On the Use of a Non-local Medium Theory for a Unified Field Theory

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1 (ABSTRACT)

The purpose of this paper is to do a conceptual investigation on the use of a non-local medium theory (NMT) for a unified field theory (UFT). It is proposed that a non-local medium which can maintain what this paper terms as "local contained waves" and "traveling contains waves" can act as the ontological system behind the empirically accurate systems of Quantum Mechanics and Relativity.

The non-local medium theory for a unified field theory described here is an alternate physics theory. Its foundation was built on the concept that relativity and quantum mechanics can accurately predict experimental outcomes. This paper strives to make scientifically accurate statements on phenomenon and then propose hypotheses for how an NMT UFT would account for them.

The main outline of this paper is to discuss the question "If an NMT is the ontological mechanism behind the UFT, what would be required for it to explain the empirically accurate systems of Quantum Mechanics and Relativity?" Some implications and requirements for an ontological NMT UFT are proposed. A concept is introduced for a non-local flow mechanism.

This is a causal theory. Therefore the requirements of a causal theory are a strong part of this discussion. Much of these discussions must apply to any causal theory.

Finally a road map for the development of an NMT UFT is laid out along with some requirements for an NMT UFT which if not met would indicate its invalidity as a theory.

2 Overview and Reason for a Non-Local Medium

Mediums exist in physics today. The physics of air and water motion are such examples. The physics of sound through solids is also another example of an application of medium physics. These are well known physical examples of medium physics. However to use a medium for a unified field theory the concept a medium must be expanded.

2.1 Definition of a Medium

A medium is a substance which effectively, if not infinitesimally, exists at every point within a closed volume of space. For a local medium all interactions occur completely at differential or infinitesimally close distances.

2.2 Definition of a Non-Local Medium

A non-local medium is one that can have non-local interaction or causality. For a fluidic type non-local medium, the flow of the medium may go from one point in space directly to a distant point in space without traversing any path connecting the two. However, a good non-local theory must have a mathematical model that describes how a particular non-local flow occurs. This theory has such a model.

2.3 Causality

Causality or **causation** is defined as the relationship between one event (called cause) and another event (called effect) which is the consequence (result) of the first. (http://en.wikipedia.org/wiki/Causality)

If two objects are not in direct contact then the interaction between them is either caused by something that mediates the interaction or else it is non-causal action at a distance. Action at a distance in this sense means two objects have no described way of knowing about each other and yet make relational actions.

Non-local awareness of the other object in itself may become a mediator of a type. Assume this awareness of the other object is non-local. However, how can a non-local knowledge impart a relational local force? This question must be asked when considering theories that describe the forces.

2.3.1 Causality and the Standard Model of Physics

In many respects the standard model of particle physics is a mathematical non-local knowledge based system. The equation for an electromagnetic (EM) field describes the EM force between two objects. The standard model of particle physics uses a photon as the mediator of force.

http://en.wikipedia.org/wiki/Fundamental_interaction

http://en.wikipedia.org/wiki/Particle_physics_standard_model

However, what is the mechanism that tells two charged particles to exchange a photon which will satisfy that equation? While this method is causal and the developed mathematical results are highly accuracy it still lacks a strong reason as to why it happens. There is no ontological explanation as to why it happens.

2.4 Contiguity and Causality

Contiguity postulates that cause and effect must be in spatial contact or connected by a chain of intermediate things in contact." (*Author insertion - by some described mechanism*).

2.5 Causality Works With a Continuum (Occam's Razor)

A continuum provides an infinitesimal set of actions that provides a pure contiguous framework. If the mediator is some type of continuous medium then contact from one point to the next is established. The continuous contact established with a contiguous basis that conveys force.

2.6 Summary Reason for a Non-Local Medium for a UFT

There are some major reasons for using a non-local medium for a unified field theory. Modern physics has gone outside that of ordinary life. The physics of relativity and quantum mechanics are outside of ordinary life. For the experiences of ordinary life, a constant clock and local causal theories work quite well. Experiments have shown that

effects at the limits of high speed velocity and at ultra small dimensions that which exists is not so simple.

2.6.1 Strictly Causal Must be Non-Local

Nick Herbert's book Quantum Reality and many more papers and books discuss what modern science has shown by experiment, the implication of those experiments, and a number of ways to interpret what might possibly be going on.

Quantum Mechanics via Bell's Inequality has shown that no local causal theory can be correct. Something has got to give from common experience. There are a number of possible concepts that could give.

If the theory is to be strictly causal then it must have non-local causality. The alternative is to eliminate strict causality. This is the basis for those who view Quantum Mechanics as a complete description of nature. Modern science has largely followed this path.

http://en.wikipedia.org/wiki/Bell_inequality

2.6.2 Summary

As science has increased in its understanding of causal factors it gained a better understanding of the universe. If a contiguous causal theory, like the NMT UFT, can act as an ontological mechanism that the accurately describes the known Physics phenomenon, then it could be a powerful theory.

This theory may not be correct but there no one who has enough understanding to completely dismiss it. This path has not been adequately addressed by the Physics community.

3 Background Independence

The use of a medium makes this type of background dependent theory. That is in accordance with present considerations that background dependence is with respect to the physics of particles and of photons in the very wide range of mixtures in which we have observed them.

Any non-local causal theory in some respect requires this. There are a large number of reasons for

This type of theory can be formulated to be either background dependent or background independent. A choice approach will be to formulate it as an independent background medium theory.

In fact this can be formulated with an even greater degree of background independence. Present background independence requires mainly that there is independence from inertial frames. However, there is a dependence on rotational frames.

The dynamics of the medium can be formulated differentially to be independent of inertial and rotational frames. This will imply that the equations for this medium will differ from present medium or continuum mathematics because they have built in to them

at the least rotational dependence. The dynamics equations do not have to have the property of linear momentum which imparts rotational orientation.

4 Theory Foundation

There are many known phenomena which must be accommodated for any theory to be a complete unified field theory. This paper discusses many of the major known phenomena and describes how a non-local medium theory can or should account for them. In the process some expected properties of the medium are revealed.

When using a causal non-local theory as the ontological description there are some very big issues. For Relativity theses issues are simultaneity, time, length, and mass effects. For Quantum Mechanics these issues revolve around its probabilistic and non-local properties. On a similar note there is the issue of elementary particles and photons which exhibit the phenomenon of classical particles and classical waves.

4.1 Medium Theories

The theory is founded on the concept of a medium but with one non-Newtonian concept added: that of non-local medium flow. There is a strong bias in main stream physics these days against medium theories for a UFT. There is a general notion that medium theories have been proved invalid. This notion traces back to the 19th century concept of the luminiferous aether concept and experiments such as the Michelson-Morley experiment

http://en.wikipedia.org/wiki/Michelson-Morley_experiment

4.1.1 The Former Aether Theory

At the end of the 1800's there was a medium theory known as the Aether theory. The Aether theory was before particle-wave duality theory. In the Aether theory particles were considered analogous to marbles in a medium called Aether. Aether was conceived to be the medium which conveyed light, electric fields, and magnetic fields.

Particles were expected to loose motional energy as they moved through the Aether. Astronomical observations indicated that there must be an extremely low loss of energy. Therefore unless super-fluid proprieties were given to the Aether it could not support observations. This property was not desirable and gave the theory one of its hard to accept properties.

Another property of the Aether was that is had to have an absolute frame of reference. That frame of reference is the medium's local zero velocity. Light was expected to be a traveling wave in this medium. Measurements on the velocity of light were expected to vary based on the difference between an observer's velocity in the medium and the direction that light was traveling with respect to the observer. The velocity of the Aether passed an observer was termed the "Aether drift".

The Michelson Morley experiment was designed to find the Aether drift. The experimental results however showed no Aether drift. Lorentz and Fitzgerald developed a length contraction formula to explain experiment.

(Lorentz contraction: http://en.wikipedia.org/wiki/Length_contraction)

However, in the concepts of the time, this required a force being applied to an object which would slow the velocity of the object with respect to the medium. Astronomical observations measured no such reduction in speed. The 19th Aether theory therefore showed serious flaws with respect to the empirical evidence.

Out of this scientific setting came the elegant theory of relativity. Einstein developed the equation for length contraction directly using the concepts of Relativity without the need for Aether. The concept of time dilation and eventual experimental proof is one of its crowning achievements. Relativity proved to be vastly superior in predictive capability to any other theory of the time. Soon local medium theories came to be easily regarded as obsolete and discarded.

The elimination of the Aether theory almost a century ago as a possible physics theory is the chief reason medium type theories have been eliminated from consideration from the main scientific realm. However, the concepts of the 19th century medium theories are not the only form that they can take. A theory of particles in Aether is a very limited case. In fact understanding from quantum mechanics forces a fundamental change for any causal based theory.

4.1.2 The NMT UFT is a different theory from the Aether theory

The NMT proposed here is fundamentally different than the classically formulated Aether theory. The NMT UFT is a non-local medium and the Aether theory was a local medium.

Additionally, with the Aether theory, the Aether is a medium and particles are like marbles in the medium. For the NMT UFT particles are contained waves or oscillations in the medium. They are not marbles moving through a medium they are wave within the medium. Waves traveling in a medium do experience the same medium pressure that a marble traveling through it does.

4.2 Particle Wave Duality

The particle wave dilemma came basically from an attempt to force a classical view of particles and waves on known phenomenon (http://en.wikipedia.org/wiki/Particle-wave_duality). Scientists have for centuries known of physical objects like marbles and of waves in continuous medium which included solids, liquids, and gas. The concepts of particles and waves were used as fundamental starting points to explain specific phenomena. Debate began as early as the 1600's which tried to put things like the nature of light into one camp or the other. Physics in the 1900's demonstrated by experiment that both photons and elementary particles have properties of particles and of waves.

The final answer therefore is that objects, (particles, photons, and all conglomerates of such), must be able to exhibit both properties on a singular basis. Any theory about objects in the universe must account for its wave properties and its particle properties.

4.2.1 The term "Particle"

The term particle is used in this paper to refer to specific elementary particles such as electrons, protons, neutrons detached from the concept of what they actually are. There are and have been many concepts for particles such as points, strings, quantum objects, or even the old particle concept in the particle/wave duality concept. The focus here is to use the term particle in reference to an elementary particle and then begin to describe necessary properties and what they might be.

4.3 NMT Proposal: Contained Waves

The particle/wave duality of elementary particles and photons indicates the need for objects to be able to exhibit both properties. This theory proposes elementary particles are local contained waves and that photons are traveling contained waves. A contained wave should be able to exhibit both properties.

> Note: recent articles in physics have employed the concept of constitutive wave as particles which are oscillations in the ether. This is a similar concept.

4.3.1 Contained Waves

Contained waves are the key for a non-local medium theory to be a unified field theory. The term "contained" means that the wave remains intact and does not disperse over time. Energy of classical waves is typically dispersed over time. Energy with elementary particles must not disperse. These waves must be stable over time. Energy must be wrapped up in quantum bundles and exchanged in quantum bundles.

Simple classical waves such as those on water are not contained. Consider the waves created by a pebble on a pond. It starts out large in amplitude and then diminishes over time as the energy disperses outward. Frictional forces also have the effect of dampening out waves.

A contained waves are similar to Solitons (http://en.wikipedia.org/wiki/Soliton) but not fragile like them in any sense. Solitons are fragile contained waves. They only exist when conditions are balanced to sustain them. When the medium conditions change Solitons loose coherency and once again diminish as energy spreads outward. A contained wave must be permanent in nature with an energy profile that does not disperse over time.

A contained wave should be able to bifurcate or split into other contained waves. Contained waves must be able to interact. They should be able to combine. They should influence each others motion. The end result of contained wave interaction should be contained waves. All of this must be in accordance with the known laws of physics. Different phenomenon will be discussed and how contained waves could act in accordance with the phenomenon revealing in the process some required properties.

4.3.2 Importance of Contained Waves to an NMT

As discussions proceed the requirement for contained waves should be highly considered. This is a necessary property for any non-local medium theory if it is to be used as an ontological description of the universe. If a non-local medium cannot be constructed that

has contained waves, then it is unlikely to succeed as a UFT. Proof that it is impossible would be a proof that an NMT is not viable for a UFT.

The process is to first consider how an NMT should work. Then develop the math for such a medium. If the math of the medium creates the entire set of known phenomenon then it would be an extremely strong indicator of the validity of the theory. If the math proves that no such medium can support such waves then it shows this as an invalid approach.

4.4 Two Types of Contained Waves

Considering the nature of particles and photons there must be two distinguished types of contained waves: one for particles and one for photons. Particles must travel at less then medium velocity. Photons must move at medium velocity. A particle is called a Local Contained Wave (LCW) and a photon is called a Traveling Contained Wave (TCW) to distinguish the two types.

4.4.1 Local Contained Waves (LCW)

An LCW is a contained wave whose center of oscillation travels at a velocity less than the medium wave velocity. The term "local" is used here merely to indicate that it does not move at the medium velocity. It is different than a classical pebble on a pond wave. A wave like that has a center of oscillation that does not move with respect to the medium and it disperses over time. An LCW must be a stable oscillation in the medium. It must not diminish in strength over time.

The center of oscillation for an LCW must be able to move with respect to the medium. The average motion must be constant in time if there are no forces on it caused by other contained waves. It must be able to change velocity with respect to the medium when it interacts with other contained waves. It must never be able to reach the medium wave velocity. It must require more energy to make it move faster with respect to the medium as it approaches the medium wave velocity.

LCWs must have a rich type set for the many types of elementary particles. There must be reasons for different types of elementary particles. Concepts are developed which can support this need.

4.4.2 Traveling Contained Waves (TCW)

A TCW is a contained wave whose center of oscillation travels with the medium wave velocity. This is the concept for a photon. It must be a three dimensional oscillation moving on average at the medium wave velocity.

4.4.3 Contained Wave Interactions

TCW's should not interact with each other in the sense that light beams can be shined through each other without collision or dispersal effects. LCWs and TCWs must be able to act in accordance with observations of elementary particles and photons. An LCW must be able to emit and absorb TCW's. An LCW must change its velocity when it emits or absorbs a TCW.

4.4.4 Particle Wave Duality is Natural for Contained waves

Contained waves should by nature exhibit properties of a wave and properties of a classical particle. Being contained they have a particle component. Being an oscillation they have a wave component. Interference patterns should emerge according to the environment of the contained wave. Thus a single contained wave should be able to statistically create the interference patterns observed in experiments. Thus it should be possible for LCW and TWC to support the experimental evidence showing single photons and electrons statistically exhibiting interference patterns.

5 Relativity

Special Relativity is concerned with how differing constant velocities produce different perspectives of mass, length, and time. General relativity covers gravity and accelerations. General Relativity becomes Special relativity when the strength of gravity and the magnitude of accelerations go to zero.

http://en.wikipedia.org/wiki/Special_relativity

http://en.wikipedia.org/wiki/General_relativity

It is a requirement for any scientifically viable theory that it be able to produce a system where relativity is mathematically accurate. At the very least Relativity must be the limiting accurate form. This is in the same as manner that Newtonian mechanics is a limiting accurate solution of Relativity for velocities much less than the speed of light.

5.1 Special Relativity

Special Relativity considers inertial frames of reference. That is constant velocity frames of reference and how it effects observations. Its main features include constant speed of light, length contraction, time dilation, and mass increase effects with relative differential velocities. It also has two major concepts which are that absolute uniform motion is not detectable and that simultaneity of events at distance points is observer dependent.

5.1.1 Simultaneity

Relativity has the implicit concept that simultaneity at distance points does not exist. This means that an absolute time over all space does not exist in Relativity.

http://en.wikipedia.org/wiki/Simultaneity

5.1.1.1 Absolute Time

Absolute time is at odds with relativity. It can be stated that if a non-local communication device could be created then relativity would fall. "*Special relativity shows that in the case where causal information is transmitted at superluminal rates, causality is violated*" from:

http://en.wikipedia.org/wiki/Relativity_of_simultaneity

5.1.1.2 Simultaneity and Non-Local Communication

In a typical thought experiment for relativity consider two point are separated and two events occur at those different points. Call these two points Pt A and Pt B and the events that happen at those points as Event A and Event B respectively. A situation can be constructed where in one reference frame Event A can be seen by observer 1 before Event B. In another reference frame observer 2 can see Event B before Event A. Relativity says that both sequences of events by the two observations are valid and true.

If a non-local communication device existed where when the event occurs it sends a signal to turn on a light at the other point, then when an observer sees Event A happen immediately the light at Pt B should light. In observer 1 reference frame the light at point B will turn on and then Event B will happen. This contradicts what Observer 2 expects to see. Observer 2 sees Event B before Event A. Observer 2 would therefore expect to see, Event B, the light at Pt A, and then Event A.

There are no faster than light communication devices known in physics today. Therefore the non-simultaneity concept of Relativity is safe from such experiments.

5.1.1.3 Simultaneity and Quantum Mechanics

Quantum Mechanics (QM) has a phenomenon known as quantum entanglement. This is a type of probabilistic connection between two locally separated events. This non-local nature of quantum mechanics creates some difficulties when trying to reconcile with Relativity. It has been shown that no local causal theory can account for the experimentally shown quantum mechanical activity.

Relativity says non-local causal activity cannot happen. QM says non-local activity happens. This fundamental difference between Relativity and QM is one of the main reasons for the following statement:

> *"A number of scientists have pointed out that some of the predicted consequences of quantum mechanics appear to be incompatible with relativity of simultaneity because of non-locality, in particular in the case of quantum entanglement. This issue has not yet been resolved"*
>
> *http://en.wikipedia.org/wiki/Relativity_of_simultaneity*

The dilemma between QM non-local entanglement and Relativity is presently solved with two concepts. The non-local nature of QM exhibits itself by probability and cannot be used for communication. The order of events is not important in QM. QM cannot be used to create a non-local communication device.

5.1.1.4 Non-local Systems and Simultaneity

The non-local medium proposed is deterministic and has an absolute time. All points in space are to some extent connected. One absolute time is required to allow a simple causal manner to correlate events at all points. It allows for a context for the relational interaction between locally separated points, i.e. non-local activity. The NMT therefore has an absolute time framework.

Simultaneity is a property of an NMT. Lack of it in Relativity does not need to be accounted for except for the main theory that led to it. The main theory that leads to simultaneity is the constant velocity of light for all inertial frame observers.

5.1.2 Absolute Uniform Motion and the Constant Speed of Light

The chief foundation of Relativity is that absolute uniform motion cannot be detected. The method by an absolute motion would be detected is to determine the speed of the medium in which light moves. To be able to measure a different speed of light for different inertial frames would be the ability to determine the absolute frame or reference for motion.

Special Relativity uses the concept of absolute uniform motion cannot be detected and makes the statement that the speed of light for all inertial frame observers would be the same. Medium theories typically allow for the determination of the medium velocity with respect to the observer. No Aether was found in this search. Instead the Relativistic concept that the speed of light is measured as a constant for all inertial observers bore out

5.1.2.1 Length Contraction and the Constant Speed of Light

Experiments showed that light did appear to move in a constant velocity for all inertial frame observers. Lorentz proposed a length contraction to account for this. Under the Lorentz proposal if length did contract according to his formula then light would indeed be measured to be a constant by different inertial frame observers.

5.1.2.2 NMT Length Contraction

Any proposed non-local medium theory must have a Lorentz type contraction to explain the constant speed of light for all inertial frame observers. From the non-local medium perspective, what this requires is a deformation in the shape of the local contained wave that has a relationship to its motion in the medium and not according to a pressure which would slow its motion.

5.1.3 Special Relativity and Length Contraction

Special relativity calls for length contraction in a relative moving object. The Lorentz contraction is the same mathematical formula as the Special Relativity formula for it. Therefore a Lorentz contraction would account for this aspect of special relativity.

5.1.4 Special Relativity and Time Dilation

Relativity contains a time dilation effect. Experiments and observations have supported this phenomenon. For example, it has been shown that high velocity particles have a slower decay rate.

5.1.4.1 NMT UFT Proposal: The Unit of Time for a Particle is One Oscillation.

The response to the time dilation objection is to ask this question: What is a unit of time for something that is oscillating? It is proposed that one period of oscillation can be related to a unit of time for a contained wave. If you change oscillation period you

change its unit of time perspective. If you have a system of oscillators and do something to slow the overall oscillation framework you slow the internal time of the system.

5.1.4.2 NMT UFT and Particle Decay

Particles decay according to a constant Poisson probability rate (constant probability over time)

http://en.wikipedia.org/wiki/Particle_decay)

From special relativity perspective when viewed at zero velocity to the observer a particle will have a given time decay probability factor. When a particle moves with respect to an observer, the internal particle time will slow according to the observer. It will take longer to decay.

It is proposed that for LCWs some aspect of the oscillation rate must slow and the period grow longer for increasing in velocity. It is then proposed that decay probability can be based on the oscillation period. If an LCW slows in oscillation rate as it moves faster in the medium then it will have a greater oscillation period. A greater oscillation period will be a slower perspective in time and slower time means a slower decay rate.

This is a required property. The NMT UFT must have a time dilation effect. Particle decay rate is a property to look for in any developed LCW math.

5.1.5 Special Relativity and Mass Increase

Special relativity calls for increase in mass of a relative moving object.

5.1.5.1 NMT and Mass Increase

LCW waves that increase in velocity must be shown to have a relative increase in mass. Mass is measured by determining how much effort it takes to change its velocity. An LCW is a contained wave that moves at velocities less than the medium wave velocity. The equation of motion for an LCW must be such that it requires more energy to get it to move faster as it approaches the speed of light.

The mechanism by which an LCW gains or losses energy to change its velocity will be by the absorption or emission of a TCW. The absorption of a TCW should have less effect on velocity changes as the LCW approaches the speed of the medium.

5.2 General Relativity

The focus of General Relativity is on gravity and effects of acceleration. An NMT UFT must have the properties which affect motion and time in a manner described by General Relativity.

5.2.1 Gravitational Force

The effect of an LCW into the surrounding space must be that there is an attraction between LCWs. It must also affect the motion of TCWs.

"The only possibility that Maxwell could see for salvaging the field-based approach to gravity was if we suppose that a massive body contributes negatively to the energy of the gravitational field in its vicinity… he suggested that we could postulate a huge positive *background* energy content for empty space, and then we could suppose that the presence of matter somehow diminishes the energy of this background field in its vicinity"

> http://www.mathpages.com/home/kmath613/kmath613.htm

If we take the concept of Maxwell and apply it to a medium theory then a gravitational field would be some type of reduction in relational energy in the medium. In short a general physics concept is that force is applied in the direction that will reduce potential energy.

5.2.1.1 Gravity and Time

Gravitation slows time in general relativity. Previous discussions about time from special relativity indicate that a non-local causal theory would require the interaction to slow as an object moves faster with respect to the medium. The effect of gravity slowing time indicates also that in oscillations should be slowed by gravitational fields. In the presence of many LCWs the medium should be effected in a way the causes the oscillations to slow.

Two possible ways to reduce oscillation for a mass-spring oscillation system is to either increase the mass or to decrease the spring strength. Either one of these mechanisms would slow the oscillation rate. Slowing the oscillation rate slows the internal time for a system.

6 Quantum Mechanics

Quantum Mechanics is a probabilistic framework for predicting the outcome of events. Those who pose QM as a pure ontological description of nature do not believe in determinism. The Copenhagen Interpretation is a good place to begin to research this issue.

> The Copenhagen interpretation, due largely to the Danish theoretical physicist Niels Bohr, is the interpretation of quantum mechanics most widely accepted amongst physicists. (http://en.wikipedia.org/wiki/Copenhagen_interpretation)

QM has four main aspects that need to be considered.

> Broadly speaking, quantum mechanics incorporates four classes of phenomena that classical physics cannot account for: (i) the quantization (discretization) of certain physical quantities, (ii) wave-particle duality, (iii) the uncertainty principle, and (iv) quantum entanglement. Each of these phenomena will be described in greater detail in subsequent sections.(http://en.wikipedia.org/wiki/Copenhagen_interpretation - June 4 1997)

QM poses perhaps some of the more difficult phenomenon for an NMT UFT to exhibit. It is a difficulty for any causal theory. It is the reason that non-local behavior it required for any causal theory.

6.1 NMT and Wave-Particle Duality

The foundation for the NMT UFT suggests that particles are contained wave. Being contained they exhibit particle phenomenon. Their wave nature will exhibit wave interference activity.

6.2 NMT and Quantization

The quantization of certain physical properties can extend into quantization of charge, spin, and mass for particular particles. Electrons all have the same rest mass. The NMT should have a built in quantization principle. The solution to wave equations typically yields a distinct set of possible solutions. For one solution there may be many instances. All of these instances will look alike and act alike. The energy quantization of light via the photon indicates that is can act with a corpuscular nature. However, a photon can have any energy value required for an interaction. This indicates another special difference between photons and other nuclear particles.

6.3 NMT and Uncertainty

In short, an NMT UFT can be described as a hidden non-local variable theory. The exact location, velocity, and oscillation phase start out unknown for all contained waves. Not knowing these parameters initially keeps the problem in the realm of probability. Calculations start out with a probabilistic spread of what might be occurring. Expected future events have probabilities based on the initial probabilities.

Quantum mechanics can be viewed as a "knowledge of the system" mathematical framework. The NMT UFT would be the ontological basis and QM would be the mathematical system used to calculate expected events.

6.4 NMT and QM Entanglement

QM entanglement is a non-local phenomenon where two objects, particles or photons, are quantum mechanically linked. Measuring the state of one object will set the state of the other object.

> **Quantum entanglement** is a quantum mechanical phenomenon in which the quantum states of two or more objects have to be described with reference to each other, even though the individual objects may be spatially separated.
>
> (http://en.wikipedia.org/wiki/Quantum_entanglement)

There are several experiments which have been designed to exhibit this non-local phenomenon.

> Quantum eraser experiment
> http://en.wikipedia.org/wiki/Quantum_eraser_experiment
>
> Delayed choice quantum eraser
> http://en.wikipedia.org/wiki/Delayed_choice_quantum_eraser

For any causal theory this aspect of QM must be accounted for. This is precisely why the non-local medium theory is being proposed. First it can handle the non-local relations prescribed by QM and second it can handle the need for a continuous causal system.

6.4.1 Quantum Mechanics Dual Path

There are dual path experiments where a particle or photon may have a probability for taking two paths. See Feynman lectures on Physics volume 3 and also ref [3].

In quantum theory it must be considered to be on both paths. Each path has a particular object property. Take for example a photon going through an HV splitter where H stands for horizontal and V for vertical. A photon that is at 45 degrees polarization that passes through and HV splitter where H is 0 degrees and V is 90 degrees had a 50/50 probability of going H or V. If measured in the H path the photon will now have H polarization. If measured in the V path the photon will now have V polarization. It is possible see the two paths to once again converge. If you do this the photon will once again always be measured to have 45 degree polarization. However if you then block the one of the paths like the H path then the photon eventually measured in the convergent path will always have a V polarization. If the photon takes only one path say the V path, how would it know if the H path was blocked?

The end result is that any causal theory that puts the photon on one path is incorrect. The NMT UFT must be able to support particles and photons splitting and following both paths. When a path is blocked it will be blocking a part of the dual path photon.

This is perhaps one of the most difficult phenomenon to exhibit. Conservation of energy and momentum may make this difficult to recreate. If the photon is simply split to have 50% strength on each path when one path is blocked the result must move all energy to one of the two locations, either to be 100% absorbed on the blocked path or to continue 100% on the unblocked path.

If the path is blocked the blocking action moving the energy into the unblocked photon component must not diminish the strength of the photon.

The action could impart change which would not affect total energy. This means is could impart some type of orientation change to the original value. This means a photon starting with a 45º orientation could be changed to 90º giving the photon the V orientation of the path it is on. If the NMT UFT can explain this it will be a major achievement.

6.5 NMT LCW frequency versus Quantum Mechanics Particle Wavelength

The LCW oscillation frequency is not that which is calculated in Quantum Mechanics. The reason for this delves into how QM wavelength calculation is made, how it is used, and what it must therefore mean in terms of the LCW concept. A basic equation relating a QM wavelength to motion is:

$$\lambda = \frac{h}{p}$$

λ is the wavelength

p is the momentum

h is the Plank constant

Notice first that as momentum goes to zero due by approaching zero velocity that the wavelength goes to infinity. This also corresponds to the frequency going to infinity. Secondarily the velocity is not a single object concept. The velocity has to be with respect to something.

The question is then, "How is this equation used?" The answer is that it is used to calculate interactions between a particle and other objects. It is an equation about how an object will interact. It describes the interaction of electrons through a crystal matrix. It explains the electron orbital shells for atoms. These are matter interaction activities.

From the concepts of special relativity the LCW oscillation rate must slow down as it moves faster. This indicates two aspects to the oscillation. First there is the actual oscillation rate. Then there is how this spatially oscillating object will interact with other objects in the environment. When an object is not moving with respect to an object then there will be no such interaction and the "interaction" wavelength goes to infinity.

Thus for an LCW to be capable of explaining QM wave interference patterns there must be a secondary wave interaction effect between an LCW and other objects in the environment. This equation suggests that the interactional effective wavelength is inversely proportional to the product of the mass of the object and its relative velocity to the interaction target.

7 Elementary Particles and the LCW

The NMT UFT model for particles has been described as a local contained wave. LCWs are not part of present mathematical physics. They are a different type of concept from present wave type considerations. Since they are different there is no present basis in math for understanding their nature.

The math for the medium which has contained waves will need to be developed. However, there are certain conceptual principles from present known particle physics which these contained waves will have to support. These concepts describe how LCWs should interact.

Ordinary linear waves do not interact with one another in the sense that they do not affect each other's motion. Wave interference is the result of the superposition. Superposition means all the existing waves can be considered independent of each other and the independent motions summed for a final result.

Particles on the other hand have a direct influence on one another. They bounce off one another. You cannot watch one isolated particle, then watch a second isolated particle, add the two pictures and get the results of what will happen when both are in the same picture. If the two are in the same picture they may collide with each other and you will get a very different picture. This is not linear superposition.

7.1 Electro-Magnetic Considerations for LCW Systems

The following sections describe how LCW's would work with electro-magnetic only considerations. It does not account for the Strong or Weak force implications to the internal constitution of the LCW's.

7.1.1 Single LCW System

The simplest LCW system is a single LCW. It has a center point of oscillation. The medium will flow away from the center and then back towards the center. The center point may move about within the medium. It may not be apparent whether two such LCWs would effect each other or not in their motions. A more complex LCW system can show more distinctly that two LCWs should affect each others motion.

7.1.1.1 Single LCW Motion – An Object in Motion

An LCW must be shown that when in motion it remains in motion. That is an LCW moving with respect to the medium will continue to move at least with average velocity in the same direction with respect to the medium.

7.1.2 Two LCW System and LCW interaction

Non-Local flow offers a new mode of medium oscillation. Consider a non-locally connected two LCW system in which one LCW has a net flow of medium towards its center and a second LCW has a net flow of medium away from its center. That is one LCW will be a sink of material and the other will be the source. It is reasonable then to assume that a source and a sink of material would attract each other. These two LCW's will accelerate towards one another.

7.1.2.1 Two LCW System and the Electric Field

The electric field could be described by this two LCW system. A sink LCW and a source LCW should attract each other while two sink LCWs should repel each other and two source LCWs should repel each other.

These LCWs are oscillations. The flow rate would not be constant. Rather it would oscillate around a value. If the value goes from 0 to some maximum then the flow rate would be described along the lines of:

$$\text{Flow Rate} = \text{Max Value} * (\sin(wt) + 1)$$

A neutral particle would oscillate between the source and the sink flow directions. The overall electric field effect would there for average out to zero. The flow rate for a neutral LCW would be described along the lines of:

$$\text{Flow Rate} = \text{Max Value} * \sin(wt)$$

The electric field would be aligned to the overall average motion of the medium.

7.1.2.1.1 Two Dimensional Medium Concept

One more concept needs to be introduced at this point: the possibility of a two dimensions for the medium. That is at one point there is a two dimensional medium (m_1,m_2). With this kinematic property for the medium, a positive charged LCW could be described as a sink in one dimension of the medium (m_1) and a source in the other (m_2). The negative charged LCW would be and sink (m_2) and source (m_1).

7.1.2.1.2 Reason for the Two Dimensional Medium Concept

There is a need for a two dimensional medium. The reason for this is as follows.

An LCW, being an oscillation in the medium, will be affected by changing flow of the medium. The properties of an LCW must be that when in motion with respect to the medium it remains in motion. This works in the situation where the medium has no internal differential motion. An LCW must maintain an average constant velocity in such a medium. However, if there is a section of space in which the medium is accelerating then an LCW should naturally accelerate with the medium to maintain that constant velocity with respect to the medium.

If the medium has only one dimension of existence, then electric field will only based on a one dimensional medium flow. One charged LCW will either be a sink and the opposite charged LCW will be a source. The electric field is related to the source / sink flow of the medium. An increasing electric field will have an increasing medium flow. For the single dimensional medium concept, an increasing electric field produces a region of space where the medium flow is increasing in velocity. The medium will be accelerating in a direction associated with the increasing electric field.

A neutral particle is not affected when it goes through an electric field. The velocity of a neutral LCW should be affected when it goes through a region of space where the medium is accelerating. For the single medium theory however, an increasing electric field would produce a region of space where the medium flow is increasing. This indicates that a neutral LCW should be affected when it goes through a region of space where there is an increasing electric field.

This would result in neutral particles accelerating in a direction associated with the increasing electric field. Since that has not been observed it would indicate that a single dimensional medium is likely not a possible answer for a unified field theory. However, a two dimensional medium does not have this same problem. For a two dimensional medium, there are two opposite medium flows. An increasing electric field would have the two dimensional medium flow increasing in opposite directions. Medium component (m_1) would increase in one direction and medium component (m_2) would increase in the opposite direction. A neutral LCW would have opposite flow directional forces canceling out. Therefore the path of a neutral LCW would not be so directly affected by the increasing electric field.

This is an important consideration for the non-local medium field theory. It gives a strong reason for a kinematic theory to have two dimensional constituent medium.

7.1.3 NMT, Electric Field and the Magnetic Field

A curl in the electric filed creates a changing magnetic filed. Curl is a rotational action. There should be some property of the NMT that stores energy in a rotational form that would correspond to the magnetic field.

7.1.3.1 LCW and Magnetic Moment

A magnetic field is created by a changing electric field. The electric field is associated with medium flow. The LCW flow of medium oscillates. That oscillation is analogous to a changing electric field. The changing electric field should have some effect that corresponds to a magnetic field. The oscillation should produce some type of magnetic field effect around a particle. This would be associated with the magnetic moment phenomenon.

The average value of medium flow would correspond to the constant electric field associated with charged particles. The oscillation of the field would produce the magnetic moment.

7.1.3.2 LCW and the Neutral Particle

An LCW that is a neutral particle will have a zero net average flow of medium. Medium would flow out of the center zone and then back into the center zone. This oscillation effect would produce an oscillating net zero electric field. From the consideration of magnetic fields, this oscillation of the flow field should produce a magnetic field. This would be the magnetic moment associated with neutral particles such as the neutron.

7.1.4 Three LCW And the Strong Force

A neutral LCW oscillates between the source and the sink flow directions. The overall electric field would therefore have an average value of zero. However it does have potential for interaction that formulates atomic nucleus. To explain this some equations of the electric field are proposed.

For a charged particle the strength of the electric field is proportional to q/r^2. The force between two particles is proportional to the charges and inversely proportional to the distance squared.

$$F \approx q_1 \, q_2 / r^2$$

In this equation the charge, q, is constant. An LCW has an oscillating electric field. This could be modeled by an oscillating charge.

$$Q_{\text{positive charge}} = q \, (\sin (wt) + 1)$$

The constant ‘1’ keeps the Q positive. The charge factor for a neutral particle would look like

$$Q_{\text{neutral charge}} = q \, (\sin (wt))$$

This makes the average charge equal to a zero.

For the helium 3 atom there are two protons and one neutron. Assume the following configuration of particles:

Proton1---distance r ---Neutron---distance r --- Proton2

The next step is to calculate the force on Proton1 due to the Neutron and Proton2. A few assumptions to be made are as follows

1) The particle oscillations will be synchronized
2) The Neutron will be most negative while the Protons are most positive
    a. This is where the '-' term enters the "- q (sin (wt))" term

Force on Proton1 away from center due to the neutron and the other proton is

$$F_{P1} \approx F_{P1dueN} + F_{P1dueP1} \approx q_{P1}\ q_N / r^2 + q_{P1}\ q_{P2} / (2r)^2$$

If the total average force is negative then the proton will be bound in the nucleus.

The force on the proton due to the neutron is:

$$F_{P1\ due\ N} \approx (q\ (\sin\ (wt) + 1))\ ((-q\ (\sin\ (wt)) / r^2)$$

Calculating the time average for this force noting the math simplification formulas:

$$\text{Time Ave}\ (\sin^2\ (wt)) = ½$$

$$\text{Time Ave}\ (\sin\ (wt)) = 0$$

The time average value for this force is

$$\text{Time Ave}(F_{P1\ due\ N}) \approx (q)\ (-\ q / 2r^2) = -\ q^2 / 2r^2$$

Calculating the force on the proton due to the other proton yields:

$$F_{P1\ due\ P2} \approx (q\ (\sin\ (wt) + 1))\ (q\ (\sin\ (wt) + 1) / (2r)^2)$$

$$\approx q^2\ (\ \sin^2\ (wt) + 2\ \sin\ (wt) + 1\ )\ /\ 4\ r^2$$

$$\text{Time Ave}(F_{P1\ due\ P2}) \approx\ q^2\ (\ ½ + 1)\ /\ 4\ r^2$$

$$\approx\ \ q^2\ 3\ /\ 8\ r^2$$

Next calculate the total average force on the proton:

$$\text{Time Ave}(F_{P1\ due\ N}) + \text{Time Ave}(F_{P1\ due\ P2}) \approx -\ q^2 / 2r^2 + q^2\ 3\ /\ 8\ r^2$$

$$\approx (-1/2 + 3/8)\ q^2\ /r^2$$

$$\approx (-1/8)\ q^2\ /r^2$$

Thus there is a total average force of - q^2 /8 r^2 which is negative indicating a central overall binding force.

This calculation is very simplistic with many assumptions. However, its purpose is to illustrate a potential nuclear binding strong force created by the LCW model. It does not attempt to use the three quark model of the standard particle theory. Interactions between LCWs should be LCWs.

7.2 Conservation of Charge

The electric charge was associated with a nonzero net average flow of medium into a sink or out of a source. If the strength electric field is related to the total flow of the medium

into a point or out of a point, then there would be an overall equality of positive and negative charges in the universe. Conservation of medium will yield the fact that for every sink there should be a source. Every charged particle or set of particles should be connected in some way to opposite charged particles.

Any particle not connected to other particles would have to be neutral. However, there is no reason at this time to think that neutral particles must be isolated. A neutral particle composed of zero balancing charges could have connections to other particles.

7.3 The Connection between LCWs

Reference [7], On the Kinematics of a Non-local Medium, develops of a set of kinematics equations for a physical non-local medium. This paper discusses the concept of a non-local interconnection bond which forms the causal connection that allows for the non-local flow. This bond gives a mathematical reason and formulation to the non-local flow.

When the strength of this bond is zero, it means there will be no causal relation. When the strength of the bond is infinity, it means that two points are inextricably connected. It will be as if they were right next to each other in the local sense. Only a very minute differential, in the concept of a calculus differential, is allowed in the difference between medium quantities between two infinite bond connected points.

It is suggested that two particles, or LCW's, such as the proton and electron would have this infinity bond connection at their heart and core. The theory also allows for systems of LCW's to be connected: such as all electrons to all protons.

One question to investigate would be if systems of connected LCWs are required or if individual connections will work. Some of this will get into the methods of original formation as done in Cosmology for the Big Bang theory construction of the universe.

7.4 Standard Particle Theory and LCWs

Standard Particle Theory has a list of particles, constituents of particles, i.e. quarks, and the forces between those particles which is mediated by other particles and photons. Some of the main concepts are that there is a discrete list of particles and a discrete list of processes by which those particles can interact with other particles. There is a mathematical framework to describe when those processes will occur.

7.4.1 Implication for LCW and TCW Theory

If the theory for the quark content of Hadrons is to be taken as correct then the implications are that there would be two different types of LCW oscillations. There would be one type for the electron and one for the proton. The neutrino might be another type of oscillation. Neutrinos and electrons are Leptons. The Neutrino mechanism is therefore be highly related to the electron mechanism.

The focus an exploration should be on the completely, as far as we know, stable particles. The only stable Hadron is the proton. The electron is a stable lepton. The neutrinos are in a sense stable. Even though they may oscillate between the different types, there are

only three known types and they do not decay to a more fundamental form. The photon is also stable.

Therefore the focus should be on the four stable forms:

- Proton
- Electron
- Neutrinos
- Photons

A system which produces these stable LCW's and TCW would be a good start.

7.4.2 Interactions

To show how these would interact is the next step. The interactions should take place in a discrete set of processes where by a quantized component exchange takes place. In many respects the strength of a "force" is related to the propensity for an exchange to take place.

The Standard Particle Theory has a list of exchange processes and a mathematical framework to determine when they will occur. However, it does not describe the process in "3D". A medium theory would have a set of continuum equations which give a three dimensional view into the LCW and the processes which result in exchanges taking place.

8 Motions in Medium

The motions of CW's, that is both LCWs and TCWs, will be with respect to the medium. If the medium is moving on a large scale the motions of the CW's will have this additional motion factor to consider. The effect of motions in the medium would be tied into the large scale effects found in cosmology.

8.1 Rotational Motion in Medium

If a very large, say galactic sized, section of the medium is rotating, the CW's would be going along with this rotation. Centripetal force calculations due to orbiting a central point would have to have the rotational motion of space subtracted before final force calculations could be made.

If the rotation is in the direction of the orbiting objects, the stable orbital velocity for objects would be faster than that calculated by assuming a static (to the background universe) space and only the force of gravity. Without knowledge of the rotation of the medium, one might conclude that there was an invisible dark matter adding gravitation force to keep the system bound.

8.2 Rotational Motions in Medium

Two different sections of space may have different rotational directions. There would be a type of relative energy found in the different rotations. If these rotational spaces had some force for alignment, then relative rotational energy would have to go somewhere. A

repulsive force would be a possible director of energy. This is one possible explanation for dark energy. That is a repulsive force which resists the alignment of rotation in differing rotational zones.

8.3 Medium Forces

If the medium were simply a pressurized substance like a gas or fluid under pressure, then it might also have a repulsive force to expand. This could also be related to a large scale cosmological expansion force.

9 Future Development Goals.

This type of theory in essence breaks down the entire foundation of physics and requires it to be rebuilt from scratch. Many learned principles of science should be valuable but each should be carefully considered in its application and explanation.

The following outlines an approach to rebuild this foundation.

1) Suggest how a non-local medium could be the foundation for a UFT. This paper.
2) Begin the mathematical modeling for the medium. See the paper on the Kinematics of a Non-local Field with application towards a Unified Filed Theory.

At this point nothing has been proved about whether such a medium could result in a UFT. It should however give a good indication of why this approach has some good possibilities.

The main questions remaining are:

1) Can a non-local medium be constructed that has both TCW's and LCW's.
    a. If not then such a medium cannot be the solution
2) If so then more then proceed to analyze the physics of contain wave interactions.

    Once TCWs and LCWs are found then one-to-one correspondence between the mathematical construct of the non-local medium and present experimental observations should be developed. This will require a dynamics model and the development of the principles of TCW and LCW types and interactions.

    a. What kind of LCWs can exist
        i. The Proton, Electron, and Neutrino LCWs
    b. LCWs should interact like particles
        i. Newtonian motion laws at low speed
        ii. Relativistic or Lorentz type framework
    c. TCWs should travel and interact like photons
    d. Electro-Magnetic Forces
    e. Strong Forces
        i. Simple nucleus like H and HE.
    f. Gravitational attraction

g. Quantum Mechanics: Probabilistic interpretive framework with unknown locations and phases

h. Quantum Mechanics: two paths followed blocking path either absorbs or redirects energy. Only rotation commuted.

i. Weak force

Cosmological investigations are also required

j. Beginning of the universe and the formation of the systems of particles, photons, and medium motions.

k. Explanations for dark matter effects

l. Explanations for dark energy effects

3) Computer simulation of the equations would be a powerful investigative tool.

Isolated TCW's and LCW's will be the solution with the simplest possibly mathematically soluble form. Multiple TCW-LCW interactions may yield three body type insoluble forms except for special cases. However there should be solvable math that can show a variety of LCWs to begin to account for particle physics.

Although simulations can show such dynamics, main essentials should be shown mathematically for definitive proof.

9.1 Final Statement

Rebuilding physics from the ground up for any new theory requires a vast amount of work to do to bring it up to the present levels of sophistication of scientific research. There are some very difficult problems to solve. However, for any new young theory there are tremendous opportunities.

10 References

Whereas many of the associated texts are not strict scientific papers they are all by respected authors in the field.

[1] Nick Herbert, Quantum Reality

Good discussion on many different potential view points for scientific theories compatible with modern scientific knowledge with special focus on Quantum Mechanics.

Good description of Bells Theorem.

[2] Brian Green, The Fabric of the Cosmos

Reference especially for its discussion on Newton's bucket.

[3] Misner, Thorne, Wheeler, Gravitation

Standard text book on more advanced topics in Gravitation and general relativity.

[4] A. Cermal Eringen: Non-local Continuum Field Theories

This is the only real textbook on Non-local Continuum Field Theories that I have found. Although I derived my expression of kinematics separate from this, I wish I knew of it before hand. This gets much more in depth into Non-local Field theory mathematics than I have attempted in this paper.

[5] Nick Herbert, Faster than Light, Superluminal loopholes in Physics

Discussion in possible methods for faster than light communication methods. Also states none presently exist and no experiment has even done so.

[6] http://en.wikipedia.org/

wikepedia is a great online resource for information especially for the sciences.

[7] D. Gilbertson, On the Kinematics of a Non-local Medium

Development of a set of kinematics equations for a physical non-local medium and an initial development of dynamics. http://www.nmtuft.com/nmtuft/