On the Kinematics of a Non-local Medium

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1 ABSTRACT

The purpose of this paper is to develop the kinematics for a non-local medium. A first order of dynamics is also developed. For the purposes of this paper the “first order dynamics” is to determine where the kinetic and potential energies should exist without yet developing the full dynamics.

The long term goal of this paper is to use this as a basis for a non-local medium theory with application for a unified field theory. With the advent of and experimentally shown Bell’s inequality theorem, any strict causal theory for a unified field theory must be non-local in nature. The non-local nature of this medium theory gives it a foundation which has all the elements needed for a true causal unified field theory.

2 Overview of a Non-Local Medium

For those to whom the concept of non-local is new the following explanation if given: A non-local medium is one that can have non-local 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.

This is not how we observe anything in daily life. So why propose such a theory?

2.1 Contiguous Causal Requires Continuum

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)

While it can be said that a constant observable relationship is empirically causal the fundamental ontology still needs to bear out. One may say that the moon causes the tides by observing tides and the location of the moon. However this is not necessarily the true fundamental basis for the activity. There may and in this case we know there is a more fundamental causal explanation.

Consider the standard model for Physics. The electric field is considered to be mediated by photons. Two charged particles in empty space exchange a photon with the effect described by the electric field. While this method is causal and the developed math results are accuracy it does not result in a strong reason as to why it happens. The question could be posed how or by what mechanism does a particle in empty space know that it should send a photon to mediate an electric field.

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

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

"Contiguity postulates that cause and effect must be in spatial contact or connected by a chain of intermediate things in contact."

A continuum provides an infinitesimal set of actions that provides a pure contiguous framework. The question might be posed, “Is such a framework required?”. Nature may work in any way that God chooses. However, a contiguous causal theory, like the NMT UFT, which can act as the ontological mechanism behind the known Physics phenomenon, would be a powerful theory.

2.2 The Necessity of Non-Local

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

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 that causality could be ruled out. This is the basis for those who view Quantum Mechanics as a complete description of nature. Modern science has largely followed this path.

2.3 Sensible Non-Local Medium

A goal of this paper is to give a mathematical sense to the non-local flow. The local integrity law will give some insight as to how the local three dimensions are so observed in the macro level in the universe while yet containing a non-local essence to its ontology.

3 Non-Local Medium Kinematics Terms

Kinematics is the study and description of all possible motions for a material. Dynamics is the study of laws that describe how things interact and determines which of all the possible motions will be followed. Kinematics is therefore a good starting point for a description of the physics of motion of systems. The determination of the kinematics terms or variables is the first step.

3.1 Absolute Time - Needed by a Non-local Causal Theory

In a non-local medium every point can have an influence on every other point. There is instantaneous contact between every point in space. A single time for the entire universe allows for a simple interaction perspective. The first variable for this theory then is an absolute time, t, applicable to all points. The state of the universe may be given by knowing the value of all kinematics terms at a single instance of time.

3.2 Fundamental Local Kinematics Terms

Fluidic and gaseous mediums typically have the following terms: multidimensional spatial coordinate *S*, a time coordinate *t*, a density scalar $\rho(S,t)$, and a local velocity vector $\vec{V}(S,t)$. The multidimensional spatial coordinate, *S*, locates a point in space. The simplest case of interest for a unified field theory is the three dimensional medium. The density scalar, $\rho(S,t)$ or simply ρ, is the density of the medium at point *S* and time coordinate *t*. The term density here refers to a quantity divided by the multi-dimensional volume. The local velocity $\vec{V}(S,t)$ describes the local motion of the medium at point *S* and time *t*.

These terms are all familiar to local flow medium descriptions. Non-local density flow is the main new concept being introduced by this paper. This flow introduces some new terms not found in local flow mediums.

3.3 Non-Local Kinematics Terms

Experiments involving Bell's Theorem have shown that any strict causal theory must have a non-local nature to it. Therefore there must be a non-local nature to any strict causal theory.

It is instructive to ask a dynamics question at this point: "Why would material flow from point A to a distant point B without the traversal of any point in between?" Another way to ask this question would be to ask: "Why if there is no non-local motion initially would there be a change in the non-local motion?"

For the case of the non-local medium, different points at separated points in space may have a causal relation. Consider two separate points that hold a quantity of the medium and the medium will flow from one point into the other. There must be a causal relation between the two points that will allow for and describe how medium at one point would flow into another point.

3.3.1 The Interconnection Bond (I-bond)

This non-local medium theory uses the concept of an interconnection bond (I-bond) to create the causal relation between two points in space and will be what allows for flow from one point to the other. This is the term that will give mathematical sensibility to non-local flow.

The relationship between point A to point B is not necessarily and the same as from point A to point C. The kinematics terms must allow for a variable casual relationship between points in space.

The strength of the I-bond indicates the strength of the connection. A stronger the I-bond will have a stronger relation. Medium at one point will have a stronger force for flowing into the connected point. If the I-bond strength is zero between two points then there is no connection between the points. If the strength is infinity, then the points will be inextricably connected.

It is proposed that the I-bond has a type of substantial existence. It is a relation that exists and only changes in response to its state and the mediums state. As such it is considered to be an additional property of the non-local medium. One way to view this is as a separate but interactive substance. This substance principle will give it properties that allow for a mathematical description of its motions and interactions with the medium.

3.3.2 Non-Local Kinematics I-Bond Term

The term used for the I-bond strength is given by $I(S_1,S_2,t)$ where I is the I-bond strength between the two points S_1 and S_2 at time t.

3.3.3 Non-Local Flow Variable

Non-local density flow is medium flow per unit time and describes the flow of the medium between distant points. Some ways to designate this are $f(S_{in},S_{out},t)$, $f(S_1,S_2,t)$, $f_{in \to out}$ or $f_{1 \to 2}$. Here S_{in} or S_1 is the sink location from which the medium is flowing while S_{out} or S_2 is the source location into which it is flowing. The phrases "from which" and "into which" are only intended to indicate the direction of positive value flow. A negative flow will be medium flow in the reverse direction.

3.3.4 Interconnection Bond Motion

The interconnection bond strength will be used in dynamics to determine how the non-local flow will change over time. However, the next issue to handle is to develop the mathematical framework to describe how the interconnection bond itself will change.

As proposed previously the I-bond has a type of substantial existence and it is a relation that exists and only changes in response to its state and the mediums state.

The strength of the bond is declared independent of the medium density variances between the points. This implies that the I-bond strength will remain constant with respect to changes in differential pressure between end points and the density flow through it.

The substance principle means the I-bond can be considered a type of 6 dimensional medium. For this I-bond medium it will be declared that changes in the term $I(S_1,S_2,t)$ over time will be the sum of changes at S_1 and changes at S_2.

The I-bond is allowed to move and the motion of one point is independent of the other point. The motion will be described by the motion at one end point of the I-bond. The velocity term $\vec{v}_I(S_1,S_2,t)$ describes the velocity of the I-bond $I(S_1,S_2,t)$ at point S_1. Another more descriptively subtitled term would be $\vec{v}_I(S_{vel\ pt}, S_{connection\ \ pt}, t)$.

3.4 Dual Medium Theory

For this non-local medium theory, the medium is a 3 dimensional material. The I-bond is considered a second 6 dimensional medium that causes the non-local activity of the first medium. The dynamics description of this medium will have to consider how these two mediums interact. This is a type of dual medium theory.

3.5 Pressure Term

For a compressible medium pressure is an important term. The term used for pressure is p*(S)* or P*(S)* and the term for pressure density will be $\wp(S)$ or $\mathcal{P}(S)$.

3.6 Metric of Space

The metric of space will be what relates density of the medium to pressure. The term for the metric of space will be *M(S)*.

Space may simply be a void or non-existent. The medium may be something that "sits on nothing" and is the only thing that exists for relation. In this case where space is void then *M*(*S*) would have the property of not having a direction and being the same everywhere. This would mean that the relation between pressure and density would be constant in the universe.

3.6.1 Metric of Space as a Third Medium

Another possibility is that the metric of space gets defined by the material that fills it. This is a type of general relativity concept. The spatial metric will then have a complex expression which allows it to vary in time and space.

If this is the case there should be a direct functional relationship between the medium state and how the metric *M*(*S*) of space is developed. The end result would be a much more complex tri-medium type theory.

3.6.2 Simplest Metric of Space

This simplest case is for to use a non-local medium which defines all that exists and the metric of space is a constant. Since this concept can relate to the thought that the medium is all that exists and a void is constant in the sense of no variation or motional orientation it will be the first case to consider when dynamics are developed.

4 Kinematics Equations

The kinematics equations use the previously described variables and bring out some other properties for this non-local medium theory.

4.1 Conservation of Medium

Conservation of the quantity of the medium will be considered a fundamental law. The sum total of the medium will remain constant. Using *C* as a constant this law can be expressed as:

$$\int_{\infty} \rho(S)dS = C \tag{1}$$

A corollary to conservation of medium law is found in the non-local flow term $f(S_1,S_2,t)$. The quantity of medium flowing from a point S_1 into a second point S_2 must be the negative of the amount of medium flowing from S_2 into S_1. This is expressed by:

$$f(S_1,S_2,t) = -f(S_2,S_1,t) \tag{2}$$

This equation intuitively yields the following conservation integral equation:

$$\iint_{\infty} f(S_1,S_2,t)dSd_1S_2 = 0 \tag{3}$$

This states that the sum total of non-local flow in the medium is zero. Basically, this means that there are no overall sources or sinks. For any source in one area there must be a corresponding sink in another area.

4.2 Euler's Equation of Continuity Modified

The conservation of medium brings about Euler's equation of motion for a compressible medium. This is often called the equation of continuity. The equation of continuity for a local medium with conservation of mass is:

$$\frac{\partial\rho(S,t)}{\partial t} + \nabla(\rho(S,t)\vec{v}) = 0 \tag{4}$$

The divergence term here gives the change in density over time. It is a general mathematical principle that the divergence of the product of a quantity and its velocity will yield the amount of change in a quantity over time.

For the case of a non-local medium we must add a source/sink term Q shown as follows:

$$\frac{\partial\rho(S,t)}{\partial t} + \nabla(\rho(S,t)\vec{v}) = Q(S,t) \tag{5}$$

Future more the quantity Q is directly related to the sum of all non-local flow:

$$Q(S,t) = \int_{\infty} f(S_1,S,t)dS_1 \tag{6}$$

This integral indicates that the change in quantity at a point S due to non-local flow is equal to the sum of all non-local flow into that point. Q is the total volume integral over the variable S_1. This equation gives f some mathematical meaning to how non-local flow interacts with local flow. The final full form of Euler's equation of continuity modified for non-local velocity is:

$$\frac{\partial\rho(S,t)}{\partial t} + \nabla(\rho(S,t)\vec{v}(S,t)) = \int_{\infty} f(S_1,S,t)dS_1 \tag{7}$$

4.3 Euler's Equation of Continuity for the I-Bond

The substance principle for the I-bond means that it has a quantity that does not appear and vanish. When a material medium flows from one point into another the total quantity of medium remains constant. The I-bond strength will be considered to be a conserved quantity. Changes in strength will be the sum of changes in strength at end point.

$$\frac{\partial I(S_1,S_2,t)}{\partial t} = \left.\frac{\partial I(S_1,S_2,t)}{\partial t}\right|_{Due.to.Velocity.at.S1} + \left.\frac{\partial I(S_1,S_2,t)}{\partial t}\right|_{Due.to.Velocity.at.S2} \tag{8}$$

The term for the I-bond $I(S_1,S_2,t)$ indicates the two points related at a point in time by the I-bond strength indicator. The two points, S_1 and S_2, of the I-bond move independently. The velocity of the I-bond $I(S_1,S_2,t)$ at point S_1 is described by $\vec{v}_I(S_1, S_2, t)$. Applying Euler's equation of continuity for the motion of the I-bond at point S_1 yields:

$$\left.\frac{\partial I(S_1,S_2,t)}{\partial t}\right|_{Due.to.Velocity.at.S1} = -\nabla(I(S_1,S_2,t)\vec{v}_I(S_1,S_2,t)) \tag{9}$$

This implies the divergence of the product of the I-bond quantity term and its velocity at a point S_1 will give the change in I-bond strength due to the motion of the I-bond at S_1.

Similarly, the equation for the change in I-bond strength due to the motion of the I-bond at point S_2 is given by:

$$\left.\frac{\partial I(S_1,S_2,t)}{\partial t}\right|_{Due.to.Velocity.at.S2} = -\nabla(I(S_1,S_2,t)\vec{v}_I(S_2,S_1,t)) \tag{10}$$

Note the difference between equations is the order of the S_1 and S_2 in the velocity term.

The change in the total I bond strength will be the sum of the change happening at point S_1 and the change happening at point S_2. Putting these two terms together yields the final equation of continuity for the I-bond:

$$\frac{\partial I(S_1,S_2,t)}{\partial t} + \nabla(I(S_1,S_2,t)\vec{v}_I(S_1,S_2,t)) + \nabla(I(S_1,S_2,t)\vec{v}_I(S_2,S_1,t)) = 0 \tag{11}$$

The zero on the right hand side indicates there will be no spurious sources or sinks in the I-bond strength. The term spurious is used because of this medium theory will use an infinity I-bond for considerations to be given. An infinity I bond may be a source or sink to the I-bond, but there will be constraints to them as described in the dynamics section. Wherever there is no infinity I-bond these equations will apply.

5 First Order Dynamics Investigation

Dynamics brings laws and concepts to give this dual medium a description for changes in motion based on an initial motion and quantity values. The development of dynamics is often historically been largely based an empirically derived set of rules to constrain the kinematics expressions.

This dynamics investigation does not have directly observable quantities and should use the best concepts of past dynamics and philosophical theories.

A first order investigation is to determine what should be true and what are possibilities exist which should be investigated. Potential and kinetic energies are indicated as to what they should be functions of but not the specific equations for those functions.

5.1 Different Possible Foundations

There are a number of possible dynamics that could be applied to this kinematics set of variables. Two distinctive possibilities are a Newtonian type foundation and a relativistic type foundation.

5.1.1 Newtonian Foundation

One method would be to develop the equations based on Newtonian principles of motion and energy. This would include momentum and energy vectors associated with directions of motion. This non-local medium theory would be Newtonian in the sense of motion, forces, and energies. Its one new concept would be that of non-local motion.

The Newtonian concept however implicitly implies to some extent a Cartesian type absolute space. Rotation, as a chief example, would be in relation to what is considered a static background space. So the Newtonian foundation would still beg the question as to what is the rotation with respect.

Another aspect of the Newtonian foundation is the F=ma equation. That is related to the statement that an object in motion remains (constant) in motion (following a particular line) unless acted upon by an external force. What defines that line? The Newtonian foundation would likely need a more generally relative metric for space.

5.1.2 Causal Relative Foundation

Another method of dynamics would be to setup the equations to only be with respect to causally linked locations. This is a purely relativistic type framework. Relative motions and relative differentials in quantities should be the only important relations. This type of foundation will be devoid of the background against which objects feel rotation or acceleration. It will instead define what relative rotation and accelerations are and they may be different at different locations in space due to the motions in the medium.

This could yield a solution which would be a philosophically sound relativistic concept from the view that only relative relations in causal contact are important.

5.1.3 Spatial Relative Foundation

It may be impossible to not consider the geometry of space upon which the dynamics are founded. This is where the metric for space comes into play. One possible philosophical consideration might be that the medium sits on a property-less void. That void in a sense has a constant property.

The alternative would be to use a General Relativity type metric whose properties would be some function of the medium state. This could be used to give answers to the rotation and linear definitions once again. The Newtonian foundation could be appended with this metric to once again yield a relative foundation.

Since this path has not been determined as necessary and it will add complexity it will not be considered to deeply for the initial development.

5.2 Common Concepts for Any of the Prescribed Foundations

Rather than develop a specific complete dynamic theory at this time, this paper will focus on some concepts that should apply to any dynamics foundation. Some considerations for the difference between Newtonian and Causal Relative foundations will be given.

5.2.1 Conservation of Energy

Energy is about activity and potential for activity. To keep a system stable the sum of activity and potential for activity should remain constant. The concept of conservation of energy keeps a system stable. It ties to the principle that nothing is lost only transformed. The conservation of energy between kinetic and potential energies in a system with two objects attached by a spring keeps the system in a constant stable oscillation.

5.2.2 Conservation of Momentum

Where Energy is about activity, momentum is about quantities in motion with a given direction or the quantity velocity product. Conservation of momentum keeps the total sum of the quantity velocity product to be a constant.

The non-local flow part of this medium concept considers the flow of medium from one point to another. There is no spatial velocity associated with this action. Therefore the concept of momentum does not apply to this activity.

There are spatial velocities associated with the local medium motion and with the I-bond end points. The concept of momentum can apply and the application of the conservation of momentum may be used.

5.3 Identification of Energies

Energy has two forms: kinetic and potential.

Potential energy involves static relational values. It requires two quantities in some type of causal relation. This causal relation will be a “force for change”.

Kinetic energy involves rate of change in relational values. One cannot see a static picture of the universe and know what will happen next without knowing the kinetic energies. There is a type of information about rate of change held within an instance of time. This is the kinetic energy and the reason for velocity terms found in the kinematics.

5.3.1 Interplay of Local and Non-Local

One of the aspects of this theory is that there will be local properties and non-local properties. Determining the interplay of these properties is one of the main difficulties in the development of the dynamics for a non-local medium.

The approach taken will be to consider the two separately. Energies of local actions and energies of the non-local actions will be summed to yield total energy..

5.3.2 Energy Density and Energy

Force for change relates to Potential energy and rate of change relates to kinetic energy. These terms are most easily identified in the point to point relations. At this level the relation is an energies density. The total system energy will be the sum of all energy densities. The term $\mathcal{E}$ = dE will be used for energy density.

5.3.3 Potential Energy

Potential energy is about static quantity relations which have relation to the force for change. There are two potential energy densities in this medium which are the local potential energy density and the non-local energy density.

$$\mathcal{E}_{\text{LP}} = \mathcal{E}_{\text{Local Potential}} \tag{12}$$

$$\mathcal{E}_{\text{NLP}} = \mathcal{E}_{\text{Non-Local Potential}} \tag{13}$$

5.3.3.1 Pressure as Force for Change

For purposes of this theory pressure is related to the force for change. Force for change based on static relations is where potential energy is stored.

The concept of pressure in a gas or liquid is derived from molecular motion. Internal thermal motion produces an expansive force. With a continuum the concept of pressure may need some special consideration.

5.3.3.2 Local Pressure

If the medium does not have a thermal property then there could be a simple relation between density and pressure. This would include the local density and metric for space.

$$\mathcal{p}(S) = \mathcal{P}(\rho(S), M(S)) \tag{14}$$

5.3.3.3 Energy of Pressure

Pressure is a force for change. There will be an energy based upon the pressure

$$\mathcal{E}_{\mathcal{p}} = \mathcal{E}_{\text{Pressure Potential}}(\mathcal{p}(S)) \tag{15}$$

This has a relation which is independent of relational terms. It is therefore difficult to use in understanding the force for change at the local and at the non-local levels.

5.3.3.4 Potential Energy Local Relative

At the local level the force for change is based on the gradient of pressure changes at a point. The gradient gives local relational value of pressure.

$$\mathcal{E}_{\text{LP}} = \mathcal{E}_{\text{Local Potential}}(\nabla \mathcal{p}(S)) \tag{16}$$

5.3.3.5 Potential Energy Non-Local Relative

At the non-local level there will be a force for change between two points based on the difference of local pressures and the strength of the I-bond. The non-local energy will be related in some way to the difference of the pressure terms since the main concept to the pressure term is force for change. Therefore the energy density will be some function of the pressure $\wp$.

$$\mathcal{E}_{NLP} = \mathcal{E}_{\text{Non-Local Potential}}(\wp(S_1) - \wp(S_2), I(S_1,S_2))) \quad (17)$$

5.3.4 Kinetic Energies

Kinetic energy is about the rate of change. There are two kinetic energy densities to be considered with this medium: the local energy density ($\mathcal{E}_{\text{Local Kinetic}}$ or $\mathcal{E}_{LK}$) and the non-local energy density ($\mathcal{E}_{\text{Non-Local Kinetic}}$ or $\mathcal{E}_{NLK}$).

5.3.4.1 Kinetic Energies Local

At the local level the kinetic energy will be a function of the velocity of the medium and its density.

$$\mathcal{E}_{LK} = \mathcal{E}_{\text{Local Kinetic}}(\vec{V}(S,t), \rho(S,t)) \quad (18)$$

5.3.4.2 Non-local Kinetic Energies

There are two components to the non-local energy. One is related to the flow of medium through the I-bond. The other is in the motion of the I-bond itself.

The non-local flow will continue as a constant unless acted upon by a force to change its value. This rate of change contains a form of Kinetic energy. The energy related to the flow of medium though the I-Bond will have some relation to the rate of flow though the I-Bond.

$$\mathcal{E}_{NLFK} = \mathcal{E}_{\text{Non-Local Flow Kinetic}}(f(S_1,S_2,t)) \quad (19)$$

The non-local kinetic energy is related to the motion of the I-bond end points. There is an expected relationship to the strength of the I-bond and its motion.

$$\mathcal{E}_{NLIMK} = \mathcal{E}_{\text{Non-Local I-Bond Motion Kinetic}}(I(S_1,S_2,t), \vec{v}_I(S_1, S_2, t)) \quad (20)$$

The final non-local kinetic energy will be the sum of the two non-local energies

$$\mathcal{E}_{NLK} = \mathcal{E}_{NLFK} + \mathcal{E}_{NLIMK} \quad (21)$$

5.4 Total Energy Conservation

The conservation of energy will keep the sum of all of the energies a constant.

$$C = E_{total} = \int_S(\mathcal{E}_{LP} + \mathcal{E}_{NLP} + \mathcal{E}_{LK} + \mathcal{E}_{NLK})\, dS \quad (22)$$

5.5 Law of Local Continuity

A method to keep strong locality and the medium continuous is to let the I-bond strength go to infinity as two end points approach each other.

$$\lim_{S_1 \to S_2} I(S_1, S_2, t) = \infty \qquad (23)$$

This I-bond strength constraint will keep the medium continuous. Given the following relations:

$$(\text{Energy} \to \infty) \text{ as } (\text{I-bond} \to \infty) \text{ and } ((\wp_1 - \wp_2) \text{ remains constant}) \qquad (24)$$

$$(\text{Energy} \to \infty) \text{ as } (\text{I-bond remains constant}) \text{ and } ((\wp_1 - \wp_2) \to \infty) \qquad (25)$$

That is the Energy is a monotonically increasing function of I-bond strength and of the pressure differential. Then if energy remains finite an infinite I-bond will keep the local pressure differential in the continuous realm:

$$((\wp_1 - \wp_2) \to 0) \text{ as } (I \to \infty) \text{ and } (E \text{ remains finite}) \qquad (26)$$

$$\lim_{S_1 \to S_2} \wp(S_1) = \wp(S_2) \qquad (27)$$

The conservation of energy will keep total energy finite and the infinity I-bond will keep the local pressure variation continuous. The relation between pressure and density is a property of the metric of space. If the metric of space is continuous then the relationship between pressure and density will be continuous and approximately the same between two local points.

$$\lim_{S_1 \to S_2} \rho(S_1) = \rho(S_2) \qquad (28)$$

This implies the density will be kept continuous if there is an infinity I-bond between locally connected points.

This is how two points are inextricably connected when the I-bond strength is infinity. The reason that this law keeps the medium continuous is due to the forces conveyed upon the medium with respect to the I-bond.

5.5.1 Some Corollaries and Results of an Infinite I-Bond

1) Since the I-bond strength goes to infinity in the local sense, the integral of I-bond strength over all space is a meaningless quantity.

2) Since the I-bond strength goes to infinity, the I-bond may have apparent sources and sinks. Loosely speaking, I-bond may flow out of or into an infinite point-to-point I-bond without affecting the infinite quantity in that point to point I-bond. A conservation of energy system constraint should keep this "infinite" I-bond normally wrapped up in its point-to-point location.

It will be of great interest in the future to see if waves with in this medium can allow the infinite I-bond to bifurcate, split off into two regions, thus allowing two points that are not next to each other, to be connected by an infinite I-bond. That is two distant particles can be connected together by an inextricable infinite I-bond connection.

It may also be that system of particles could be related by a single infinite I-bond.

6 Final Thoughts on Particles

It is suggested the particles would be connected by an infinity bond. This would make the connections permanent. It would not necessarily be that all particles are connected by a single infinity bond. It may be that only a few are or it could be that systems of particles are. At the very least it seems that a positive charge particle should have an infinity connection bond to a negative charge particle.

For a discussion on a conceptual basis about how this theory could account for known phenomenon in physics see reference [2].

7 References

Except for the non-local nature of this paper, I do think any concepts presented here are beyond a undergraduate textbook theories. However, for those wanting a developed mathematical basis for non-local medium theory the following book is presented.

[1] 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 are 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.

[2] D. Gilbertson: On the use of A Non-local Medium Theory for a Unified Field Theory

For a conceptual non-mathematical investigation into how this theory can account for the known phenomenon of physics see *http://www.nmtuft.com/nmtconcept/*. This writing gives conceptual reasons for many initial questions about how the medium would have to act in order to be a unified field theory.

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