can be used interchangeably. The definition of these two words are circular, i.e., the definition of each depends on the definition of the other. Their use by individuals in their daily activities poses few problems, but when applied to the understanding of the universe care must be exercised. I will redefine the meaning of these two words, existence and reality, to eliminate the apparent circular definition, then explore the impact on physics that these relatively simple changes produce. Why undertake such a trivial pursuit in the first place? Two statements by Einstein provides motivation.

Einstein[Einstein, 1916] in his memorial notice for Ernst Mach wrote:

Concepts that have proven useful in ordering things easily achieve such an authority over us that we forget their earthly origins and accept them as unalterable givens. Thus they come to be stamped as necessities of thought, a priori givens, etc. The path of scientific advance is often made impassable for a long time through such errors. For that reason, it is by no means an idle game if

[3] "objective "; means not influenced by personal feelings or opinions in considering and representing facts

we become practiced in analyzing the long-commonplace concepts and exhibiting those circumstances upon which their justification and usefulness depend, how they have grown up, individually, out of the givens of experience. By this means, their all-too-great authority will be broken.

An example of this is the delay of almost 200 years in the progress of chemistry. Understanding the nature of fire was derailed by the acceptance of the phlogiston[Mason, 1962] theory[4] that at the time seemed to fit the givens of experience.

Then in a letter to Robert A. Thornton, Einstein writes[Einstein, 1944];

I fully agree with you about the significance and educational value of methodology as well as history and philosophy of science. So many people today - and even professional scientists - seem to me like somebody who has seen thousands of trees but has never seen a forest. A knowledge of the historic and philosophical background gives that kind of independence from prejudices of his generation from which most scientists are suffering. This independence created by philosophical insight is - in my opinion - the mark of distinction between a mere artisan or specialist and a real seeker after truth.

It is not necessary to redefine the entire definitions of existence and reality, we shall only add definitions for use in connection with physics and leave the colloquial definitions for other applications.

The new definitions I wish to explore are:

Existence;

As applied to the universe means the universe in its entirety, known parts and unknown parts. Multiverses, if such exists, are but subsets. The processes of the universe are independent of observers. Physical observers are made entirely of matter and energy, they are part of existence but can not extract themselves to examine the attributes of existence from the outside.

[4]The phlogiston theory is an obsolete scientific theory that postulated a fire-like element called phlogiston

Reality;

> *Is a internal mental model, a belief or theory developed by physical observers, as to how the universe exists. The physical observer as well as his internal model are attributes of existence.*

This supports Einstein's remark, "the Moon exists even if it's not being observed". However, this means that imbedded observers can never know the true nature of existence. Since non-imbedded observers do not exist, existence can never be viewed from outside and thus can never be known, but the attributes of existence are observable and can be theorized by imbedded observers.

Throughout the remainder of this work, the word "reality" always means the internal model of observers, it never means how the universe actually exists. The word "existence" means the entire universe, including observers and their internal models. The words, existence and universe, are occasionally used interchangeably but always mean existence as defined.

There are some parallels to the philosophy of Berkeley[Stanford Encylopedia of Philosophy, 2004] and others that hold that all that exists is in the mind. However, existence is not denied here. The universe exists independent of observers but has no inherent reality. The universe creates creatures that can impose upon it a reality. These creatures and their collective internal models exist as attributes of the universe.

Thus reality is how we believe the world to be, defined by all known observations and givens of experience. This is labeled science. Science describes observed attributes of the universe that can be repeated and verified by any observer. Reality can also be created by our imagination, this is often called pseudoscience, sometimes religion. These are realities that can not be verified by independent observers but are held as beliefs. New ideas that do not fit with existing ideas and theories are often labeled pseudoscience.

All knowledge of the universe is intimately dependent on our internal model. Electrical impulses that race through our brain and nervous system exist but add no information about the universe until they are interpreted by our internal model. It can be said:

> *"The attributes of the universe become "real" by virtue of dynamic memory that is itself an attribute of the universe"*

As Sir James Jeans observed;

> *The universe begins to look more like a great thought than a great machine.*

With these changes we can begin to question some of the basic foundations of our physics.

2.3 Cause and Effect

What is meant by Cause and Effect? Effect follows cause by definition, in all cases, as interpreted by our internal model. Cause and effect started as a local idea. We manipulate something which is said to be the cause and something else happens, thus there is an effect. Cause and effect are always interpreted by the memories that exist when other memories arrive. The internal model, through collective reasoning, abstracts these local series of memories into broader attributes of the universe, i.e., an apple falls to the ground, an effect, and thus universal gravity, the cause, thus causality is invented. The notion of cause and effect begins at the earliest age, for an infant the memory of crying is already present when the memory of eating arrives. Cause and effect begins to develop in the internal model of creatures with dynamic memory from the earliest moments. Thus cause and effect are created by our internal model by its interpretation of connected memories. Cause and effect often form chains, i.e., a house is destroyed, an effect, a storm, the cause. The storm an effect, the weather the cause. The weather the effect, the sun the cause. The sun the effect, gravity and nuclear energy the cause. All are interpreted by our collective internal model.

2.4 Time

Time is a series of events recognized and interpreted by existing memories in our internal model. To see this in another way, consider the following thought experiment. Imagine ancient cognitive beings whose only notion of time is through watching the motion of the sun and stars. Now imagine all inhabitants are put to sleep for an arbitrary period so that no dynamic memory measures the duration of their sleep. Now let all be woken and asked how long they were asleep. This question can not be answered. They look at the position of the sun or stars and guess, but this requires a memory of the sun or star positions. Even if they remembered the positions, the

truth be it known, might be a day or many days plus the guess. They might look around to see if other things have changed, such as the growth of a tree, but this also requires memory of the tree before they went to sleep. There is no way to know without invoking memory. Therefore, we must conclude that time is judged by memory and the internal model. Memories arrive in sequence and the arrival of a memory is always evaluated by the events already in memory.

Related to this, the brain operates over some range of frequencies. Brains must work through their memories before they can arrive at an interpretation. This manifests itself in the general but subtle notion that youths reckon time as slow, whereas elders reckon time as fast. The more memories that fill the brain the longer it takes, as reckoned by external clocks, for the brain to process information. During that process the brain is unaware of the movement of the clock or of the sun. We understand the world by the electrical currents that continually flow through our brains, evaluating sensory inputs by the continuous interaction with our internal model. With the ability to manipulate attributes of existence, we can construct mechanisms that record events. Thus we invent clocks and believe time to be a fundamental attribute of the universe, whereas time is an invention of our internal model.

2.5 Space

A similar argument can be made about space. Let us think further about the observer. His perception of the world is through his five senses; to be more explicit, include the entire nervous system. We have already discussed the observer's ability to analyze incoming events and place them in some order based on memories, thus the notion of time is formed.

How does an observer's internal model distinguish space? As the internal model develops from infancy it comes to model our extremities not just through our eyes but also tactile senses. One comes to know that an arm can only stretch a limited amount based upon the feeling of muscle tension. This then feeds the internal model with a sense of length, although as an infant, length has no meaning. With the help of older communicating care givers, our internal model comes to understand the concept of length.

We learn to manipulate our muscles, thus we learn to walk. We can then reach objects that earlier we could only see. This further supports the

impression of space, where actually the collection of electrical signals that move through our brain and nervous system add to the internal model of the external world. As a youth we see a ball, our internal model recognizes the object and the signals pass through our nervous system manipulating our muscles, propelling us toward the ball. The feedback through our eyes and the continual analysis by our internal model form the conception of space. We build upon our internal model by constructing rigid rods to measure space and clocks to measure time, but both these measures are part of reality, although the constructed objects exist. How is this different from a dream? In a dream all of these effects can occur. How does our internal model distinguish a dream from a non-dream? A dream is an effect, our internal model upon analysis comes to realize that there was a cause event, the act of going to sleep. Thus our dynamic memory sorts out what we believe to be a dream from a non-dream.

The existence of all attributes, space, time, momentum and energy as well as the forces, are not measurable quantities[5] without observers. Thus all measures of these things are by definition reality. It cannot be said that existence does not possess space and time, it can only be said that existence of space and time have no measure. Our reality superimposes on existence a measure that is valid only so far as our instruments allow us to see processes taking place. Extrapolations of our theories beyond actually observed processes transform science into pseudoscience, by assuming we can extract ourselves from the universe to view it from the outside.

Einstein[Einstein, 1920] in a Leiden address

> *There can be no space nor any part of space without gravitational potentials; for these confer upon space its metrical qualities, without which it cannot be imagined at all.*

And again he insists[Einstein, 1952],

> *a pure gravitational field might have been described in terms of the metric tensor (as functions of the co-ordinates), by solution of the gravitational equations. If we imagine the gravitational field, i.e. the metric tensor functions, to be removed, there does not remain a space of the type Minkowski spacetime, but absolutely nothing, and also no topological space.*

[5]Measurable quantities mean by any language, natural or mathematical.

These are correct statements about the reality of the General Theory of Relativity but not about existence, as is implied. Clearly these statements imply our internal model cannot imagine space without a measure. What is imagined, according to Einstein, is the attribute of gravitation and not space. Since space and time are only properties of reality, and do not exist independent of dynamic memory, does not imply that they are not useful in the description of existence. Imbedded observers are at a loss to imagine how the dynamical world exists without resorting to our constructs. Therefore theories invented with the aid of those constructs are useful, but limit our understanding of existence.

2.6 Mathematics and the Universe

The physical world is defined in our collective reality by providing a means of measurement, thus anchoring abstract dynamic memories to quantities that can be analyzed and communicated. This is most effectively done by mathematics, whose most fundamental property is a system for counting. The logical structure of mathematics is a tool that quantitatively defines the world that our internal model has constructed. Mathematics facilitates the conversion of a subjective to a collective internal model. It is a communication tool, as are all natural languages.

Existence has no measure. The most that can be said is that existence has attributes that can be observed. The speed of light is thought of as a constant, but that attribute implies a measure that does not exist. The same applies to Planck's constant and the gravitational constant and all others. All mathematical theories are properties of our internal collective model and are realities. Newton's mathematical laws define force, mass and acceleration. Maxwell's mathematical laws define charge and electromagnetic fields. Einstein's special and general relativity theories define space, time and gravitation in the large scale. Quantum mechanics defines the world on the small scale. All are mathematical realities that attempt to model the attributes of existence.

3 Part II Consequences of this Philosophy

Various aspects of the fundamentals of physics were discussed in Part I. In this part several theoretical sketches will be discussed.

3.1 Structure of the Universe

Suppose all attributes of the universe exist for all *space and time* and are defined as commonly done in quantum theory. That is to say there exists an infinite collection of states, $\{|U\rangle\}$ that constitutes the universe. Even though this describes to the workings of existence, it is only a model of our reality. It is worth stating again existence is not knowable, writing down the total collection of states, $\{|U\rangle\}$ or even imagining those states is our subjective reality and has nothing to do with existence. We can not make any statement as to the nature of the collection of states, $\{|U\rangle\}$. The individual states, $|U\rangle$ could be elementary particles or stars, we have no idea. In the universe how does dynamics exist without space or time? It is imagined that dynamics take place in existence by instantaneous jumps from one state to another. Energy and momentum change when jumps occur, thus dynamics without space and time can be imagined. Heisenberg's notion seems to fit,

> *The atoms or elementary particles themselves are not real; they form a world of potentialities or possibilities rather than one of things or facts.*

3.2 The double Slit Experiment

In a laboratory an experiment is constructed to study an attribute of existence. A barrier, containing two small slits, is placed between a light source and screen that will record the results. The source has a control to adjust the intensity, thus allowing only one source entity at a time to be emitted. The entity travels from the emission point to the screen and there registers its arrival. With this simple setup all that can be known is that an entity left the source and arrived at the screen. How it got there cannot be known, simply because the experiment was not designed to determine that. What the observer sees is a point on the screen; and when many points arrive, an interference pattern is observed. Here the point must be made that the screen that registers the arrival of entities is not the observer since it is only static memory. The observer must have dynamic memory and is the designer of the equipment and the interpreter of the pattern that appears on the static memory. From past observations, interference patterns are associated with waves.

Furthermore, experience, provided by Compton[Compton, 1926], shows that photons behave like particles when they interact with matter. The experimenter asks how could a particle go through both slits at the same

time to produce the interference pattern. That leads the observer to ask how did the entity get to the screen? His internal model questions which slit the particle went through; if it went through one slit, where did the interference pattern come from? This imagined scenario is a perfectly natural question based upon the content of his collective internal model. He then re-designs the experiment by placing a detector at one of the slits to determine the path of the entity. However, unbeknownst to our experimenter, his new experimental design selects out a different subset from the states of the universe, and when the experiment is run a different result is obtained. The point to be drawn here is that the observer selects the subset from the states of the universe when he designs the experiment and the results can only be determined by the selected subset. There is no need to introduce a wave function collapse[Bohr, 1928] when the event is recorded on the static memory. Or to envision Everett's alternate universe[Everett, 1957] or Cramer's transactional backward-in-time absorber theory[Cramer, 1986].

3.3 Gravitation

Gravitation was the first "fundamental"force to be defined. In the present epoch our collective reality envisions four fundamental forces from observed attributes of the universe, electromagnetism, the strong nuclear force, the weak nuclear force and gravitation. The first three forces appear to have somewhat similar strengths, but the fourth, gravitation, is weaker by many orders of magnitude. The vastly different strength have no explanation. The weakness of gravitation is a mystery. The three quantized forces, of similar strength, are built on background dependent space and time, whereas Einstein's gravitation is built on background independent space and time.[6] Quantizing gravity has never been accomplished, although many attempts have been made. At present, quantizing the theory of General Relativity is one of the most outstanding problems in theoretical physics. It is possible to show that the structure of General Relativity follows from the quantum mechanics of interacting theoretical spin-2 massless particles[Feynman, 1995] called gravitons; however, there is no concrete evidence that the attribute of gravitons exist. String theory, superstring theory, M-theory, and loop quantum gravity all depend on the existence of gravitons and that attribute is vital to the validation of various lines of research to unify quantum mechanics and relativity theory.

[6]Background independent space time means that space and time are dynamical and determined by the theory. Background dependence is where space and time are fixed and not determined by the theory.

I will now sketch a, subjective reality model, of gravitation. Let us imagine that gravitation is not a fundamental force. This will provide a way to build the attribute of gravity from micro-scale components of the universe. It will also removes the weakness issue. To explain this, imagine that all states, as discussed in section 3.1, are distributed uniformly, by this I mean there is maximum disorder. This would be void of any structure, and so observed attributes of the universe, including observers, would not exist. I will postulate that the root cause of gravitation is the maintenance of a balance of order and disorder of the universe. Suppose there are two new operators, an order operator G and a disorder operator $\bar{G}$, these operators operate on states of the universe as discussed in section 3.1. Further we postulate that these operators operate continually on random collections of states throughout the universe. A local group, for example, of single particle states can be represented as a sum, thus

$$|\psi\rangle = \sum |\phi_i\rangle. \tag{1}$$

A multi-particle state constructed from this collection is

$$|\Psi\rangle = \prod |\phi_i\rangle \tag{2}$$

Then when G operates on the collection of single particle states

$$G|\psi\rangle = |\Psi\rangle, \tag{3}$$

it generates a multiple particle state. The order operator G produces more order and higher local energy. If this were the only property, the universe would end up as a large multi-particle state of total order, this condition is not an observed attribute.[7] The disorder operator, $\bar{G}$ breaks up multi-particles into single particles increasing disorder and thus decreasing local energy. When $\bar{G}$ operates on multi-particle states it reverses the process,

$$\bar{G}|\Psi\rangle = |\psi\rangle. \tag{4}$$

I envision that both the order and disorder operators function randomly and continually throughout the universe. The random nature of these two operators will create local density fluctuation that can grow into classical

[7]The two condition, complete disorder or complete order are not physical, the universe never reaches either condition.

size objects.

Before discussing this growth let us return to the question of energy. It shall be argued that the Hamiltonian operator, that determines the energy, does not commute with G or $\bar{G}$, the comutators are,

$$[H, G] = -\Gamma G \tag{5}$$

and

$$[H, \bar{G}] = \Gamma \bar{G}, \tag{6}$$

where Γ is the binding energy that holds particles together, it is part of the order disorder process. The Hamiltonian has two parts $H = H_\psi + H_\Psi$ such that

$$H_\psi |\Psi\rangle = H_\Psi |\psi\rangle = 0. \tag{7}$$

To demonstrate this calculation consider the case where two isolated protons[8] are bonded together

$$|\psi\rangle = |\phi_{p1}\rangle + |\phi_{p2}\rangle, \tag{8}$$

$$G|\psi\rangle = |\Psi\rangle, \tag{9}$$

where

$$|\Psi\rangle = |\phi_{p1}\rangle |\phi_{p2}\rangle. \tag{10}$$

To determine the energy, equ(9) is operated on by the Hamiltonian,

$$HG|\psi\rangle = H|\Psi\rangle. \tag{11}$$

Using the comutator, equ(5) yields

$$GH|\psi\rangle - \Gamma G|\psi\rangle = H|\Psi\rangle, \tag{12}$$

where

$$H|\psi\rangle = (M_{p1} + M_{p2})c^2 |\psi\rangle. \tag{13}$$

Then equ(12) becomes

[8]It is assumed, for simplicity the protons are taken to be electrically neutral, and neutrons are not considered.

$$G(M_{p1} + M_{p2})c^2|\psi\rangle - \Gamma G|\psi\rangle = H|\Psi\rangle. \tag{14}$$

The Hamiltonian operating on the multi-particle state is

$$H|\Psi\rangle = E|\Psi\rangle, \tag{15}$$

where E is the total energy of the combined system. Now let G operate through the left side and we get,

$$(M_{p1} + M_{p2})c^2|\Psi\rangle - \Gamma|\Psi\rangle = E|\Psi\rangle \tag{16}$$

The total energy of the combined system is the sum of the masses of the two protons minus the binding energy. The mass of helium $M_{He} = ((M_{p1} + M_{p2})c^2 - \Gamma$ is less than mass of the two protons, thus an energy of Γ is released. This process can also go in reverse by applying the Hamiltonian to equ(4)

$$H\bar{G}|\Psi\rangle = H|\psi\rangle. \tag{17}$$

This time

$$H|\psi\rangle = E|\psi\rangle, \tag{18}$$

and E is now the total energy of the two isolated protons. Now apply the commutator rule equ(6) and get

$$\bar{G}H|\Psi\rangle + \Gamma\bar{G}|\Psi\rangle = E|\psi\rangle. \tag{19}$$

Since E of the assembled system is $M_{He}c^2$ so we have

$$H|\Psi\rangle = M_{He}c^2|\Psi\rangle, \tag{20}$$

and equ(19) becomes

$$\bar{G}(M_{He}c^2)|\Psi\rangle + \Gamma\bar{G}|\Psi\rangle = E|\psi\rangle. \tag{21}$$

Now by letting $\bar{G}$ operate through we get,

$$(M_{He}c^2)|\psi\rangle + \Gamma|\psi\rangle = E|\psi\rangle. \tag{22}$$

Therefore the energy reverts to the energy of the two isolated protons, $E = (M_{p1} + M_{p2})c^2$.

In this sketch it is imagined that quantum assembly is not a high energy collision process, but is analogous to accretion[Tytell, 2004] of small entities into classical size objects. High energy collisions, we assume, do take place when the collection becomes classical in size, i.e., within stars. Further imagine that order and disorder happens at some steady state rate, and statistical variations in the density of space form the nucleus for classical size objects to build.

Even though it has been argued that there is no space or time in existence, we can continue to use space and time in our reality. This allows us to use the higher local energy built up increasing order...and accretion...in the Einstein gravitational equation, and thus General Relativity continues without alteration. As the multi-states build, the increased energy creates and distorts space-time which in turn further increases the incorporation of multiple and single state objects.

To use the Einstein gravitational equation the energy developed above must be represented as an energy density. To see how this connects with General Relativity consider a single proton[9] with energy $E_p = M_p c^2$, which needs to be cast in terms of an energy density. The mass density can be written as $\rho = f^2/G_N$, where G_N is the Newtonian gravitational constant and f is a frequency. We interpret, f, as some characteristic frequency related to the local mass density, given by $\sqrt{\rho\ G_N}$. It follows then that the energy density is

$$\rho_E = E_p^2 c^2/h^2 G_N. \tag{23}$$

Starting with the metric

$$ds^2 = -Bdt^2 + Adr^2 + r^2 d\theta^2 + r^2 Sin^2\theta d\phi^2, \tag{24}$$

where both A and B are functions of r, and all the off diagonal terms are zero. The Einstein gravitational equation[Weinberg, 1972] can be written as

$$R_{\mu\nu} = -8\pi \frac{G_N}{c^4}(T_{\mu\nu} - \frac{1}{2} g_{\mu\nu} T^{\lambda}_{\lambda}), \tag{25}$$

then for a perfect fluid at rest the gravitational field equations become

$$R_{rr} = -4\pi (G_N/c^4)(\rho_E - P)A, \tag{26}$$

[9]It is assumed the quarks and gluons contribute to the mass of the proton, but their internal motion is ignored at present.

$$R_{\theta\theta} = -4\pi(G_N/c^4)(\rho_E - P)r^2, \tag{27}$$

$$R_{tt} = -4\pi(G_N/c^4)(\rho_E + 3P)B. \tag{28}$$

For this theoretical sketch, it is assumed there are no internal velocities or pressure. Combining equ(23) and equs(26, 27, 28), it is noted that G_N does not appear. Define, $\gamma = \frac{8}{3}\pi(E_p/hc)^2$ and write down the expanded components of the Ricci tensor to get

$$R_{rr} = \frac{B''}{2B} - \frac{B'}{4B}(\frac{A'}{A} + \frac{B'}{B}) - \frac{A'}{rA} = -\frac{3}{2}\gamma\ A, \tag{29}$$

$$R_{\theta\theta} = -1 + \frac{r}{2A}(-\frac{A'}{A} + \frac{B'}{B}) + \frac{1}{A} = -\frac{3}{2}\gamma\ r^2, \tag{30}$$

$$R_{tt} = -\frac{B''}{2A} + \frac{B'}{4A}(\frac{A'}{A} + \frac{B'}{B}) - \frac{B'}{rA} = -\frac{3}{2}\gamma\ B. \tag{31}$$

To solve for A, write

$$\frac{R_{rr}}{2A} + \frac{R_{\theta\theta}}{r^2} + \frac{R_{tt}}{2B} = -3\gamma \tag{32}$$

This yields a solution for A, we find

$$A = \frac{1}{1 - \gamma r^2 + \frac{\kappa}{r}}, \tag{33}$$

where κ is a constant of integration. Before we can solve for B we must decide what to do with κ, if we set $\kappa = 0$ we find that the space is divided into two regions about a singularity. The position of the singularity occurs at $r_s = 4.56 \times 10^{-16}\ meter$, this is interpreted as the radius of the confinement space occupied by quarks and gluons in the proton. For $r < r_s$, the metric $g_{rr} = A_{in} = 1/(1 - \gamma r^2)$ does not have a singularity at $r = 0$.[10]

For $r > r_s$ the proton has no mass outside r_s, then $\gamma = 0$ and $\kappa = -2G_N M_p/c^2$, therefore $g_{rr} = A_{out} = 1/(1 - 2G_N M_p/c^2 r)$ as we might expect[11].

[10] If the quarks have mass, then from equ(23) the mean radius of the quarks can be estimated by using the mean quark rest energy in place of the proton energy, then $\rho_E V = M_q c^2$. Then from the volume, V, the radius can be determined. This works out to be 3.8×10^{-28} meters, for a quark mass of 1.57×10^{-29} Kilograms. This suggests that quarks are very small but are not point particles.

[11] The outer region has a singularity, usually associated with the event horizon of a black hole, but here it has no physical significance since it is very deep inside the inner region.

With this configuration a solution for B is obtained. For $r < r_s$, by writing

$$BR_{rr} + AR_{tt} = -3\gamma AB \tag{34}$$

Given A from equ(33) the solution of equ(34) is

$$B_{in} = \sqrt{A_{in}} \tag{35}$$

and for $r > r_s$ we get

$$B_{out} = 1 - \frac{2G_N M_p}{c^2 r}. \tag{36}$$

For the space $r < r_s$. The metric becomes,

$$ds^2 = \frac{1}{(1-\gamma r^2)}(dr^2 - \sqrt{1-\gamma r^2}\ c^2 dt^2) + r^2 d\Omega^2. \tag{37}$$

This space approaches flatness, or free space, as γr^2 decreases and at $\gamma r^2 = 0$ the space is flat. Particles such as quarks in the confinement space $r < r_s$ will "see"an infinite spacetime since the metric $ds^2 \to \infty$, thus quarks will be confined to the inner space. This is consistent with observed attributes, since there are no free quarks. Outside ($r > r_s$), the space is the Schwarzschild space-time.

As order increases and the macro scale size of the universe grows, the disorder operator appears unable to maintain a balance of order and disorder. Other effects enter to assist in establishing balance, for one, supernovas. Another is the expansion of the universe, consistent with the Einstein gravitational equations since there are no steady state solutions. As the mass density decreases, due to expansion there is more space for particle states to occupy thus more disorder. Furthermore, as the mass density, given by $\rho = f^2/G_N$, decreases, frequency decreases so distant attributes appear redder. It is not necessary to introduce the Doppler effect. The balance of order and disorder must be maintained, thus more macro scale objects may have to appear to balance the expansion. The Hubble ultra-deep field images[Beckwith, 2006] are suggestive of this balancing.

The Cosmic microwave background[Penzias, 1965][Smoot Group, 1996] thought to support the big bang can be understood as a continual interaction of particle states with electromagnetic quanta in the disordered regions distant from classical size objects. This suggests that this attribute is not at

the fringes of the universe but occurs throughout all of space. In this subjective reality model, the big bang is not needed. Furthermore, accepting the big bang model as an attribute of existence is equivalent to assuming we can extract ourselves from the universe to view it from the outside, contradicting the premise set forth in this paper. Further, the assembly in the disordered state, distant from massive classical objects, is more likely to assemble and disassemble at some rate producing a steady state concentration of helium without Nucleosynthesis. This larger concentration of helium was one of the arguments against the steady state universe and was thought to support the big bang.

When discussing processes on the micro scale we introduced a characteristic frequency related to mass density as a means to determine energy density. Is the characteristic frequency scale dependent or does it apply on all scales? This can be tested by considering the solar system where we will assume the characteristic frequency is related to the observed attribute of planitary orbital period. In Table 1[Fowles, 1962]. the planetary data used in the calculations are given. The main problem is to determine the mass density. The mass determination is straight forward, it will be the total mass enclosed by the orbit of each planet. For example, the orbit of the earth encloses four masses, including itself,[12] $M_{Sun} + M_{Mercury} + M_{Venus} + M_{Earth}$. The volume that encloses this mass is more difficult. Let us assume that the volume associated with the mass is shown in Figure 1 and given by

$$V = \frac{4\pi}{3} a^3 (1 - e^2), \tag{38}$$

where a the semi major axis and e, the eccentricity, are given in Table 1. The mass density, $\rho_M = \sum mass/V$, is the sum of the mass enclosed by the orbit of each planet divided by the volume created by that orbit. Even though the planetary orbits are in a plane, the total mass enclosed by a particular planet orbit is associated with this volume. This clearly does not fit with our internal model, in fact the entire gravitation theory presented here does not fit, since we have argued that space and time are only part of our reality and have no measure in existence. Continuing with the calculation, the characteristic frequency for each planet is then $f = \sqrt{\rho_M G_N}$. If the characteristic frequency and the orbital period are related the product will be constant. This is clearly demonstrated in Figure 2 for each planet.[13] Thus the characteristic frequency is valid on the macro scale as well as the

[12]The mass of the Sun was not included in Table 1, it mass is $1.9889 \times 10^{30} kilogram$

[13]To get these results the astroid belt needed to be included.

micro scale.[14] On the micro scale the gravitational constant, G_N does not appear in the result and is only introduced to satisfy the boundary condition at infinity, implicit in the Schwarzschild solution. On the macro scale the gravitation constant is clearly a part of the solution.

The force we call gravitation is due to the distortion of space-time as described by Einstein. This distortion, in fact space-time itself, is created by energy. The usual view of Einstein's gravity is that energy tells space and time how to curve and space and time curvature tells energy how to move. In this view, energy creates space and time and endows it with a metric, a useful reality.

To repeat Einstein[Einstein, 1920]

> *There can be no space nor any part of space without gravitational potentials; for these confer upon space its metrical qualities, without which it cannot be imagined at all.*

Most important, in this new underlying philosophy, it is not the true nature of the universe, it is only our collective reality. Our theory is a new way to look at the root cause of gravity. I have added only a brief amount to this gravitation model to indicate that a number of unique attributes of the universe are contained within it. The order-disorder concept of what we collectively call gravitation, I believe, has some potential for future study. I will not take it any further at this time.

4 Conclusions

It has been observed that words carry forth connotations from the past and enter into our thinking in ways not easily deciphered. When we attempt to theorize beyond what we can actually observe we run the risk of carrying forward ancient ideas. Many times key elements of our theories are passed over and set aside as perhaps belonging to other disciplines. One such key element, I believe is the observer, others are words that can carry thoughts of our predecessors. In the work presented here a new definition of physical observer was given. In doing so, we have found surprising changes to occur.

[14]The Sun does not appear in Figure 2., it has no well defines orbit in the solar system, but it is included in the mass calculation for each planet. The perihelion precession of the orbit of Mercury is different from the others planets, this suggests that the volume defined by the orbit of Mercury is different, this may account for it's discrepancy.

Our arguments show that memory plays a profound part in how physical observers observe and interpret the world. We draw a distinction between static memory and dynamic memory that can recall and analyze mental content. We thought the definitions of existence and reality were circular, each dependent on the other. We wondered what would be the consequences of redefining those two words to remove the circular connection. It is worth repeating, observers are responsible for all words and languages, including mathematics. The meaning of words, in ways unexpected, weave the thoughts of antiquity into our modern science and technology. Our evolving internal model is influenced by our language, the meaning of words affect how we, as observers, see the world.

Changing the definitions of existence and reality has had a startling impact on the concepts we hold dear. One wonders in what other ways the threads of ancient thoughts are impacting our modern world through the evolution of words and languages. We added a new definition of existence; *The physical universe exists independent of observers, but entities that exist in the universe that have dynamic memory build a mental model of existence and that model is reality as defined.* We conclude that we will never know how the universe actually exists, we can only observe its attributes and create models and theories as to how it exists. Once the physical observer, existence and reality were redefined we found that cause and effect as well as time and space are only part of our mental model. We further found that mathematics is not an inherent part of existence but is no more than a communication tool that helps to convert our subjective internal model to our collective internal model supported by all those, living or dead, that have contributed to our efforts to understand the universe.

Finally we constructed a model of existence, wherein all of the attributes of existence are states analogous to states as defined by quantum theory, and have found a simple explanation for the mysterious double slit experiment. We also introduced some thoughts on how gravitation might be connected to elementary constituents of the universe, as we presently understand existence. There are many other attributes of existence that we have not addressed. They will be left for future work.

Existence is unknowable and contains aspects of all things that affect the life of physical observers in ways we have not yet conceived. The internal model of observers is their belief system, be it science or pseudoscience, it all comes down to a belief system that we construct. The subjective inter-

nal model can become collective in both cases, but only with science is our collective model supported by observable attributes of the universe.

As J. M. Jauch quipped;

> *The interpretation of quantum mechanics has remained a source of conflict from its inception. For many thoughtful physicists, it has remained a kind of "skeleton in the closet".*

I hope that this work will cracked open the closet door just a bit to let a few photons illuminate the skeleton.

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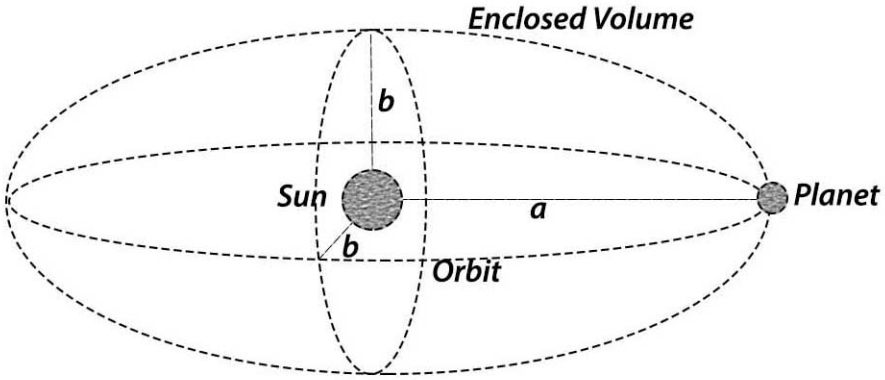

Figure 1: Volume geometry for determining the mass density.

Table 1, The mass of the Earth is $5.97 \times 10^{24} Kilogram$

Planet	emimajor Axi (A.U.)	Period (Years)	Eccentricity	Mass (Mass of earth)
Mercury	0.387	0.241	0.206	0.05528
Venus	0.723	0.615	0.007	0.81575
Earth	1.000	1.000	0.017	1.00000
Mars	1.524	1.881	0.093	0.10749
Astroid Belt	2.750	4.502	0.000	0.00050
Jupiter	5.203	11.860	0.048	317.92300
Saturn	9.539	29.460	0.056	95.19260
Uranus	19.190	84.020	0.047	14.54100
Neptune	30.070	164.800	0.009	17.15240

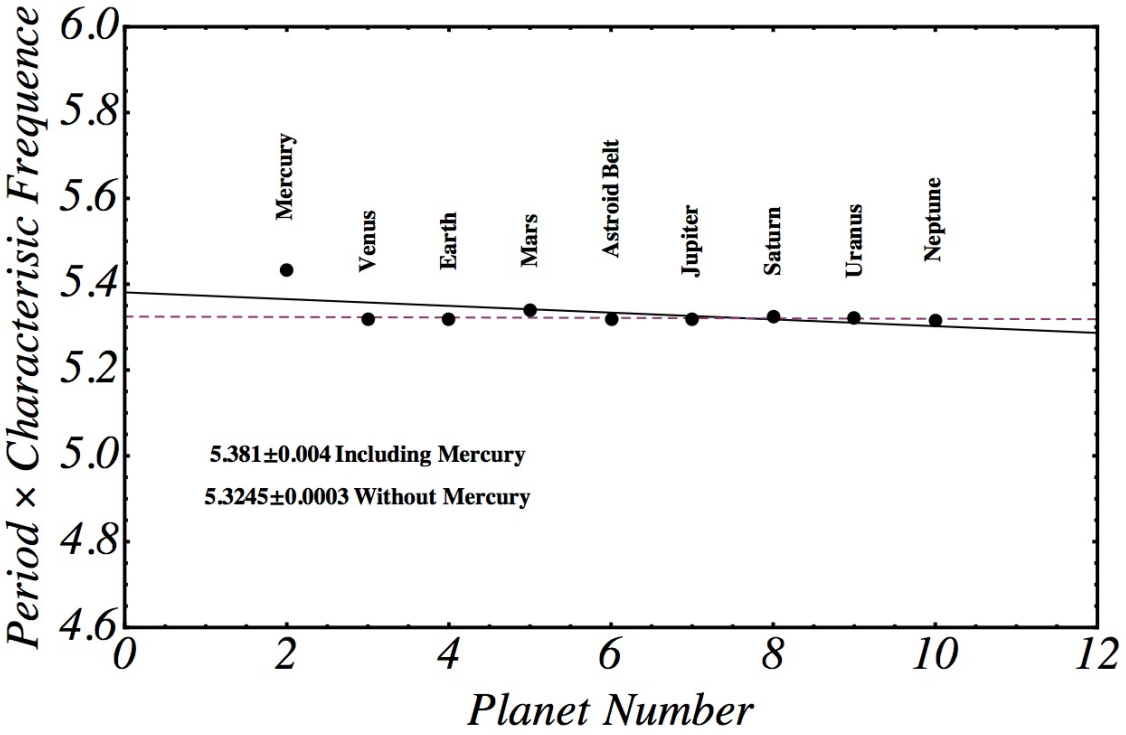

Figure 2: Relation between the characteristic frequency and the period of the planets.