ESSAY ONE

THE ESSENCE OF MATTER

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INTRODUCTION

The problems of modern physics seem to founded in an incomplete or improper understanding of the basic dimensions that physics uses, namely Mass, Length and Time. Of these the most ill-understood physical dimensions are of time and mass, and while length seems to be the simplest to relate to, it can be quite odd when seen in some particular ways. Physics is divided on certain laws that seem to hold well enough in one aspect but fail in another. The discrepancy is largely between Quantum Mechanics and General Relativity and scientists have been trying to understand, for several decades, without success, as to what exactly went wrong and where Attempts have been made to reconcile the schism between the laws of quantum physics (QM) and those of general relativity (GR) and one such attempt identifies the problem as being the manner in which time is treated in QM and GR.

The following extract from Hitoshi Kitada's paper on local time is one such example

…the main theme of the paper is to present one possible consistent unification of quantum mechanics and general relativity. This is stated intentionally with anticipating the naive refutation that the Euclidean geometry which quantum mechanics follows and the non-flat Riemannian geometry which relativity follows can never be united consistently.

Our trick of the consistent unification of these two theories is to adopt a ten-dimensional vector bundle X x R^6 (the reason R^6 is adopted instead of R^4 will be touched below) as the total physics space, where the base space X and the fibre R^6 are mutually orthogonal. Quantum mechanics is set on the Euclidean space R^6 and relativity theory on the curved Riemannian space X. Each point (t,x) in X is correlated to the centre of mass of the local system consisting of finite number of (quantum-mechanical) particles, and these centres of mass are considered as the classical particles. These classical particles are regarded as moving following general relativity in the Riemannian manifold X on the one hand, and the particles inside the local systems are regarded as moving following quantum mechanics on the other hand.

In this sense each point (t,x) of the base Riemann space X of the vector bundle X x R^6 corresponds to the local system consisting of finite number of particles which follow quantum mechanics in each fibre R^6. – Hitoshi Kitada, Theory of Local Times, (from http://kitada.com/timeI.html)

Dr. Hitoshi Kitada seems to have identified two kinds of motions – the ones that follow GR in the Reimannian manifold X and the other kind that follows QM "inside" the local system. Assuming that the centre of mass of a local system is a point

"outside" the local system – and it is correlated with the classical motions in the manifold X of GR, what an observer sees is only the "outsides" of local systems. Further, as per the theory, Local systems are internal clocks – and the very activity of local systems is "clocking", but this time is not "visible" from the outside. So much so that Hitoshi describes the internal clocking of the local system "as if the inside world of the mind"

The involvement of "mind" and "observer interaction" in physics has seriously upset the apple-cart of a purely objective physics of the Newtonian kind.
In QM it is the Heisenberg's Uncertainty principle, in GR it is the speed of light. Either way, it is not possible for our observations to follow the common sense of Newtonian physics and we are forced to create counter-intuitive geometries and complex analytical systems in the process.
But even doing so, while we are good enough with the mathematics, we are still at a loss to understand the basic physics that we are attempting to analyze with our complex calculations. It seems to me that while mathematics has advanced phenomenally in the past century or so, physics is still languishing in the pre- and post-Newtonian age.

My purpose is to take a new look at the basic dimensions of mass, length and time – and whether these are the true physical dimensions or mere conveniences of measurement. It is my intention to gradually introduce "mind" into physics itself, and take a radically different look at the conventional dimensions that physics uses.

To talk about physics is to talk about substances. I draw some support from Leibniz in the course of the study of substances and try to create what is called "matter" by using a combination of fundamental substances. Like Newton I rely heavily on understanding the nature of the physical world as what we ourselves *experience*[1], and how these *experiences* can be objectified and eventually absorbed into a self-consistent physics.

ABSOLUTE SPACE AND TIME

Einstein's relativity declares outright that there is no such thing as absolute space and time. All is "relative". In a relative world, it is impossible to be sure of the measurement of any motion with any degree of certainty whatsoever. However by integrating space and time together as a single entity (what is called the space-time continuum) Einstein was able to get rid of relativity and accurately predict what Newton's mechanics could not. However we shall see that Einstein's theories are devised only in so far as we are concerned about the motions of *material objects* and only as far as we need to pro-actively *measure* such motions using physically standardized units of length and physical clocks.
Newton's Space and Time were metaphysical – in the sense that they did not lend themselves to measurement and were thus "above" the realm of practical (measurable/demonstrable) physics. Newton's space was always at absolute rest and his time was always in absolute motion. It is not at all difficult to imagine space that is at absolute rest – when we understand that *emptiness itself does not move*. Similarly

[1] Mass, force and time, work, power and energy – all these were, before Newton, purely subjective experiences which he tried to objectify and measure – with a fair degree of success.

time as relentless motion is also a purely common sense idea and even without reference to any motion of any physical body, we easily understand that time does not stop – that it is always flowing no matter which way we look. By rejecting absolute space and time, it is not that Einstein is rejecting our common sense, but because *measurement introduces relativity,* our common sense understanding of space and time is not practicable when it comes to actual calculations and verifying experimental results.
This is the only reason why Newton's absolute space and time was relegated to and still continues to languish in the "metaphysical" domain.

Let us start with what Newton had to say about absolute space and time.

Absolute Space, in its own nature, without regard to any thing external, remains always similar and immovable. Relative Space is some moveable dimension or measure of the absolute spaces; which our senses determine, by its position to bodies; and which is vulgarly taken for immovable space.

*... And so instead of absolute places and motions, we use relative ones; and that without any inconvenience in common affairs; but in Philosophical disquisitions, we ought to abstract from our senses, and consider things themselves, distinct from what are only sensible measures of them. For it may be that there is no body really at rest, to which the places and motions of others may be referred. (**Newton**, 1687)*

Comments: In the first part we see the reference to bodies – material objects – *"which our senses determine, by its position to bodies"* – and which is "vulgarly" taken for immovable space. In philosophical disquisitions, Newton says, we ought to abstract from (draw away from, keep away from) our senses (of physical things) and consider things in themselves (metaphysically) as distinct from what are only (merely, practically, crudely) sensible (sense-based) measures of them.
Please note that Newton is explaining an *observation problem* in regard to the understanding of absolute space, i.e. that sense perception will not reveal any proof of absolute space. Thus for the sake of sense-perception we utilize a relative space merely for our convenience.

The concept of absolute time also follows similarly:

... Absolute, True, and Mathematical Time, of itself, and from its own nature flows equably without regard to any thing external, and by another name is called Duration: Relative, Apparent, and Common Time is some sensible and external (whether accurate or unequable) measure of Duration by the means of motion, which is commonly used instead of True time; such as an Hour, a Day, a Month, a Year.

*... For the natural days are truly unequable, though they are commonly consider'd as equal, and used for a measure of time: Astronomers correct this inequality for their more accurate deducing of the celestial motions. It may be, that there is no such thing as an equable motion, whereby time may be accurately measured. All motions may be accelerated and retarded, but the True, or equable progress, of Absolute time is liable to no change. The duration or perseverance of the existence of things remains the same, whether the motions are swift or slow, or none at all. (**Newton**, 1687)*

Comments: Absolute time flows equably without relation to "anything external" – which again indicates that no material reference is required for its existence and that time will continue even without reference to any manner of clocks. It also flows "of itself" and "from its own nature" – which means it is uncaused, natural, and, being uncaused or unprovoked or uninitiated, it is a relentless continuity. The term "duration" as employed by Newton is better not confused with a "measure" of duration. If we were to measure the duration of say, the earth's rotation as "one day" and relate this to the motion of a clock, we would be doing a "relative" measure of time. Duration is the time-interval between a beginning and an end. This time interval may vary as per our measure – when we make a comparison with some "standard" measure like a clock. This is further complicated by the knowledge that standard clocks themselves vary according to the relativity theory – what Einstein calls "time dilation or contraction" depending on the velocity of the inertial frame in which the clock is kept (such as a fast jet plane). Clocks are material bodies in "motion" and the linear "motion" of the clock's frame itself seems tangled with the circular motions of its hands. The moving frame (such as the fast jet plane) is also a material body in motion, because the clock has to be physically carried within this moving frame.

Throughout this essay, I refer to Newton's absolute time as "Motion" as it is just that and nothing else but that

The Continuum Thesis of Space and Motion

Let us imagine space and time (motion) without the existence of any material bodies. In this utter emptiness, we will lack awareness of any shape, size, distance, position or movement. In fact we would lose our concepts of space *and* time entirely. To understand space we need to have bodies separated by a distance, to understand time we need to register some change - whether of position, motion, shape, size or whatever. Without any material reference we are more or less in an eternal oblivion.

Let us call this oblivion as Absolute Space and Absolute Motion

If we place one solitary point (with zero size and zero mass) in this oblivion and call it an observer, this observer may be hurtling along at high speed, twisting, turning and spinning – perhaps suddenly stopping to a dead halt and again plunging onward crazily at breakneck speed but, all along, this solitary observer is not in the least aware of any position nor is he aware of any motion because he has no visual reference and no sensation of inertia.

To understand the idea of "absolutes" we have to first understand the meaning of "continuum". A continuum is that which prohibits the appearance of any parts. It is given entirely or not at all. Space and Motion, as absolutes, obey the continuum thesis, whereby:

Every point in space is an absolute position and also the whole of space.
Every point in motion is an absolute motion and also the whole of motion.

We can liken the continua of space and motion with the real numbers. In any real number line, there is a continuum of numbers between any two given numbers. That is, between 1 and 2 there is a continuum of numbers, even between 0.0001 and 0.0002

lies the *same* continuum of numbers. To generalize the description of continua from the real numbers we have to avoid the terms zero and infinity altogether, and use only "point" and "continuum". Note that the "zero" of a real number line has no particular position – any position will do just fine because there is a continuum on both sides anyway.

Every point in a continuum is an identical point because, between any two points no matter how close or how far, there is a continuum and on either side of these points there is also the *same* continuum. The distance between any two points in a continuum is indeterminate because the whole continuum field can expand or contract and it will not make any difference whatsoever. Any number of points anywhere in the continuum are indistinguishable from one another because they lack any distinctive qualification. They seem to keep slipping just out of reach, no matter how delicately we try to extract them. The Real Number axes are therefore not numbers at all but a field of *possibilities* of numbers. Even the origin of any three mutually orthogonal axes could be variously placed anywhere in a continuum field. Since all points are identical to each other, identity and uniqueness of any number is not possible to possess unless we use an entirely different way of presenting a unique identity. For this, the identity of any point must be such that it is no longer a part of the continuum of points, but rather stands out from the continuum as something separated from it. It must therefore be a discrete entity that exists of itself and apart from space and motion. Identity and distinction are what we *possess*, while space and motion are not possible to possess as one's own – they must always remain common to all. By understanding a continuum we are in a position to understand the quantum – which we can then call "the absolute number". There are no absolute numbers to be found among the reals.

The three basic dimensions of classical physics Mass, Length and Time are represented as real number lines. If we have understood the continuum thesis – then mass and mass-number (quantity of mass) are different, length and length-number (distance) are different, time and time-number (duration) are different. We have to treat numbers, as measures, as something apart from the continuum of their supposed origin – as separate entities in themselves.

For our purposes, we treat only space and motion as continua, and reject all other possible continua because with just these two continua we can build the whole of physical world.

Leibnizian theory of substances:

Leibniz seems to have understood the continuum thesis well enough[2]

1. The Monad, of which we shall here speak, is nothing but a simple substance, which enters into compounds. By 'simple' is meant 'without parts.' (Theod. 10.)
2. And there must be simple substances, since there are compounds; for a compound is nothing but a collection or aggregatum of simple things.

[2] It is interesting to note that both Leibniz and Newton co-created what is called The Calculus in mathematics. Calculus deals with infinite regressions to zero and infinite progression to infinity – with miraculously accurate results that seem to eliminate zero and infinity to produce "perfect wholes" which are given, as per our continuum thesis. in an "all or nothing" manner.

3. Now where there are no parts, there can be neither extension nor form [figure] nor divisibility. These Monads are the real atoms of nature and, in a word, the elements of things.
4. No dissolution of these elements need be feared, and there is no conceivable way in which a simple substance can be destroyed by natural means. (Theod. 89.)
5. For the same reason there is no conceivable way in which a simple substance can come into being by natural means, since it cannot be formed by the combination of parts [composition].
6. Thus it may be said that a Monad can only come into being or come to an end all at once; that is to say, it can come into being only by creation and come to an end only by annihilation, while that which is compound comes into being or comes to an end by parts.

Space and Motion, as simple substances, seem to follow all the above six definitive rules. Space and motion are "monads" in that they are given entirely or not at all. They are "without parts". This is the continuum thesis re-iterated.

7. Further, there is no way of explaining how a Monad can be altered in quality or internally changed by any other created thing; since it is impossible to change the place of anything in it or to conceive in it any internal motion which could be produced, directed, increased or diminished therein, although all this is possible in the case of compounds, in which there are changes among the parts…

We can see here a reference to space and motion: "…*since it is impossible to change the place of anything in it or to conceive in it any internal motion which could be produced, directed, increased or diminished therein*…"
Space and motion, as the foundational grounds for "place" and "activity" are the fundamental substances that make up any entity. But Space and Motion by themselves are not in a position to distinguish the entity as separate *in itself*, nor as different *in relation* to any other entity.
Distinction is possible only in compounds, he says, and this part also agrees with what we have said above about "identity" that has to be given in "an entirely different way" and "stands out from the continuum (from the monadic substance) as something separated from it".
Thus our view is that a unique identity of a thing is a combination of a Monadic Substance and a distinguishing substance – it is a compound. Further, the distinguishing substance must be characteristic to the entity that it describes and is somehow created or comes into existence for or by the entity that seeks such identity
By this we can say that Space and Motion are the primary substances that all entities share without distinction, and having shared these, the differentiated entities appear by introducing the secondary[3] substances that distinguish them and set them apart. We

[3] http://groups.yahoo.com/group/time/message/5230 The following is the relevant extract from the above mentioned message on my time group (from Atso Eerikainen) "*"Two dimensional time" is not exact expression. Kitada's "two kinds of time" is better. The philosophers have used also terms: "process" and "transition" of time. The process of time is a secondary becoming. It is an infinite or limitless, continuous, and irreversible sequence of successive present moments. The transition of time is a primary becoming, where the secondary becoming appears into existence. In the other words, "not yet become" reality becomes "already become" reality. Thus, the transition of time is bound with a certain location in the experienced world. Any certain point among other similar points in the continuum of physical time suddenly receives from the non-objectifiable space an accent that distinguishes it from the other points.*"

shall call these secondary substances as time and energy[4]. Time combines with Space to give form in space – the Body, and energy combines with Motion to give Mass or Mind.
Hitoshi Kitada (as quoted in the Introduction) introduces the concept of "local" time which agrees very well with what we have been saying so far. That time, as a distinguishing substance in the formation of an entity is necessarily a local thing – that is, it cannot be a part of any continuum
Time, as per Hitoshi's theory is a "local" appearance and there is no time in the Universe as a Totality. Quantum mechanics requires the Newtonian absolute space and time, but relativity theory rejects it completely. So Hitoshi retains the requirements of quantum mechanics by restricting or confining the validity of its rules to a "local" system, and correlates the points (t,x) of the Reimannian space X (Einstein's space-time continuum) with the *centre of mass* of each such local system. If we translate this in our own terms we can look at Quantum mechanics – by the very existence of discrete "quanta" - as the "identity parameters" (distinguishing substances) of any entity and which are "confined" to that entity alone. Continua do not offer any distinction of one point from another. Yet, as *secondary substances*, i.e. the distinguishing substances have no value without the pre-existence of the continuum substances or *primary substances*. So the identity parameters of quantum mechanics must be co-related to some point in the (primary) continuum substances in order to acquire completeness of being. We can easily relate to Einstein's space-time continuum by looking at his time-in-terms-of-motion (he uses a mechanical clock-time) simply as our own concept of the motion continuum. In this way, Einstein has unified our space and motion continua as a single continuum – for reasons that we shall examine later. Note here that Hitoshi's correlation of the "centre of mass" of a local system with a point (t, x) of X is not without sound basis and agrees wonderfully with our own views expressed herein.

Time and Energy are "temporary" creations and appear in existence in the form of quanta. The Body is a temporary creation, as is the mind or the mass of an entity. In fact, any "entity" or thing that can be described quantitatively or qualitatively is a temporary creation and can be created or destroyed partially or wholly without affecting the existence of other entities – unlike the monadic substances of space and motion which can only come into being or be destroyed as wholes.
The Body as such, as an entity distinct from the rest of the space that it "occupies" is a temporal "duration" in that it is given as a time-number – it has a limited life-span. While the living body endures and dies (degrades) slowly, the dead body deteriorates much more rapidly in the absence of life. The Mind is a temporary creation and exists as such as energy combined with motion. Thus just as a body has temporal extension in space, mind (and mass) has temporary extension in motion. *Motion is the field in which energy localisms are expressed as mass or mind*. By comparison, energy decays much more rapidly than time. Much of the delicate structures of the body-mind union of a living thing are based on energy and a gradual decay of this energy (energy death) results in loss of vitality and the aging of the creature. When the vital levels of energy are no longer sustainable due to excessive losses, the creature dies, and the decay that follows is far more rapid than it was when the creature was alive. Life thus endeavors to maintain the energy levels of the creature within acceptable limits, failing which the organism or creature is no longer feasible as a living thing.

[4] Time and energy, like position and momentum, are the "conjugate pairs" of quantum mechanics

Leibniz draws a parallel between his Monads and living things or entities or minds. In a sense he is trying to describe the meaning of individual existence – i.e. existence in the "individual" form or in the form of unique "entities". But the word individual may be misleading if we look at things from our perspective where entities are a composite of substances, unless we redefine and understand the word "individual", not as the composite entity as such but as the true center of the composite entity. The entity is what it is by relation to this true centre. The character and quality of any entity is determined holistically by this true center. If I lose an eye or break my leg I do not stop being myself, nor if I change my mind and start believing something else that I never so far believed in. I am not changed, "I" am still the same "I", but given differently in perception, particularly so in the perceptions of others.

…The Monads have no windows, through which anything could come in or go out. Accidents cannot separate themselves from substances nor go about outside of them, as the 'sensible species' of the Scholastics used to do. Thus neither substance nor accident can come into a Monad from outside.

Leibniz's Monads are unique in themselves, and this makes them solipsistic in character and philosophy. They have no windows through which anything can come in or go out and he rejects the "sensible species" of the Scholastics[5]. Yet, there is something to be said for Monads in regard to the first person experience. Only "I" can experience hot and cold, or taste my food or see a bird in a tree or enjoy an evening with a friend. There is absolutely no way in which "you" (as not-"I") can taste the food that my tongue is tasting, unless you eat that food yourself. And then again there is no way to ascertain that you taste it in the same way that I do, and there is no conceivable way in which *your* tasting of the food is going to satisfy *my* desires. In fact we can say that "I" don't even know that "you" see the colour blue the same way that "I" see it. Maybe "you" see red but by your learning you have associated this with blue and hence "you" and "I" agree on the common terminology between us. The external conventions may be the same but the internal experiences may be entirely different between all observers and there is absolutely no way of verifying this.
This sharp separation between what "I" can experience as myself and what I imagine that "you" may be experiencing is the windowless aspect of the Leibnizian Monads that I accept. Experience in the first person is what isolates me "entirely" from the others and makes me "windowless" to and from the outside. But while Leibniz rejects any "substance" exchange, I still keep an open mind about it. For without substance exchange can there be any sort of basis for interaction between entities?

While the perspectives of any entity from space and motion are identical perspectives, the *perceptions* through time and energy are entirely personal experiences. Only "I", by my unique observation, can "see" or "feel" or "opine" in a way that only "I" am capable of experiencing or perceiving or understanding. I may try to explain my experiences or perceptions to another and another may try to simulate my experience or perception in his own way in an attempt to understand my perspective or feeling, but the other cannot directly plug in to me and go through all the exact perceptions and feelings that I am going through.

[5] A similar sort of sensible species theory was presented in the Tattva Bodha of the Shankaracharya

8. Yet the Monads must have some qualities, otherwise they would not even be existing things. And if simple substances did not differ in quality, there would be absolutely no means of perceiving any change in things. For what is in the compound can come only from the simple elements it contains, and the Monads, if they had no qualities, would be indistinguishable from one another, since they do not differ in quantity. Consequently, space being a plenum, each part of space would always receive, in any motion, exactly the equivalent of what it already had, and no one state of things would be discernible from another

Leibniz is concerned about quality as a differentiating aspect between Monads. But we have said that no one part of Space or Motion is distinguishable from any other. All perspectives (of an observer) from any point in space or motion are identical perspectives. What distinguishes is "difference" or "change" and this difference or change is brought about by Time and Energy. This means we disagree that the Monads themselves are differentiated qualitatively, rather we say that the entities are all the same in so far as they are part of the space and motion manifolds, and that it is only the set of identity parameters (of time and energy) specific to each entity that differentiates one from another. Any entity or individual is distinguished from another by its specific identity parameters and these identity parameters are always of a *secondary* and *temporary* nature, and appear only as *absolute quanta*.

To summarize we have four basic "substances[6]": Space, Motion, Time and Energy. The first two, space and motion, are "common" to all perspectives, absolute, identical and given entirely. They are "continuum" or "monadic" substances. In this sense they are the foundational substances or fields within which all individual creations (entities) play out their existence. The simple substance of Motion is developed, through combination with Energy, as Mass or Mind depending upon whether the entity is non-conscious or conscious. Energy thus becomes the local qualitative distinction between one mind and another and one mass from another. Time is the means of distinguishing one body from another in Space. Thus the combination of Space and Time brings about the physical body – the object with extension in space, i.e. the object that can be described in terms of physical size in space – of how much space it "occupies".

It may be a little difficult at first to think of time as an object-former in space. But we may look at objects – as discrete entities in space - as temporary or time-bound things that can be created or destroyed and thus somehow relate "time" with this temporariness of material objects.

We rejected Leibniz's Monads because he posits an infinite number of Monads – thus requiring an infinite number of primary substances. Instead we need only four substances to create an entity and all its differentiating qualities and these substances we shall call the basic constituents of matter.

In regard to the creation of matter itself, we can look at the Big Bang theory of creation in two ways:

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[6] It may be possible to show eventually that the necessity for the existence of any "substances" can be discarded – but we are still a long way away from that.

a) That the primary substances of Space and Motion were given prior to the Big bang and only the secondary substances of Time and Energy were created or
b) That all four substances primary and secondary were created all at once with the Big Bang.

We will need to qualify our decision as to which seems the most correct view as we go along with this essay.

Quantum Mechanics

By definition of the word "quantum" itself – QM deals purely with the secondary substances of time and energy. But we have said that secondary substances are secondary only with relation to the pre-existence of primary substances. If we look at the two basic parameters of QM – namely position and momentum, we can identify "position" as position "in space" because position in itself is meaningless. Analogously we can identify momentum as momentum "in motion". What we are doing here is to attach a particle (a quantum of secondary substance) with a primary substance, where the primary substance is given as a point in the continuum. By the continuum thesis the point and the continuum are the same. Thus the position of a quantum particle "in space" is an absolute position and *also the whole of space itself*. The physical particle as an object is a body that "occupies space", not by displacing it like a body immersed in some fluid but by being associated with some discrete volume or "size" in a way that does not diminish or increase the "volume" of space itself. To give a simple analogy, when we draw a figure on a blackboard, we do not diminish the extent nor modify the character of the black-board itself, but "add-on" a secondary substance like a chalk mark, such that the blackboard and the chalk mark are only associated in *perception*. The quantum particle thus can be said to be floating "outside" space, it exists "transcendentally" in relation to space and hence is in an ideal state of existence to choose and fix an absolute position for itself. The position of a quantum particle in space is an absolute position because it is free of any relative references – by being transcendental.
Similarly for the momentum parameter, the motion of the particle is given as an absolute motion. However we detract from the classical view that particles move, rather we say that the Quantum Mechanical momentum parameter is a particle OF motion – not a particle IN motion. Positions are thus given in SPACE and momenta are given separately in MOTION. Thus the body and its associated motion are given *separately*. They are given in different[7] FIELDS altogether.

This is the crucial understanding of Space and Motion as entirely different media or substances, whereby QM has *intuitively* differentiated them as independent parameters. What a brilliant intuition!

Roger Penrose writes:
"The versatile and original Irish mathematician William Rowen Hamilton (1805-1865) …had developed this form of theory in a way that emphasized an analogy with wave propagation. This hint of a relation between waves and particles – and the form

[7] This is the same crucial differentiation that will eventually lead us to an understanding of mass.

of Hamiltonian equations themselves – was highly important for the later development of quantum mechanics…
One novel ingredient of the Hamiltonian scheme lies in the 'variables' that one uses in the description of the physical system. Up until now, the positions of particles were taken as primary, the velocities simply being the rate of change of position with respect to time…in the specification of the initial state of a Newtonian system we needed the positions and the velocities of all the particles in order that the subsequent behavior be determinate. With the Hamiltonian formulation we must select the momenta of the particles rather than the velocities….This might be a small change in itself, but the important thing is that the position and momentum of each particle are to be treated as though they are independent quantities, more or less on an equal footing with each other. Thus one 'pretends', at first, that the momenta of the various particles have nothing to do with the rates of change of their respective positions variables, but are just a separate set of variables, so we can imagine they 'could' have been quite independent of the position motions. In the Hamiltonian formulation we now have two sets of equations. One of these tells us how the momenta of the various particles are changing with time and the other tells us how the positions are changing with time. - (from "The Emperor's New Mind" ISBN 0-09-977170-5)

We can comment here that there is no need to 'pretend' as Roger Penrose says, rather position and momentum simply just 'are' separate parameters altogether.

Probabilities

Quantum Mechanics deals with subatomic particles as if they were probabilities. So far the probability approach to QM has been very successful except that no one has yet established any *physical basis* for probability – that is, while we accept the mathematical equations for what they are and the results that they produce, we will now try to understand the physical basis of these equations.

In the formalism of quantum mechanics, the state of a system at a given time is described by a complex wave function (sometimes referred to as orbitals in the case of atomic electrons), and more generally, elements of a complex vector space. This abstract mathematical object allows for the calculation of probabilities of outcomes of concrete experiments. For example, it allows one to compute the probability of finding an electron in a particular region around the nucleus at a particular time. Contrary to classical mechanics, one can never make simultaneous predictions of conjugate variables, such as position and momentum, with arbitrary accuracy. For instance, electrons may be considered to be located somewhere within a region of space, but with their exact positions being unknown. Contours of constant probability, often referred to as "clouds" may be drawn around the nucleus of an atom to conceptualize where the electron might be located with the most probability. Heisenberg's uncertainty principle quantifies the inability to precisely locate the particle given its conjugate.- from Wikipedia "Quantum Mechanics"

I have underlined the reference to an "abstract mathematical object". Given the nature of our continuum substances as described above, we do not need the term "abstract" nor do we need the term "mathematical object" – because it is the nature of the continuum itself that every point is a possible point. Every point in space is always a *possible* position and every point in motion is always a *possible* motion.

We thus have a physical basis for the existence of probability and we have discovered the reality underlying the quantum mechanical world.

Bound states

We now look at how quantum substances "bind" with continuum substances with the resulting appearance of matter. All those who are familiar with QM have heard of what is called the "wave function collapse"

*"In quantum mechanics, **wave function collapse** (also called **collapse of the state vector** or **reduction of the wave packet**) is the process by which a wave function, initially in a superposition of different eigenstates, appears to reduce to a single one of the states after interaction with the external world. It is one of two processes by which quantum systems evolve in time according to the laws of quantum mechanics as presented by John von Neumann. The reality of wave function collapse has always been debated, i.e., whether it is a fundamental physical phenomenon in its own right or just an epiphenomenon of another process, such as quantum decoherence. In recent decades the quantum decoherence view has gained popularity. Collapse may be understood as a change in conditional probabilities."* – from Wikipedia "Wave Function Collapse"

Something happens when the wave function collapses. As Danah Zohar cryptically remarks in her book "The Quantum Self" – "Reality happens when we look at it". In our opinion what happens when "reality happens" is that a quantum binds with a point in its particular continuum i.e for energy the continuum that it binds to is Motion and for time the continuum for binding is Space.

The bindings of energy and time with the respective continua bring about the existence of what is called "matter", such that matter is a compound of these four substances

END

CONCLUSIONS:

1) The schism or "gap" between the understanding of QM and GR is approached
2) Newton's Absolute time and space is recovered as an essential part of physics
3) A real basis for the probability approach in QM is established – rather than being a mere "mathematical tool" – the probability approach is verified as having a physical reason
4) Similarly the distinction between position and momentum as separate variables in QM is no longer a trick of mathematics – but has a firm physical grounding
5) A physical basis for what happens in a wave-function collapse is explained.
6) The basic constituents and formation of matter is explained.

NOTES

1) Terms commonly used in physics such as “Wave Function Collapse”, “Bound States”, “Quantum Mechanics” may have somewhat different meanings in current physics circles than those used in this essay. The reader is advised to be cautious because many of these terms even as used today are not completely well-defined.
2) The ideas presented in this essay were developed to this form after almost thirty years of introspection and the author is indebted to the time@yahoogroups.com internet group and to Prof. Hitoshi Kitada of the University of Tokyo for his kind indulgence and encouragement from the year 2001 till today.
3) In July 2009 the author dicovered an amazing co-incidence with Dr. Atso Eerikainen’s work (as as a footnote quoted in the above essay) or rather, was able to understand, for the first time as it were, the true essence of what Dr. Eerikainen has been saying for all these years on the time list