Introduction to

Space Lattice Theory

A Lattice Theory for the Universe

A Theoretical Search for the Grand Unification of Matter, Energy, Space and Time

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March 16, 2015

With figures

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Abstract

Space Lattice Theory is a theoretical study of the fundamental structure of the universe. The study asks what the structure of space might be like if, instead of being mostly an empty void, space is a densely packed, crystal-like Lattice. In this Lattice, the existence and interaction of what we call matter is due to movable defects or dislocations in the Lattice similar to those observed in metals and semi-conductors.

The study found that a dislocation model could produce a comprehensive set of simple, visualizable explanations for most of the concepts of physics, including many that are currently highly speculative. It suggests conventional physics explanations for matter, time, cause and effect, energy, and how energy converts to matter. It suggests structures for gravity, electric, and magnetic fields, how they can be physical realities, and how they could function. It suggests classical foundations for relativistic observations.

Space Lattice Theory supports a "big bang"-like beginning for a 3-D "visible" universe, suggesting how it could easily emerge from what appears to be the nothingness of space, but without having to change any classical laws of physics. Solutions to puzzles like the particle-wave nature of photons are suggested. Problems with current standard model theories for subatomic particles, cosmology and Special Relativity are discussed and partial solutions suggested. New models supporting the suggestions are proposed.

Most significantly, Space Lattice Theory suggests a comprehensive model for the Grand Unification of all forces and matter in the universe.

1 Introduction

1.1 General editorial notes

This introductory paper is essentially a composite of the summary sections from the original paper. Additional explanatory material has been included for the fundamental concepts of SLT which are very different from current physics.

Problems with Language: The paper introduces many concepts which are new to both classical and modern science. Poor concern by physicists for precision in the creation and use of terminology has created substantial misunderstandings for both science and society in general. A **glossary** is provided at the end of both this document and the original paper to clarify the specific understanding of terms of special importance as used in the paper. The first **critical** use of a listed term in this paper, where the term is **defined,** is shown in **caps**: e.g. LATTICE. When a term is used that has multiple meanings in common practice, or appears to be trivial, based on common use, but has a **critical meaning** in the paper at the point of use, that term is shown in **bold type**: e.g. **Lattice**. If a term is commonly used in science, but with multiple meanings, and the paper uses a meaning that is less frequently used, or must be understood in a particular way, or the term is frequently misused or generalized, that term will be highlighted by quotation marks: e.g. "Lattice". Bold may also be used for emphasis.

This introduction, like the original paper, is organized to present material for reading in numerical page number order. Concepts presented later in the documents depend on

explanations and terminology presented earlier. At times, the planned order does not justify providing a complete explanation for a concept when it is first introduced. In those cases, the concept may be initially presented only in generalized terms.

A number of figures from the paper are excluded from this introduction. The figure numbers are not consecutive, but use the same numbering as in the original paper. In these figures, there are **two different types** of depiction being used. A VISUALIZABLE DEPICTION is a drawing that could possibly represent the actual geometry of an object. A visualizable depiction is also referred to as a PICTORIAL depiction. A FUNCTIONAL DEPICTION is a **stylized** representation of the components of an object that attempt to describe how they act functionally, or how they interact with other physics elements. Only the components important to explain functionality are included in a functional depiction.

Document references in the text are enclosed with braces and identified by author and date {Einstein 1916} when applicable. They appear in the reference list alphabetically. General references are identified by reference number, e.g. {38}.

1.2 Purpose and fundamental assumptions

The purpose of the Space Lattice Theory (SLT) study was to theoretically explore the ramifications of a universe that could be constructed based on a single novel assumption about the fundamental nature of "matter" in the universe (assumption 1 below). As the study evolved, three additional assumptions were developed to further bound the study:

Assumption 1: the entire foundation of the universe is a tangible **Structured Lattice.** The Lattice fills the universe. The Lattice exists as a **structured arrangement** of a **single** "**object"** referred to in the paper as an **Aa**. The structure of the Lattice is produced by a **self-organizing** property of the Aa, which acts to restore that structure in the event of disruptions to the Lattice.

Assumption 2: The Lattice is **inherently under pressure**. The Lattice structure is determined by the **shape** of the Aas, and is maintained by the **pressure** on the Aas. **All forces** observed to act on **particles** of **matter,** or which act on **flows** of **energy** through the Lattice, are generated, **entirely**, by **distortions** in the **Lattice**, through **pressure** imbalances**.** There are **no attractive (tensile) forces** in the Lattice or in any **particle** interactions.

Assumption 3: the property that physics refers to as **matter** is produced, not by a tangible, physical substance, but by a **disruption** in the Lattice. The disruption is caused by the **absence** of Aas from the regular Lattice structure. Each missing Aa creates a **dislocation** in the Lattice. Each dislocation causes a **local density reduction** in the Lattice, which is communicated outward without limit, with **spherical symmetry**, with **decreasing magnitude proportional** to **distance**. A Lattice spherical density variation pattern caused by a dislocation is what physics refers to as **gravity**.

Assumption 4: the property classically known as **electric charge** is produced by an **arrangement** of **dislocations** which **introduce** a second Lattice structure variation. The property known as electric charge is produced by a **twisting pattern** in the Lattice. The twist is communicated outward in a **pancake configuration** with **decreasing magnitude proportional** to **distance** without limit. The Lattice twisting pattern

produces both electric and magnetic **fields**. These fields are a phenomenon of the **same Lattice elements** that produce gravity.

These four assumptions, working together, suggest that the concept we call SPACE, the UNIVERSE, or the GREAT UNIVERSE, which is space in its entirety, is **not** predominantly an empty **void** sparsely dotted with "objects" composed of what we call matter. Instead, it is a **densely** packed universe filled throughout with a very small "OBJECT", in this paper called an "Aa". The Aa occurs in only **one form**. The Aas are pushed together by an inherent universal **pressure.** The Aa has some geometric property that causes Aas in proximity, due to the pressure, to self-organize into a structured **Lattice**.

The property we call **matter** is not a physical substance, but rather, exactly the opposite. Matter, or more precisely, the behaviors we relate to matter, are caused by a **dislocation** or hole in the Lattice where an Aa is missing from the expected uniform Lattice configuration. **All forces** in the universe are caused by the **universal pressure** acting on non-uniform geometries. There are **no attractive forces** in the universe.

The collection of theoretical observations and principles that are suggested by the hypothetical results of introducing dislocations into a universe densely filled with small objects that form a structured lattice framework, are referred to as **SPACE LATTICE THEORY (SLT)**.

1.3 Motivational Background

The floundering of science

"From the beginning of physics, there have been those who imagined they would be the last generation to face the unknown. Physics has always seemed to its practitioners to be almost complete. This complacency is shattered only during revolutions, when honest people are forced to admit that they don't know the basics… We live in one of those revolutionary periods, and have for a century." {Smolin 2006}

In his book, Smolin lists 5 major problems that remain unanswered for physics. One of those is, "Determine whether or not the various particles and forces can be unified in a theory that explains them all as manifestations of a **single, fundamental entity**." While this is logically appealing, there is no fundamental principle that mandates there must be only one. Classical theory certainly accepts that gravity and electro-magnetism are caused by different **co-existing** principles. One of the strongest motivations to conduct the extensive explorations described in this paper was the early appearance of patterns that suggested such a singles structure "GRAND UNIFICATION" was possible.

Personal Experience

The environment that led to the initial formulation of the SLT assumptions resulted from the convergence of six personal experiences:

1. The speed of light problem

As part of high school physics, I was told about the Michelson-Morley experiment and how it reported finding a "**null**" result. As presented to me, "null" was stated to mean **zero**. This "null" result was supposed to **prove** that the "aether" concept was false. I was curious about the details of the experiment and read a copy of the original paper. The "null" claim was **clearly misrepresented**. It was **not** a pronouncement of finding **zero** aether speed. It was a statement about the experimental observations **not**

supporting the **hypothesis** of finding an aether flow with the same rate as the known rotation speed of the earth in its orbit. The experiment recorded a flow rate about **half** the earth orbit rate. I followed that trail and found references to many experiments that did not agree with Michelson-Morley, yet which have been broadly suppressed in education.

2. Einstein's SPECIAL THEORY OF RELATIVITY (SR)

Early in high school, I read a book about Einstein and the social and scientific environments that led him to produce what has become known as the Special Theory of Relativity. (I regret I have been unable to find that specific book again to produce a citation. Another with a similar interpretation is provided below.) Around the time SR was written (early 1900s), public and scientific views were emerging that the speed of light was **constant relative** to the **observer**. Einstein, according to my reference, believed that concept was **logically** unsupportable. The book stated that Einstein set out to produce a paper with the goal of quantifying a new physics **that would result** from such an assumption to **quell the fad**. He believed that by showing how **bizarre** physics would become to support the assumption, scientists would easily reject the idea (Occam's razor in the extreme). In short, Einstein **never believed** that his "Special Theory" was an accurate depiction of physics. To the contrary, it was his intent to produce **an indirect "proof"**, starting with the assumption that "light speed was constant, simultaneously, with respect to all observers", to disprove the assumption.As summarized by Auffray,

"His [Einstein's] **long-standing rejection** of **relativistic spacetime** and his life-long lack of acceptance of the quantum theory as it developed during his lifetime are well known… Einstein destroyed his manuscript shortly after his paper appeared in print. And he subsequently abandoned the line of reasoning he had proposed in this paper to establish the Lorentz transformation. No major physics textbook … has ever taken the pain to reproduce Einstein's original line of reasoning. Einstein himself never returned to it…" (Auffray 2007)

As we know, to the contrary, Special Relativity was adopted as the "standard model". I believe this misunderstanding has led to a tragic hundred year blind alley for science.

3. Problems with the Standard Model of Physics

It has long concerned me that science has failed to produce a consensus model for the **fundamentals** of the universe that provide **verifiable visualizable principles** for **any** of them, despite having mathematical relationships with such high precision for most of them.

4. Discrepancies in SR teaching

I studied SR in high school, throughout college, and in post-grad studies. To support those studies, I read a lot of explanations about how SR applies to specific situations and worked out many application assignments. The ubiquitous discrepancies in the explanations and differences among my professors added to my uneasiness. Mainstream science, to its discredit, has avoided addressing these discrepancies, appearing, rather, to want to avoid them as they get buried in a historical landfill of confusion.

5. Scientific fraud and misrepresentation of SR in the media

I already mentioned the imprecise reporting of the Michelson-Morley results (the **null** problem). A similar, but intentional, imprecision was related to the Arthur Eddington starlight bending fraud in 1919. However, Eddington's analysis of the data was questionable enough for the Nobel Prize committee to **exclude** relativity from Einstein's 1921 Nobel Prize for physics."{Brooks 2012}

6. Studies of dislocation theory

I learned about dislocations studying metallurgy and semiconductor physics. It was shear coincidence, and also very surprising, when I drew a connection between dislocations and Einstein's gravitational fabric given that **dislocations (holes)** and **knots** in a fabric are conceptual opposites.

My interest in a Space Lattice began with the dislocation concept of Assumption 3. Once I envisioned assumption 3, the motivation to follow it was brought to life by how quickly, and **simply**, the model **solved**, from a **functional** standpoint, some of the **most fundamental puzzles** of physics, including Grand Unification (Occam's Razor again).

The SLT paper presents only preliminary observations. Nonetheless, the concepts lead to so many simple, but broadly insightful answers. Even though they may fall short of the rigor needed to establish precision in scientific verification, their insights are already sufficient to open new channels of thinking to solve some of the "great" puzzles that have eluded science for millennia.

1.4 Scientific foundation

For most of human history, it was commonly believed that the earth's atmosphere was a void. A VOID, in **conventional** science, is a volume of space that does not contain **matter**. A void, however, may contain a "field".

Some scientists, however, at least as early as Aristotle, observed that air was actually composed of invisible atoms. This wasn't generally accepted, even by science, until the 17th century. Issac Beekman, in 1618, compared air to water with the phenomenon of pressure increase at depth. Renown scientists of the time, including Galileo and Descartes, "steadfastly" disagreed. {16} Torricelli created a "sustainable" vacuum around 1644. {2} "Pascal's vacuum-in-a-vacuum experiment [~1646] and his theory of pressure equilibria resulted in the determination that the pressure exerted by a vacuum is zero." {2}

The term "gas" was only first used by Helmont in 1671, "to define a state of matter other than liquids or solids." {16}

The importance to science of accepting the principles of a vacuum, and specifically, that the pressure of a vacuum is **zero**, was the corollary that a vacuum was **incapable** of exerting **any negative** force on the **surface** of an object. Negative here means that the direction of a force applied to a surface cannot be away from the solid composition that defines the surface. This meant that **all** "mechanical" forces produced by gases and liquids required explanations based **only** on **pressure**. The value of this observation was critical for science to correctly explain many principles and explain the inaccuracy of generally accepted notions, like vacuum , that were incorrect.

Space Lattice Theory suggests there are similar principles that universally apply at the fundamental particle scale, not just to surfaces. Specifically, in SLT, a void is a volume of space that does not contain an Aa of the newly proposed structure called the SPACE LATTICE. The void may be as small as the interstitial space between closely packed Aas, or as vast as a galaxy. In SLT, however, avoid can **not** contain a field. It is totally empty.

There are **no tensile forces** of any form in the universe. By TENSILE FORCE is meant the ability of any entity A to interact with another entity B by causing a force in B that is directed toward A based on development of a tension state in entity B. That is, **all forces** in the universe, at the fundamental particle scale, occur as **pressure** driven **forces**. These pressure forces create forces on macro scale objects by generating compression states in the molecular bond structure of those objects. SLT suggests the same principle will apply to all "forces at a distance": i.e. gravity, electromagnetics and the weak and strong nuclear forces.

This principle could have been stated as "there are no **attractive** forces in the universe". However, the term "attractive" is often applied in the same way as the term "vacuum", and can easily lead to a misunderstanding. For example, it might still be said that two planets "attract" each other, while, at the atomic and subatomic levels, SLT suggests that the gravity fields of the two planets interact in such a way that the atoms of each planet are being **pushed** towards the other planet, **rather** than being **pulled** toward the other planet.

This idea is actually confirmed by major groups in science without other groups realizing it. In the General Theory of Relativity {Einstein 1916}, in the section titled "The Gravitational Field", Einstein states (emphasis added): "If we pick up a stone and then let it go, why does it fall to the ground? The usual answer to this question is: "Because it is attracted by the earth." Modern physics formulates the answer rather differently for the following reason. As a result of the more careful study of electromagnetic phenomena, we have come to regard **action at a distance** as a process **impossible** without the intervention of some **intermediary medium**." He then describes the interaction of a magnet and a piece of iron, stating: "…we cannot be content to regard this as meaning that the magnet acts directly on the iron through the intermediate empty space, but we are constrained to imagine — after the manner of Faraday — that the magnet always calls into being something **physically real** in the space around it, that something being what we call a "**magnetic field**… The effects of gravitation also are regarded in an **analogous manner**. The action of the earth on the stone takes place **indirectly**. The earth produces in its surrounding a **gravitational field**, which **acts** on the stone and produces its motion of fall."

Einstein's paper then goes on to add mathematical depth to measure the forces involved in observations. However, there is something else Einstein stated in the same section that has been broadly ignored by the scientific community:

"We shall not discuss here the **justification** for this incidental conception, which is indeed a somewhat arbitrary one. We shall only mention that with its aid electromagnetic phenomena [and by analogy, gravitation] can be theoretically represented much more satisfactorily than without it..."

Each of the highlighted words and phrases in the previous quotations are concepts that Einstein and the scientific community have still failed to explain in even a rudimentary way. Extensive theory development has produced mathematical functions that describe

force relationships between observed phenomenon to very high precision. Technology has produced amazing instruments that can also measure the interactions of material with high precision. However, the scientific community has still **failed to produce provable, physically visualizable models** for even the most basic scientific concepts, which is what Einstein meant by the word "justification". By "physics models" I mean functionally accurate humanly visualizable depictions of the basic components of the universe. One ubiquitous exception to this claim about science's failure to produce a model was the heliocentric Bohr atom model. While now considered inaccurate, it focused most of the research during the early 20th century.

In figure 4 of the General Theory of Relativity, Einstein showed a set of six curved lines in a plane arrayed as a 3 X 3 curved trellis to support discussion of a Gaussian co-ordinate system and relate it to a rectilinear Cartesian co-ordinate system. The figure was later used by Einstein as a two dimensional model to visualize a gravitational field. The figure, which looks like a magnified portion of a woven cloth, eventually led others to refer to the gravity field as the **fabric** of space. This second ubiquitous exception to providing a physical model has prevailed for as long as Bohr's atom.

Unfortunately, as frequently happens in both science and society in general, the casual selection of terms or graphics to illustrate one narrow issue, can later turn around to cause very adverse conceptual problems when applied to broader issues. **Fabric** is one of these terms. In common use, a "fabric" has inherent properties. It is made of strings. Strings are typically long continuous filaments. They are strong in tension and approach the geometry of a straight line when under tension. Under compression, however, they buckle and twist with no simple or repeatable structural shape. Under tension, strings are observed to be easily set into vibration exhibiting a simple set of dynamic geometric motions that are easily describable wave functions. However, under dynamic motion which does not put the strings in tension, they have a tendency to fold, tangle, form **knots** and have no periodic properties. These forms are extremely complex and not easy to describe.

The attempt by science to describe space with models based on "strings" is not coincidental. The notion that "**mass**" might be "**knots**" in the fabric of space is not a coincidence either. Once Einstein presented the visual model of space as a fabric, it was imprinted in the minds of every student who encountered high school physics or popular magazine and television science programs. The link between a fabric, a knot in the fabric, and an object in a space fabric that is round and hard, is straightforward.

While studying metallurgy and solid state electronics in 1968, I was introduced to the concept of dislocation theory. This theory was presented at that time as a "breakthrough" in explaining why typical metals were much weaker than crystals of the same material. Evidently, the professors teaching the class didn't know that dislocation theory was actually already quite advanced in metallurgy by the late 19th century {Hirth 1934}. I made no connection between dislocations in dense matter, such as metals, and space at that time. However, after reading an article by Smolin on quantum gravity, I remember considering the question: what if the "knots" in Einstein's fabric were replaced with "**holes**", the "holes" being dislocations?

2 Foundation

2.1 Space Lattice basics

Space Lattice Theory (SLT) concepts for the Lattice are based on the following postulates which expand the basic assumptions:

1. The basic constituent of the universe is a very small object. The object is unique. There is only one form in the universe. In the paper, the object is referred to as an "Aa".

2. The universe is a conventional 3-dimensional space. It is typically densely filled with Aas. The Aas are in **physical** contact with each other. The COORDINATE SYSTEM for SLT is a rectilinear, 3-D Cartesian system. Axes descriptions use the "right hand rule" and rotations are positive in the counterclockwise direction.

3. The Aas are tightly pressed together as if they are under a **pervasive universal pressure** which acts like fluid pressure. This pressure establishes an **energy density** for the Lattice. It continuously changes in time and location but is bounded as a **constant** for the Great Universe.

4. The shape of the Aas causes them to self-organize and align to become a universe filling STRUCTURED LATTICE. The term "structured Lattice" means the Aas form a simple repeating **geometrical pattern** that continues in all 3 dimensions throughout the infinite expanse of the Great Universe maintaining a **long-structure** order.

5. The term LONG-STRUCTURE means that an element of the repeating geometrical pattern of Aas in one geometric pattern must touch a corresponding element in an adjacent pattern, which has an identical overall pattern, in such a way that a single, non-branching, non-converging **path** can be followed indefinitely throughout space. The term "path" is used here because the long-structure will not be a geometric straight "line" but rather a continuously changing set of zigzagging line segments between Aas that approximate a **spline** over larger scales.

6. The basic long-structure shape will approximate a straight line LINEAR STRUCTURE unless disturbed by forces that develop in the Lattice that bend the lines.

7. If the structured pattern of the Lattice is disrupted, the self-organizing property of the Aas acts to restore the structure. This is called LATTICE HEALING.

8. The Lattice is semi-rigid like that of a crystal Lattice and experiences **elastic** deformation.

9. The Lattice appears isotropic at scales much greater than the size of an Aa. The Lattice is not isotropic on the scale of the Aas.

10. The term PRISTINE LATTICE refers to the geometry of a universal space Lattice that would occur in a theoretically static undisturbed uniformly pressurized universe. Being a theoretical concept, there may be no occurrences of pristine Lattice in the universe. The term PREVAILING LATTICE refers to the geometry of the universal space Lattice at any point just prior to being affected by an approaching particle or field event.

2.2 Matter basics

11. The property called **matter** in the universe is caused by a dislocation. That is, matter is not caused by the occurrence of a tangible, physical substance in an otherwise empty

space. Instead, it is caused by the absence of some tangible, physical substance (i.e. an empty void) where some substance was expected based in the regular structure of the Space Lattice.

12. All the interactions we observe in nature between objects, which we relate to the properties we call matter and energy, can be explained by the presence, motion, and interaction of Aas in response to the presence of dislocations.

13. A Lattice DISTORTION occurs when the shape or scale of the Lattice differs from Pristine Lattice, but no long-structure lines are broken. All distortions in the Space Lattice can be categorized as bending.

14. A DISRUPTION is an uncontrolled environment that occurs when the prevailing Lattice structure breaks down and makes one or more long-structure lines discontinuous. The disruption is resolved when the Lattice pressure and inherent "self-assembly" properties of the Aas reassemble the Lattice forming continuous long-structure lines or confine the disruption within continuous long-structure lines. A dislocation is a confined disruption.

15. A DISLOCATION is a disruption in the Lattice in which the normal continuous repetitive structure of Pristine Lattice is locally disrupted by the absence, addition or misalignment of one or a small number of Aa elements. The localized disrupted area is referred to as the near field. Directly surrounding the near field, the Lattice structure is continuous.

16. Dislocations can include: 1. removal of an Aa from the structure; 2. a forced insertion of an Aa into the structure; or 3. A rotation of an Aa into a stable position that crates a discontinuity in a Lattice structure line from prevailing Lattice.

17. A DISLOCATION STRUCTURE is a collection of dislocations, and particularly the stress-strain state in the Lattice caused by a specific collection of dislocations.

18. A BENDING distortion occurs when the Aas in the Lattice, viewed over a region of the Lattice, vary in position from their expected positions in a pristine Lattice, but the regular geometric structure of the Lattice can be traced through the region without encountering a disruption, i.e. any loss of structure.

2.3 Energy basics

In SLT, ENERGY appears in the following forms:

19. Potential energy – the elastic energy of the Aas in compression, either in linear compression or bending. This energy can not be negative in a static situation.

20. Kinetic energy – the dynamic energy of Aas in motion due to the inherent inertia of the Aa. This energy can not be negative in linear motion.

Specifically, SLT suggests there is no other form of energy in the universe. That is, all gravitational, electromagnetic and mechanical energy are due to specific patterns of Aas in compression and motion.

3 The Lattice

1. The universe is infinite, singular, continuous, and has a simple 3-D Cartesian structure. It is typically filled with Aas.

2. In SLT, the Aa is envisioned as an elongated body, with axial symmetry, having 2 spherical ends of equal size. The spheres are joined at the center of the body with a blending structure. This configuration is shown **pictorially** in Figure 1 below. In the figure, variable D is the diameter of a minimum circumscribing sphere that would contain the Aa. Variable d is the diameter of the end spheres. The Aa in Figure 1 has D/d=2.00 which will be assumed throughout the paper.
SLT does **not** claim empirical evidence for the shape of the Aa. Other shapes might be possible. However, the organization of the Lattice is **precisely** determined by D/d and theoretical models vary drastically with only small variations of this ratio.

3. The Aas are under pressure unless they are floating in a void.

4. The Aas exhibit the conventional material properties of **elasticity** and **inertia** similar to those we observe in tangible objects.

5. The discrete values of elasticity and inertia along with the geometric parameters of the Aa define the elastic and inertial constants of the Lattice, which in turn define a **Lattice Relaxation Response** for the Lattice. The values for the Aa properties are "quantized" in that they are the same for all Aas.

6. The Aas have no external friction, no internal plasticity and no thermal properties.

7. The Aas form a structural scaffold throughout space which is referred to in SLT as the **Space Lattice**.

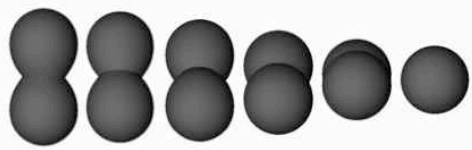
8. The Lattice structure exhibits long-range organization due to the nesting shape of the Aas. A section of Lattice is shown from multiple views in Figure 3 below.

9. The **structure's** role is to "telegraph" any change that occurs at one point in the Lattice to **every** other point in the Lattice with strict geometric constraints.

10. The long-structure organization can be disrupted. The disruption will be healed by the prevailing pressure and the self-organizing shape of the Aas.

11. Aas motion is not quantized, but continuous in translation and velocity.

12. When the Aas come to rest, the rest locations are periodic within the Lattice due to the geometry of their surround.



A single Aa: 2 spherical ends, elongated body, blended, D/d = 2.00 . Rotations shown at 0, 20, 40, 60, 80, 90 degrees.

Fig. 1

An Aa

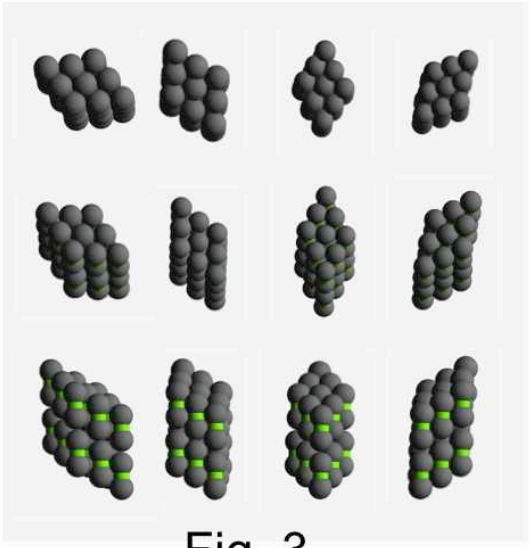


Fig. 3

3-D Lattice views for a 2-sphere Aa with D/d = 2.00

4 Matter

How a dislocation creates matter

1. **Every void creating dislocation** in the Lattice produces the properties of **matter**.

2. Matter, in SLT, has no hard geometric boundaries at either the nano, micro or macro scale.

3. The Aa is not a "node" as that term is used in Einstein's or quantum gravity theory. The closest comparison is that the Aa would be similar to a string segment of a fabric or net.

4. A single dislocation is the smallest particle (**quantum**) of matter allowed in SLT.

Response of the Lattice to matter

5. Dislocations gather into preferred organizations or structures in the Lattice. The **resulting Lattice deformations** produce the property we call **mass**, as well as other properties we observe in physics.

6. **Conservation of mass** is **not** rigid at the subatomic scale.

7. Any distortion of the Lattice at one point in the Lattice produces changes at potentially **every other** point in the Lattice – an infinity of points. The amount of change decreases as a function of distance from the distortions.

8. If multiple distortions occur in the Lattice, the total response of the Lattice in the **far field** is the superposition of the individual responses to individual distortions.

Fundamental Particles

9. Fundamental particles are composed of **stable** assemblies of dislocations.

10. Fundamental particles do not have to have spherical symmetry.

11. SLT does not dispute the particle list identified in the Standard Model. However, to be considered a "fundamental" particle, it must have a **stable** form.

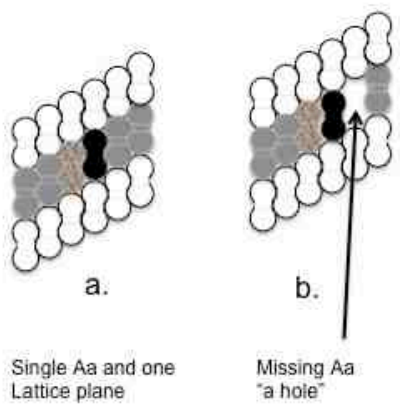


Fig. 6

Lattice showing a dislocation

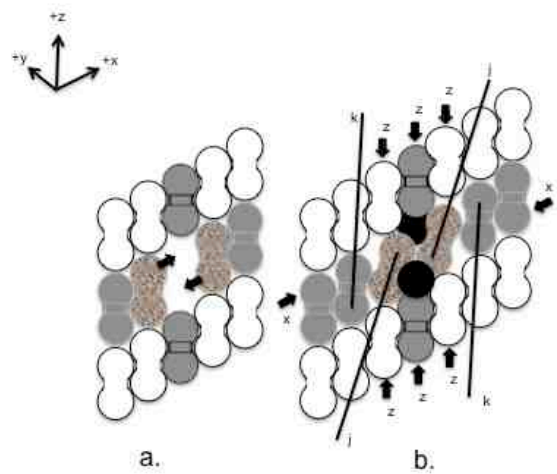


Fig. 7

Lattice response to a static dislocation

5 Time

5.1 Time

In SLT, there is no physical reality that acts as a causal metronome which broadly and directly clocks the rate of universal interactions. TIME is a convenient mathematical tool for measuring the **relative** rates of interactions of matter and energy. Being a mathematical convenience, it may be postulated as either continuous or discrete to suit the efficiency of specific calculations. For SLT, time is always considered continuous.

5.2 The Lattice Relaxation Response (LRR) and the speed of light

The statement that time in SLT is not a physical reality is not a statement that there is nothing that acts as a regulator of the dynamic rates of matter and energy interactions. The physical parameters of the Aas, specifically the combination of elasticity in compression and bending, Newtonian inertia, and space Lattice geometry, constrain the local dynamics of the Lattice. The **rate** that unrestrained Aas recover from a forced compression is referred to as the LATTICE RELAXATION RESPONSE (LRR). In simplified form, using a dumbbell model connected by an elastic spring, time is a derived property based on the elastic constant of the spring = k and the inertial mass of the ends = m, being of the form t ~ Sqrt (k/m).

1. The **rate** of all motions and interactions in the Lattice are locally regulated by the LRR. The LRR determines the maximum **speed** a Lattice disturbance can propagate. This is called the **Lattice relaxation constant**, which is equal to the speed of light "c". The size of the disturbance is related to the energy causing the disturbance.

2. The LRR is the Lattice property that produces the **Lorentz** effects observed for matter moving in the Lattice.

3. Time is a **derived** property based on the LRR. For SLT, time is treated as a **continuous** property.

5.3 The Arrow of time

The dynamics of the space Lattice explain and provide a basis for the philosophical concept we know as the **arrow of time**. Philosophers and scientists have questioned why time always appears to move forward. Many conventional equations of physics don't require time to be unidirectional. For these equations, interactions appear to work just as well if time is entered as a negative quantity.

Time (The Arrow of Time) is always observed to move "forward". For every disturbance process in the Lattice, direct mechanical forces between Aas convert the original disturbance into an outgoing wave of related motions that, theoretically, in Pristine Lattice, could eventually reach **all** the Aas in the universe out to **infinity** in both distance and time. Every disturbance in the Lattice, therefore, launches an **Expanding-Shell Discontinuity (ESD)** into the Lattice. The volume behind the expanding shell records the changes induced by the cause, while the volume outside the shell is not affected until the ESD passes.

This last point establishes the **arrow of time**. There is **no** known way, even theoretically, for the amorphous content of space to create a starting pattern of matter and energy that can exactly reverse the process of the ESD because of the discontinuity. A "first thought" approach might be to set into motion an inwardly collapsing spherical shell that, when it reaches a single point, makes a particle of mass at that point move or disappear. This is the reverse of a particle of mass appearing or moving and launching a gravity wave into the universe.

The problem is, how are the starting conditions created? It would require the synchronized setup of an infinite number of infinitesimally small motions, in the form of a surface of an infinite sphere precisely centered around the same finite point in the

universe. Such an object isn't even theoretically definable. Furthermore, these infinitely small motions could not be uniform. They would need to be **programmed** to take into account every mass and energy disturbance in the universe so that the inwardly collapsing spherical shell forms a "constructive discontinuity" that leaves the space and masses it passes appear as "undisturbed" space.

The Arrow of Time principle can be summarized as follows:

4. The ESD **creates** a **complex infinite geometrical effect** from a **simple point cause**.

5. The ESD creates an irreversible **expanding** dynamic **discontinuity** in the universe.

6. The principle of **Cause and Effect** emerges directly from the concept of the Arrow of Time.

7. Cause and effect, plus the ESD are the foundation for **Entropy**.

8. Entropy is a **thermodynamic** principle that results from the concept of cause and effect whereby energy will be lost to the Lattice through a diffusing process of strong, discrete, simple events creating infinitely diverse, infinitesimally small, **complex** results.

9. Because there are no conceivable mechanisms to record the history of the universe, nor replay such a recorded history back, nor undo the ESD, SLT does not support the concept of time travel.

10. The universe is a sustained phenomena because it cycles energy continuously between mass creation events (energy **storage** Big Bangs) and energy dissipation through entropy.

6 Dynamics of Matter

6.1 Movement of matter through space

For matter to move through the Lattice, both single dislocations and structured collections of dislocations, which make up more complex particles, must be able to **move** through the Lattice while maintaining their structure.

Dislocation physics, in various forms, are a well known phenomenon in solid materials. One example is the flow of electrons through conductors. Electric current is well understood as the "flow" of electrons. However, in order for electrons to move from a negative to a positive terminal through a solid conductor, many intermediate steps occur. A length of wire is depicted in Figure 8 below connecting positive (+) and negative (-) terminals. In the figure, the capital letters (A, B, C etc.) depict individual atoms. The lower case letters "e" represent electrons.

To create an electric current, an electron in the wire near the (+) terminal responds to the electric field in the wire induced by a voltage potential between the (+) and (-) terminals. The electron jumps out of its atom (A) (electrons are associated with the letter to their right in the diagram) into an atom in the (+) terminal (not shown). This action is shown in Figure 8-b. The arrow shows the motion of the leaving electron. This leaves atom (A) missing an electron. In electronics and solid state terminology, this is referred to as a **hole**. An electron on the adjacent atom toward the (-) terminal, (B), which is also

subject to the electric field of the poles, jumps toward the (+) terminal into the hole in atom (A). This leaves a new hole in (B) (Figure 8-c). This process continues until all the electrons in a line from the (+) terminal to the (-) terminal move **one** atomic spacing toward the (+) terminal (Figure 8-b through e). Finally, an electron from the (-) terminal jumps into atom (J) returning the wire to the original starting condition (Figure 8-a).

Over all, a large quantity of electrons have each moved a single atom step toward the (+) terminal. But, most important for this example, a **non-entity**, one virtual "hole", which itself is actually "**nothing**", is first created in the wire out of **nothing**, and then appears to move all the way from the (+) terminal to the (-) terminal where it disappears from the wire.

1. The linear displacement matter through the Lattice can be much greater than the motion of individual Aas in the Lattice.

2. The aggregate motion of Aas in the Lattice is opposite to the motion of matter.

3. Dislocations can move in all directions through the Lattice.

4. Dislocations can come to rest in the Lattice.

5. Dislocations only move in the Lattice when forces, due to **stress** in the Lattice, move them.

6. The only forces in the universe that affect the motion of matter are **positive** stress distributions in the Lattice.

7. In SLT, the "Classical" **Newtonian inertia** physics associated with **matter** is **not** a ballistic property of matter as suggested by Newton, but rather the response of dislocations to the dynamic mechanical field energy of Aas in the Lattice.

8. Objects at rest do not move because they are restrained in the Lattice by the inertia of the Aas. Objects in motion, which are not being accelerated by a force, continue to move at approximately constant speed, due to the kinetic energy field of Aas acting as a wave.

9. The conventional Newtonian equations of motion, i.e. F=ma, are appropriate in SLT for slowly moving objects.

10. Individual Aas retain the ballistic inertial properties of mass, inertia and elasticity as assumed in Newtonian physics.

11. Momentum and inertia are **proportional** to mass because a field must be built to move the mass using the same Lattice elements which define its **mass**.

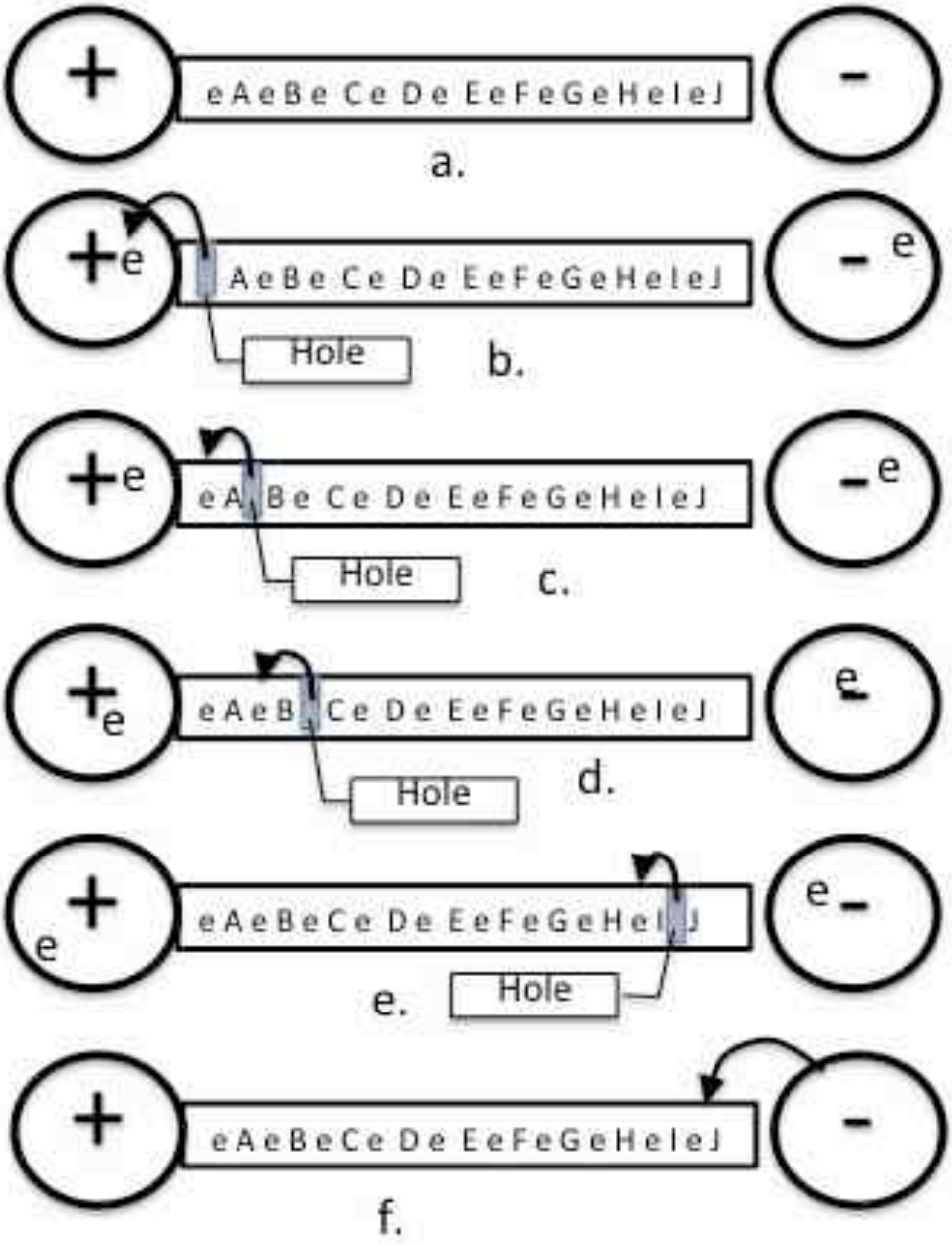


Fig. 8

Electron Hole movement in a wire

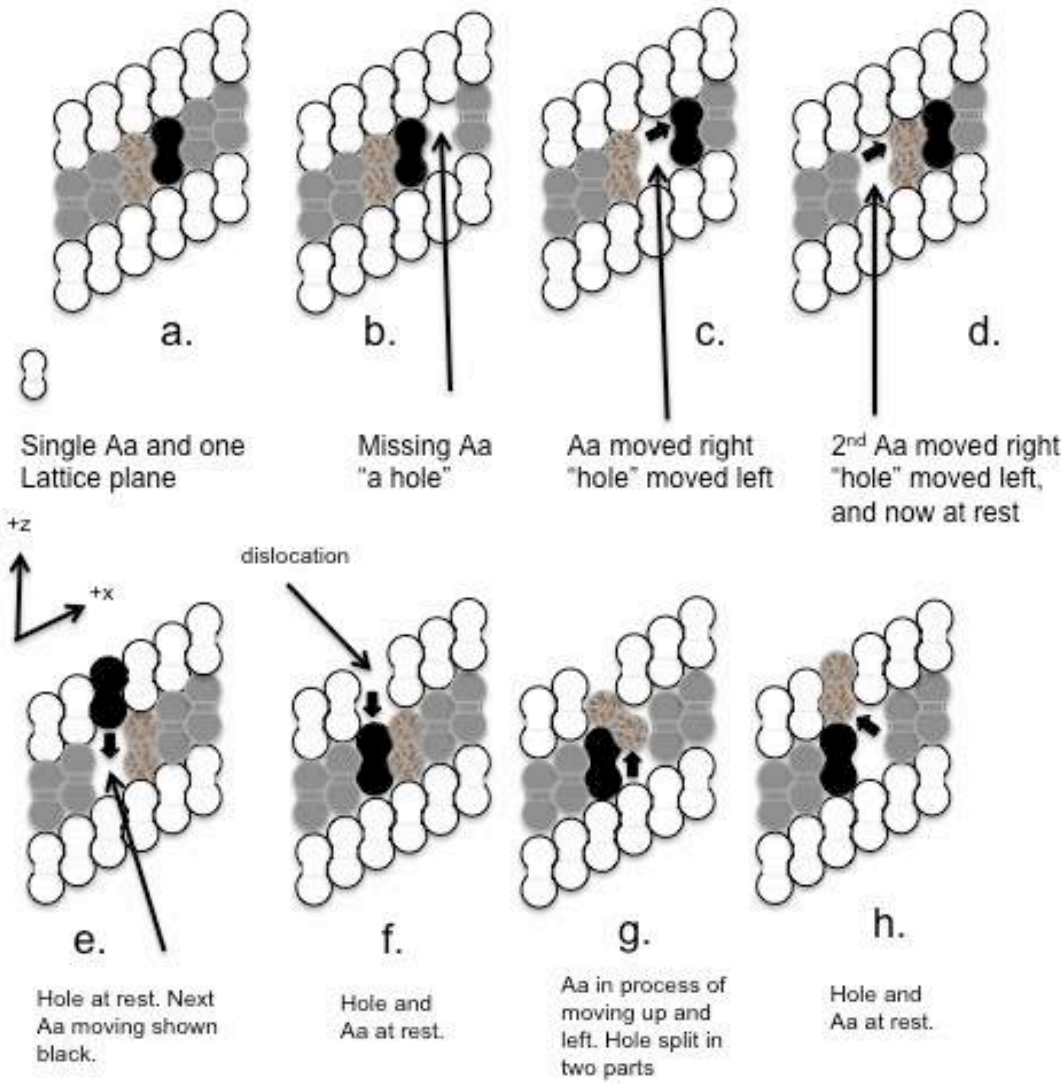


Fig. 9

Time sequence showing dislocation (hole) movement.

7 Photons

Photon construction

1. SLT **defines** a **photon** as being a combination of both a **single dislocation** in the Space Lattice and a **dynamic pulse field** which accompanies that dislocation.

2. Photons can be in **motion** or **stationary** in the Lattice.

3. The physical shape of a photon is the dynamic Lattice response to both the missing space of the dislocation and the pulse distortion field. This shape is **not** spherical except for stationary photons which only have a gravity field.

Photon creation

4. A photon is created when a single dislocation in a basic sub-atomic particle or electron shell, gets ejected into the Lattice.

5. The ejection is caused by the appearance, near a dislocation in a particle, of a high pressure region in the Lattice and a lower pressure region surrounding the dislocation inside the particle.

6. Responding to the pressure difference, an Aa from the Lattice jumps to fill in the dislocation in a the particle. This process is shown in Figure 10 below.

Photon matter, mass and energy

7. Photons exhibit the property of matter because they include a dislocation.

8. Since matter distorts the Lattice, it will produce the functional interaction called mass.

9. Photons in motion carry energy in the form of a photon **pulse** that propels the photon. This energy is mechanical stress-strain energy in the Lattice. The strain envelope defines the geometry of the pulse. The pulse's effect on the Lattice extends to infinity, but not in a $1/r^2$ form common to field structures. A pulse structure is much more confined.

10. The quantity of the energy in the photon at time of creation is determined by the sum of two phenomena: gravitational field energy and propelling pulse energy. The stress-strain of the Lattice deformation at the time the launching Aa transition occurs determines the photon's starting energy state.

11. If the energy of a photon's propelling pulse is dissipated, the photon slows down, finally coming to rest in the Lattice.

12. The energy of photons is not quantized! It can vary continuously up to an upper limit. Discrete levels are always observed in photons emitted by atoms due to the finite number of dislocation arrangements that Aa's can take as they form particles, which determine the energy needed to eject a dislocation.

13. The geometry of the photon pulse approximates a toroid (smoke ring) centered radially on the dislocation it is driving.

14. The toroid extends ahead of the dislocation during forward motion due to the LRR.

15. The toroid size is many times the size of the dislocation.

Photon particle–wave duality

16. The SLT photon model suggests a simple explanation for photon **particle–wave** duality: its central dislocation and the associated propelling energy pulse.

17. Measuring devices designed to observe particle nature will interpret the central dislocation as a particle.

18. Measuring devices designed to observe wave nature will interpret the energy content of the pulse as a wave in the process of detection due to the size of the pulse.

Matter–energy conversion, and the nature of light

19. Photons carry two forms of energy: gravitational and propulsion.

20. Gravitational or inertial matter effects observed for a photon are associated with the dislocation carried in the photon.

21. The rest mass transferred by a photon is always the same independent of the photon energy. The size of the photon dislocation does not change during transmission.

22. The ratio of the gravitational distortion energy in the Lattice to the mass effect caused by the dislocation is quantified by the equation $E= m c^2$

23. Photon energy can exist over a very large range, from the highest cosmic ray energies all the way down to rest, where it essentially becomes a bare dislocation.

24. Once it's energy level drops below the ability to interact with matter through capture or scattering, it is no longer observable to known instruments.

25. The upper energy is limited by Lattice disruption. When the energy causes disruption, the photon is torn apart.

26. The energy pulse of a photon can be visualized as a rolling toroidal mechanical stress-strain wave field analogous to a smoke ring. This field does not exhibit a conventional $1/r^2$ magnitude loss with distance because it is not spherical in either the near or far field.

27. The size of the pulse, once created, can decrease as the photon moves due to radio wave radiation into the Lattice.

28. If a moving photon encounters a particle with conditions that will allow capture, its discontinuity will add mass to the particle.

The nature of light

29. Photon motion can be compared to the motion of sound in a crystal, however, with significant limitations. The major limitation of the analogy is that photons carry a discrete dislocation kernel which is composed of a moving void.

30. SLT suggests that the phenomenon physics has classified broadly as "light" are not a single phenomena, and can not be defined simply as an electromagnetic wave.

31. SLT suggests that the phenomena classical physics classifies as "light" is actually three distinct phenomenon that include: low energy photons; electromagnetic Lattice vibrations; and mechanical Lattice disruptions.

32. All three produce mechanical "wave like" properties in the Lattice that appear similar because they produce similar responses in instruments over the infrared to ultra violet spectrum.

33. The "color" of a photon is not due to a periodic wave in the Lattice. Instead, the "color" is the measurement technique's interpretation of the magnitude and shape of the photon propelling wave.

34. The property that discriminates a photon from other forms of "light" is the photon's ability to transfer matter through the propagation of a dislocation.

35. SLT suggests that the ultraviolet energy level marks an important transition point in energy for photons. At lower energies, photons do not possess sufficient energy to transfer mass through nuclear processes in conventional matter.

36. Photon phenomenon are confused with mechanical and electromagnetic vibrations because their wavelength ranges so broadly overlap.

Photon speed

37. SLT suggests that photons can travel in the Lattice at speeds from rest to "c".

38. The determinant of photon speed is the magnitude of its driving pulse.

39. The speed vs. magnitude function, however, is not simple with "c" forming a limit speed. The limit speed is reached at a threshold energy which is very low in the allowable photon energy range.

Theoretical SLT observation summary for refraction of light and photons

40. SLT suggests that the refraction of true-wave light forms and photons must be considered as two distinct phenomena.

41. For "light" phenomenon other than photons, increased disorder in the Lattice requires the phenomenon's waves to follow circuitous but structured paths. A longer path to travel decreases the overall apparent propagation speed through a material.

42. The path length model explains how light, after slowing down in a dense medium, can resume a higher speed moving into lower density material, including returning to the speed "c" in a vacuum.

43. For photons, refraction must consider both "light" responses discussed above. The energy pulse can be diverted by a bent Lattice. The photon can also be captured and scattered due to its mass.

Red shift

44. SLT suggests that photons with energies over the range measured for red shift studies are **not** a wave phenomena, but energy pulses.

45. SLT suggests that photon motion is not lossless. Photons lose energy at a continuous rate traveling through the Lattice. That loss rate is in the range observed by Hubble and others as the Hubble constant.

46. SLT suggests that cosmic red shift is the sum of photon energy loss and Doppler shift, but the Doppler component is small.

47. SLT provides an explanation for Olber's paradox. This explanation suggests that there may be an infinite amount of stars in the universe, but the light from them is too weak and red shifted to be detected by current instruments.

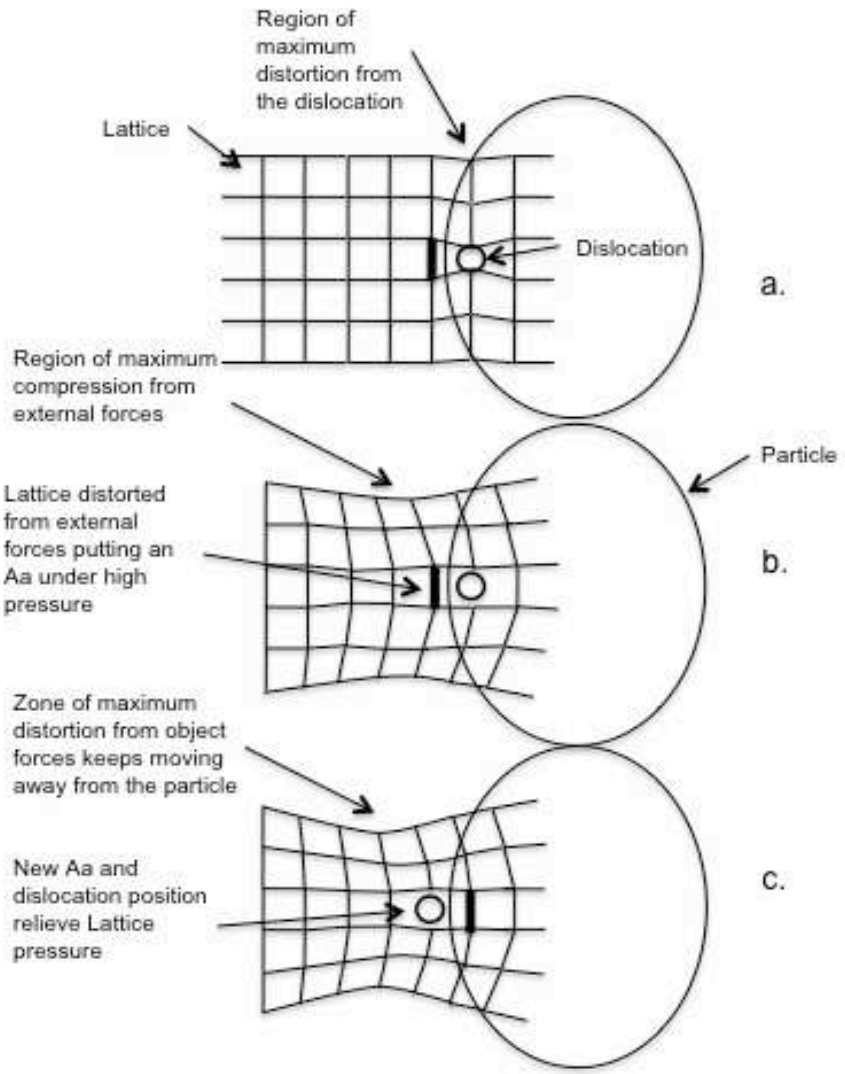


Fig. 10

Matter ejecting a photon

8 Object motion in the Lattice

1. SLT suggests that object motion at low velocity in the Lattice can be visualized using the analogy of a submarine, stationary or moving in water at a rate below that which produces turbulence.

2. As collections of dislocations move, they require a continual readjustment of the Lattice to address the moving stress-strain field associated with the dislocation.

3. SLT suggests that the Lattice Relaxation Response (LRR) creates a hard upper limit on the speed of objects in the Lattice.

4. SLT supports the speed of light "c" as an absolute speed limit for object motion in a stationary universal Lattice.

5. SLT supports dimensional distortions in the observation of objects moving at high speed similar to those presented in SR. These distortions, however, are due to LRR effects, not due to relativistic effects as proposed by SR.

9 Force at a distance - Fields

1. The term "**field**", as it is used in physics, refers to bending distortions of long-structure lines in the Space Lattice.

2. **All** forces at a distance in the universe, between objects, fields, or objects and fields, are due entirely to **field patterns** of Aas in the Space Lattice.

3. **All** forces at a distance are caused by the imbalance of **pressure** forces. There are **no attractive** (tensile) forces in the Lattice.

4. Fields, themselves, exhibit inertia. This is so because the fields are simply arrangement patterns of Aas in the Lattice. Each Aa has its own inertia. Since field patterns for **all** particles and forces extend to infinity, the fields reflect the inertia of all the Aas in the field.

5. **All** objects and field sources are "virtual" entities. They have no tangible substance. Rather, they are a stress-strain field in the Aa structure of the Lattice that is focused on and defines their associated virtual entity.

6. **All** fields "theoretically" extend to infinity. However, the influence of the fields act as expanding volumes speed limited by the Lattice Relaxation Constant "c". Fields therefore all have finite effect-sizes during finite time periods.

7. When multiple fields interact, they do so by **infiltrating** each other through a time based process.

8. All gravitational fields for all existing matter already exist. However each field has only infiltrated the fields of other matter that are within a distance "R" determined by the time span of their existence "T" where R=cT .

9. For **every** Aa in the universe, which is a component part of many other fields in space, at each instant of time, the stress-strain state of the Aas must come to a state that is the **true physical** sum, or superposition, of **all** the field in space. This superposition state for each Aa then represents a **deviation** from pristine Lattice that is spatially proportional to **all** of the fields in the universe.

10. Each entity in space would produce a characteristic Aa distortion pattern in a pristine Lattice. If placed into a universe with a prevailing Lattice structure, the entity would then experience a pressure imbalance to correct the discrepancy between actual and ideal structures, which is experienced as a force.

11. A**ll** fields, theoretically, could include all of the Aas in the universe if allowed infinite time. But at a given finite time, due to the LRR, fields only include a limited part of the universe. That part, however, for typical interactions, includes a huge 3-D volume of space due to the high "c" expansion rate of the fields. Thus, all fields are **anchored** to substantial volumes of the universal prevailing Lattice. This, of course, is not true for very short durations after the creation of new matter.

12. The magnitude of a stationary isolated field will decrease in the far field in proportion to the square of the distance due to the elastic relaxation of Aa stresses as the geometry of the field expands into a 3-D universe. There are many dynamic situations that will warp this relationship by disrupting the far field.

10 Gravity

1. Gravity is introduced into the Lattice during the creation of **dislocations** in the Lattice structure.

2. Dislocations in the Lattice structure cause Aas surrounding the dislocation to push inward, thereby bending the Lattice structure. The mechanical shrinkage pattern in the Lattice, which is a **mechanical stress-strain field** in the Lattice, produces the interactions physics calls a GRAVITY FIELD. There is **no** gravity between the Aas. Gravity is **not** a continuous property of **space**.

3. The gravity field value, $g = - G\ m/r^2$, from a mass extends out to infinity decreasing with the square of the distance, which is consistent with conventional physics. The decrease is due to the elasticity of the Aas and the spread of stress energy into a 3 dimensional space.

4. Gravity is **introduced** into the Lattice in quantized units related to the finite number of ways hole dislocations can organize into stable structures. However, the magnitude of the gravity field itself, at any point, is **not** quantized. The quantization introduced by mass in the near field decrease with distance in proportion to the field strength.

5. Gravity is created in proportion to units of **mass**. "Mass" is **not** produced as a simple summation of dislocation count, but rather as a function of the Lattice distortion related to a specific dislocation structure. The gravity field for any mass does not pervade the universe when the mass is created, but expands spherically from the point of creation at the speed c.

6. The maximum gravitational force that can be exerted by the Lattice is **finite**. The force is limited because the **position and shape** distortion of individual elements of the Lattice is limited. The bending limit is dictated by the limits that an Aa can be distorted before disrupting the Lattice.

7. Gravity singularities are not possible because of the limitation on disrupting the Lattice.

8. The interaction of two fields results in the superposition of the stress and strains of the individual fields.

9. The popular "fabric of space" model is misleading in that it portrays an elastic fabric being distorted by a solid mass. SLT suggests that a more appropriate model is two distortions in a fabric interacting.

10. SLT suggests mechanisms that produce both normal gravity and antigravity. This model suggests that gravity fields of like polarity are pushed together by the Lattice pressure (both normal and antigravity fields), while fields of opposite polarity are pushed apart.

Gravity vs. distance

11. Gravitational field strength reduction with distance is similar to the field geometry for other energy types because they are **all** actually variations of Lattice distortion in a 3-D universe. The general reduction rate is described by Newton's equation: $Fg = - G m/r^2$

12. SLT does not support the application of the gravity equation as r is allowed to vary without limits. The shell theorem explains that the highest magnitude of gravity will exist at the outer boundary of any gravity forming matter. The gravity at r=0 is zero, not infinity.

13. Gravity can only occur as long as the Lattice is not discontinuous. In the "near field", around a dislocation, the Lattice is discontinuous. So "r", in the gravity equation can never reach zero.

Gravity discontinuities in the far field

14. While the gravity field of every particle, theoretically, reaches to infinity, and gravity requires continuous Lattice, the gravity field can be interrupted by any event in the universe capable of breaking the continuity of Lattice structure lines. However, the effect such a break has on the source mass is limited by the contribution of the field strength at the point of break and the LRR time from the break back to the mass.

Gravity with overlapping fields

15. With overlapping gravity fields, the maximum bending limit of the Lattice must be addressed. Ironically, this does **not** create a problem for the fields between objects because the field directions are opposite and reduce the field. The area of concern is at the **face** of each object which faces **away** from the other object. At that point, the fields have the same bending direction.

Gravity – waves

16. Since gravity is a bending of the Lattice structure, SLT suggests that the motion of a mass will produce a moving gravitational field which will appear as waves in the Lattice. The waves will move through the Lattice at the speed "c".

Gravity and Inertia

17. The **inertia** of **mass** is an inferred property based on the inertial properties of the Aas in the Lattice.

18. The inertial "field" of a mass is directly related to its gravity field. But the "gravitational" function of "mass" (i.e. gravitational mass), which is the gravitational field, is distinct from the "inertial" function of "mass" (i.e. inertial mass) which is a wave function that propels that mass.

19. SLT suggests that gravity and inertia, are actually only slightly different Aa patterns of the same Lattice structure for a specific mass. The inertial component for moving objects is created by wave motions of Aas that move dislocations through the Lattice. The inertial component for objects at rest is the energy needed to establish the wave component for motion.

20. There are no limits to the magnitude of inertia as long as the object's inertial field does not cause discontinuities in the Lattice.

21. Both gravity and inertia are severely impacted as object speeds approach the LRR rate "c".

Gravity and Antimatter

22. Since hole dislocations in the Lattice are the **absence** of an Aa, SLT suggests that **antimatter** is the **occurrence** of an **extra** Aa stuffed into the Lattice structure: an insertion dislocation. Such a distortion would create **anti gravity** since the Lattice would be expanded around the intruding Aa. This is shown in Figure 15.

23. SLT uses the term "antimatter" to describe objects that produce "antigravity", not opposite electrical charge.

24. The directionality of gravitational force depends on the sign of each mass in the gravity equation. Due to the negative sign in the gravity equation, two positive masses ($+m_1$ times $+m_2$) are pushed together. On this basis, the same test mass response should occur if both the reference mass **and** the test mass have negative values ($-m_1$ times $- m_2$). Similarly, the equation suggests that if the two masses have opposite signed values, independent of what value the reference mass has, the interaction of the fields will be to push the test mass away from the reference mass.

25. Antimatter would **attract** other antimatter, just as matter attracts other matter. Antimatter and matter would repel each other. This property would favor the agglomeration of both matter and antimatter objects. It would also **repel** material types that could destroy it through matter-antimatter collisions.

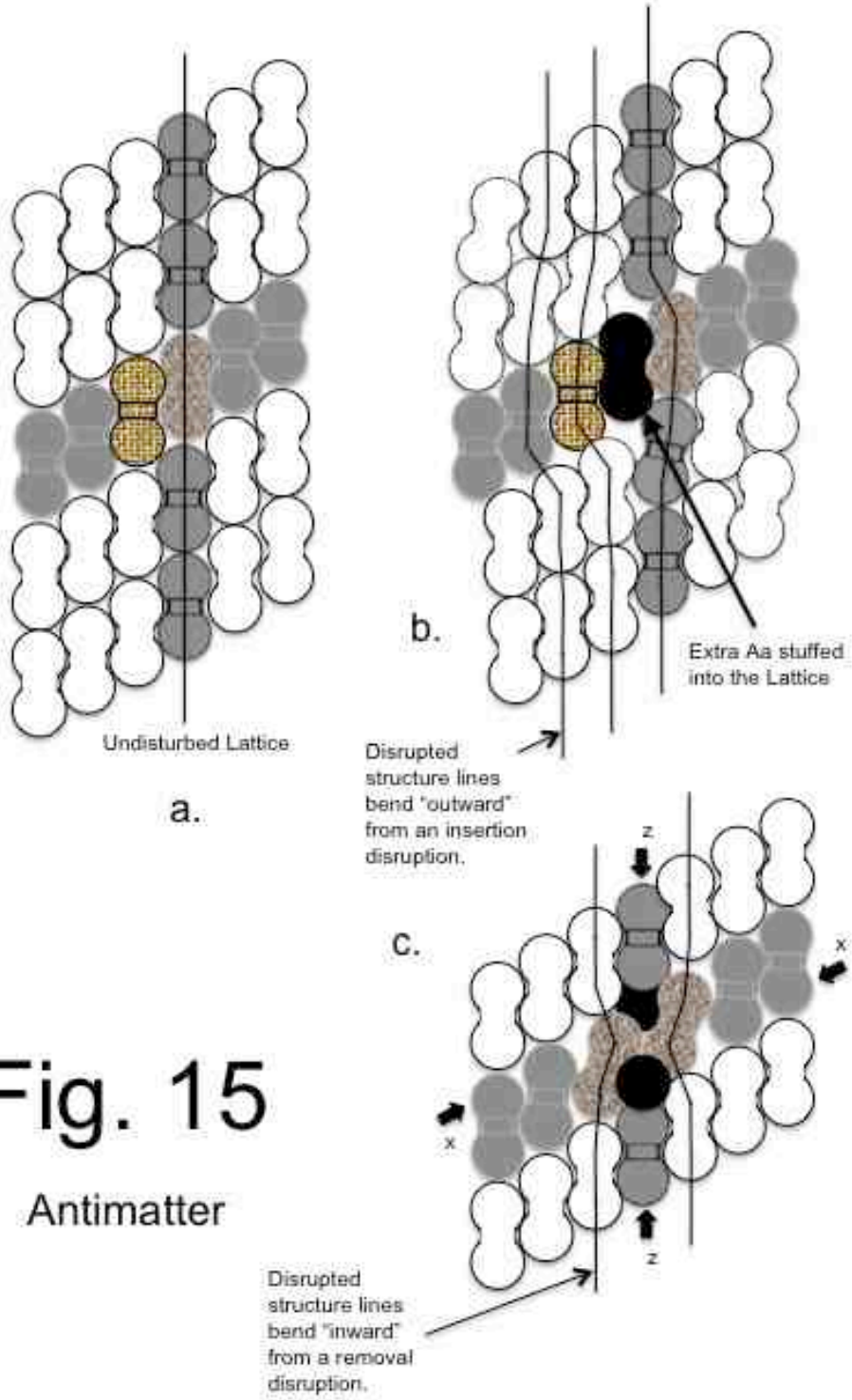


Fig. 15

Antimatter

11 Special issues in cosmology

This section is placed here in the paper rather than near the end because many of the special issues discussed introduce new principles in a simplified way which are helpful later to discuss more complex concepts in electromagnetics and particle physics.

11.1 The Big Bang

"The BIG BANG Model is a broadly accepted theory for the origin and evolution of our visible universe. It postulates that 12 to 14 billion years ago, the portion of the visible universe we can see today was only a few millimeters across. It has since expanded from this hot dense state into the vast and much cooler cosmos we currently inhabit." {6}

The model arose as an attempt to explain the currently **estimated** motion distribution of cosmic objects in relation to the currently **estimated** mass of those objects and the observed properties of gravity and the cosmic microwave background. All of these observations relate to the VISIBLE UNIVERSE, which is the volume of space we are able to observe using scientific instruments.

A "Big Bang" **type** event, as the source of all, or at least most, of the matter in the visible universe, is **generally** supported by SLT. However, there are many significant differences in the how such a process unfolds from the currently accepted model. These are presented by describing a hypothetical SLT "Big Bang" event.

The fixed energy content of the Lattice is in continuous motion. When waves in the Lattice cross, the strains of the Aas sum the wave magnitudes. Occasionally, there could be substantial dynamic events that produce large **voids** in the Lattice. These could be viewed as **cosmic earthquakes**.

The void could have dimensions on a cosmic scale. That is, SLT does not support that the Big Bang is produced by a singularity. Such bangs could also occur on much smaller scales. As the void opened, Aa's would float freely into the void off the exposed "free" edge zones of the Lattice and disperse through the void in random orientations. This void condition is called NON-CAPTURED since the near field volume around the free floating Aas have no reference to the far field Lattice. Any matter, of any construction, including black holes or even entire galaxies, that are located near the edges of a void when it opens up, would dissolve into the void.

Due to the limit of the rate at which the Lattice can deform, a large void would take a long time to open. For an intergalactic scale event, the time would be distance divided by the speed "c". SLT makes no suggestion as to whether it might measure in single digit years, or hundreds or thousands of years.

Such a void condition could not last indefinitely due to the prevailing pressure of the Lattice. Eventually, the void would collapse. The collapse would take an amount of time similar to the opening. The collapse would be violent as the edges could come together at speeds approaching the Lattice Relaxation Constant "c". As the void

collapsed, the Aas floating in the void would be pushed together again. This would start with a pressure increase in the free edge zones, propelling those zones into the void. As the edges came together, they would impact Aas along the way which would provide a counter force to the moving edges due to the inherent Newtonian inertia of the Aas.

Due to their shape, the Aas would start to reassemble as Lattice again along the imploding edges in a manner analogous to crystal growth. Due to the continuous collision of new Aas at the leading surface, many of the Aas would be caught in irregular orientations and structures. All the Standard Model fundamental particles could be produced along with many more. But, without the need to form the existing list of fundamental particles in SLT, the Aas could organize directly into neutrons, protons and electrons and then into atoms and build our visible universe. Unlike current "standard" models, the SLT model would essentially jump into the Big Bang process long after the singularity and without ever needing the singularity.

The collapse of the void would be accompanied by generation of a large rebound compression wave in the Lattice near the zone of impacting void edges. There is no reason to assume that the void would have spherical symmetry. The rebound would probably not appear to come from a single point, but rather a large diffuse volume with various wave sections emerging at different times. This would be similar in nature to the "water hammer" event of a crashing surf, due to the inertia of the compressing Lattice. It could vary substantially from this, including being a running void. That means, the rebounding compression waves could be non-uniform.

The effect of introducing a hole discontinuity into the Lattice, which creates conventional matter, **lowers** the Lattice pressure around the discontinuity, and produces gravity. So a rebounding **high** pressure wave would create the equivalent of an **anti** gravity wave. This would propel newly created matter particles and preexisting particles in the Lattice outside the void boundary outward from their original location in the void. The antigravity wave would expand from the rebound zone at the speed "c" due to the natural relaxation rate of the Lattice. Despite the force of the antigravity wave, particles would not be able to keep up with the wave.

As the expanding universe and its multiple gravity-antigravity waves settled down, the gravity fields from newly created mass would also be settling down. This means, gravity in an early "local" universe is anything but a stable phenomena. There could be mass forming near the "Big Bang" source who's ESD has not yet reached mass formed earlier.

The SLT "Big Bang" model, which might be better described as a "Big Smash" model, has many advantages:

The creation of matter out of nothing is easily handled by SLT. Since matter is due to hole dislocations captured in the Lattice as it reforms, matter is essentially formed from the void as Aas come together and trap void volume as dislocations.

Energy is conserved in this process. The void can be considered to have been "endowed" with **potential** energy by the forces that opened the void. The "void potential energy" would be dispersed into the Lattice as the void collapses in the form of **lost volume** in the Lattice. This is the mass energy associated with each dislocation. It

would be measured on cosmic scales as the integrated volume **lost** from the Lattice by the total number of dislocations formed.

Due to the preferred ways Aas align as the Lattice structure self-heals, very few anti-matter dislocations would be stable because they are harder to capture in the Lattice.

The SLT model, in contrast to the prevalent "Big Bang" model, does not require a balanced formation of matter and anti-matter.

There would be no need to alter any of the established laws of physics to explain the process. Specifically, there is no need to **overlook** the Big Bang = black hole problem which occurs if all the matter in the visible universe is starting from a very small volume.

There is no need to enlist dimensions beyond the three we can observe, or to change the size of the dimensions.

Since current physics still presents no physical reality for Time, it can't be changed in an attempt to explain the singularity of current Big Bang mathematics. SLT does not require any time alterations.

The "Big Bang" that is responsible for creating "our" visible universe, does not have to be unique. Instead, as Einstein suggested, it is more probable that the great universe is infinite in time and in all three dimensions. Given an infinite universe, Big Bang events are likely to happen randomly at all times throughout the universe. The implication of this is that the gravity waves they produce, both positive and negative, can course through space and affect, or even come together to trigger, other bangs. Since gravity is a speed limited dynamic process, our visible universe may be experiencing the effects of near-by Bangs, but not those of Bangs at great distance.

11.2 Micro Bangs

Previously, the response of the Lattice to particle accelerator experiments was discussed. Once an accelerator can provide large energies, they may have the ability to open up significant voids in the Lattice. This can be considered the equivalent of an SLT "Big Bang" on a micro scale. That would allow experimental verification of the SLT Big Bang model. The SLT Big Bang model also suggests that such experiments could be safe, because the Lattice would quickly heal without any fundamental basis for a critical mass runaway. For safety evaluation, accelerator experiments should be contrasted with the much more dangerous small void situation which occurs in Black holes as discussed below.

On the other hand, given that there appears to be no limit to how small an SLT Big Bang event can be, small events may be occurring frequently even within our visible universe.

11.3 Imbalance of matter and antimatter

Concepts in popular discussion about the "Big Bang" frequently raise the question about the substantial asymmetry in the universe between the quantity of Dirac matter (conventional matter) and "antimatter". The following summary appeared on the CERN antimatter webpage:

"The Big Bang should have created equal amounts of matter and antimatter in the early universe. But today, everything we see from the smallest life forms on Earth to the largest stellar objects is made almost entirely of matter… Something must have happened to tip the balance. One of the **greatest challenges** in physics is to figure out what happened to the antimatter, or why we see an asymmetry between matter and antimatter." {28}

A variation on this view was discussed in an article in Scientific American:

"Modern theories of particle physics and of the evolution of the universe suggest, or even require, that antimatter and matter were equally common in the earliest stages; so why is antimatter so uncommon today?... Without it, the universe today would certainly be a much less interesting place, because there would [should] be essentially no matter left around; annihilations would have converted everything into electromagnetic radiation by now. So clearly this imbalance is a key property of the world we know." {Barnett 2002}

SLT suggests multiple explanations for these imbalance challenges:

First, based on the SLT "Big Bang" model, matter and antimatter do not have to be produced in equal quantity. In fact, as the post "bang" Lattice reforms, the entrapment of "void" in the form of hole dislocations, which produces matter, appears to be much more likely, due to simplicity, than the entrapment of Aas as antimatter. For a hole to be formed, all that is required is the capture of Aas in irregular patterns during Lattice reassembly. For an Aa to be captured as antimatter, a stray Aa would have to be correctly oriented and then forcibly inserted into already properly organized Lattice. So, in SLT, antimatter would be expected to have very low occurrence.

Second, photons can play a role that has not been previously understood or observed in physics as SCAVENGER PHOTONS**.** SLT suggests that low energy photons, which no longer have the ability to interact with conventional matter, can perfectly interact with SLT antimatter. The interaction results in destruction of both the photon and the antimatter particle leaving only prevailing Lattice and energy released as Lattice vibrations.

Figure 16-a below shows both the extra Aa (antimatter) from Figure 15-b and a dislocation (photon) near each other in a Lattice. The photon is moving in the direction of the antimatter. In undisturbed prevailing Lattice, the photon hole would just continue through the Lattice. But, the stress state of the antimatter inclusion would be higher than in prevailing Lattice. Referring to Figure 16-a, when the photon hole reaches the position just to the right of the speckled Aa, which is just to the right of the black antimatter causing Aa, the speckled Aa will begin to move right to fill the hole. It will move due to the pressure on it from its surrounding Aas, one of which is the antimatter producing Aa. But the antimatter Aa will also begin to move with the speckled Aa due to its pressure state. The woven textured Aa, itself under unusual pressure from the antimatter Aa distortion, would also move more quickly. As these three Aas begin to respond to the hole, a geometry arises that is different from the motion of a photon in typical prevailing Lattice as shown in Figure 16-b. The new situation is one of a restored prevailing Lattice, which is inherently **stable**, and resists further disruption. SLT suggests that this sequence of events will **not** occur when energetic photons encounter antimatter. In that case, the energy propelling the photon will override the self-organizing dynamics of the Aas. The photon dislocation will just

pass through the antimatter, moving it one Aa width in the direction opposite to the photon motion. Once the photon energy becomes low enough, the self-organizing forces of the Lattice will overcome the photon energy and capture the photon. The antimatter causing Aa simply fills in the scavenger photon dislocation.

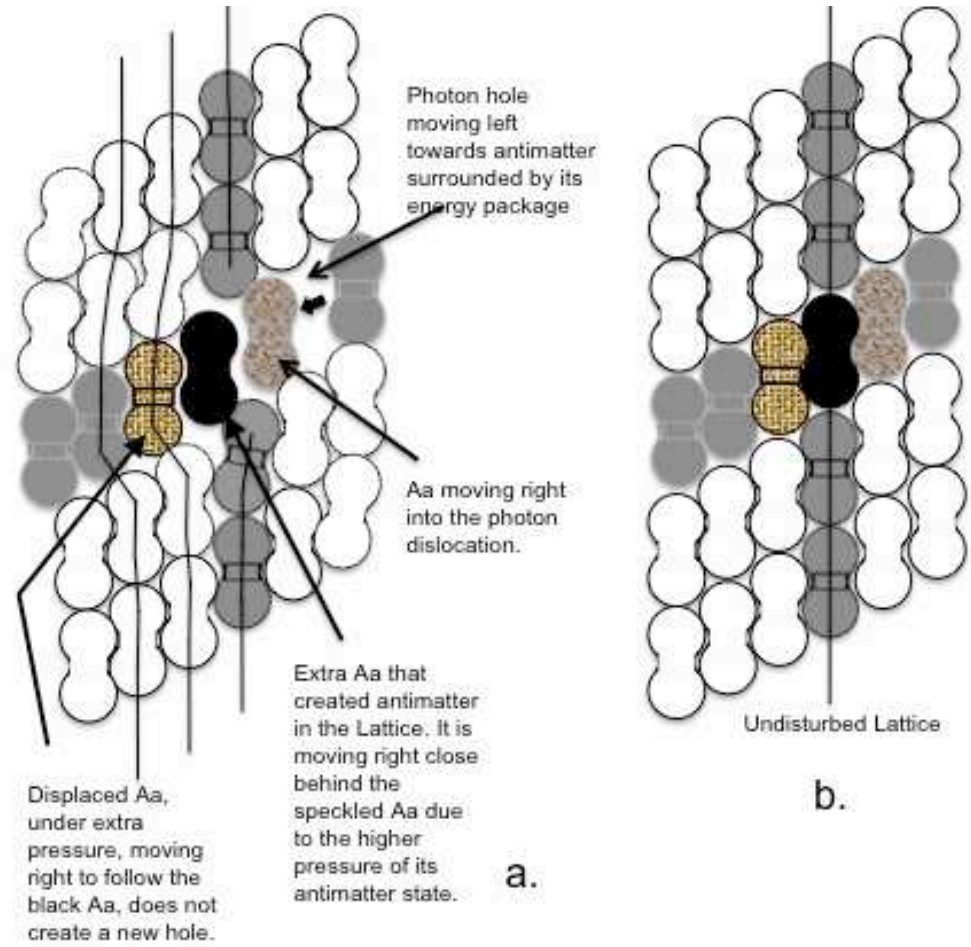


Fig. 16

Antimatter - photon annihilation

In short, SLT suggests that **scavenger photons** , which may alternatively be referred to as THERMAL PHOTONS, sweep the universe, clearing it of antimatter. This would contribute to an explanation for why so little antimatter is found. It would also suggest that the amount of antimatter will continue to decrease over time. The residual photon energy would then become microwave background, which would explain why so much of that **is** found.

If antimatter is associated with an additional Aa forced into the Lattice, a simple conclusion might be that the Lattice is entirely composed of antimatter. This, however, is not the case. This point is noted to stress that, in SLT, at the scale of the Aas, objects and interactions are **not** determined by specific items, like an Aa or dislocation, but rather by the effects caused by **arrangements** of the items. So, while an additional Aa in the Lattice, which disrupts the Lattice, produces the behavior of SLT antimatter – i.e. antigravity - the same Aa, when it is back in the structure of the Lattice, is no longer antimatter, but just the foundation of Lattice.

Another simple conclusion might be made that antimatter can be viewed as an "anti-**photon**". This is also not the case. While a photon and antimatter can annihilate leaving only energy, the antimatter Aa does not possess the "hole" property of a photon which allows it to so easily pass through the Lattice. On the other hand, if it could move through the Lattice, it would carry the ability to transfer mass, albeit in the form of antigravity antimatter.

SLT suggests a reason so little antimatter is found is that science might have to question the basic observations behind the antimatter challenge. Because of the "framing" of the term "antimatter" to apply to an **electric charge reversal** of predominant particle forms, rather than **gravitational reversal**, the search may be wrongly constraining. Given that antimatter, in the form discussed previously in the section on gravity, would **repel** common matter, three unexpected phenomenon result:

1. Antimatter particles could co-exist along side matter, with no affinity to collide and annihilate.

2. While single Aa antimatter particles would be attracted to each other, their structure may not support development of complex particles which parallel neutrons, protons and electrons, or even the Standard Model particles. The "thermalization" of space by matter may be sufficient to keep the primitive antimatter in the form of a "gas" or antimatter "plasma".

3. Current physics does not have tools or models to detect this form of antimatter. So, there would not have been efforts that could quantify how much there is.

And finally, while there is an Aa configuration that produces antigravity, it is so different in geometric structure from the geometry that produces matter, it is unlikely to produce a collection of antiparticles that are anything like a mirror image of the Standard Model of particles.

11.4 Dark Matter, Dark Energy

The same occurrence asymmetry questions raised for antimatter could apply to the absence of "antigravity. " Antigravity would be more discussed if alternative models for the functional production of antigravity existed. The only broadly accepted antigravity model is "universal expansion" in relation to the prevailing "Big Bang" theory. But this model provides the wrong geometry to explain other observations which beg antigravity solutions, such as the geometric rotational uniformity of galaxies, rather than a Newtonian gravity rotation that decreases drastically with distance.

Current discussions of a universally dispersed antigravity have led to the concepts known as "dark matter" and "dark energy". A discussion of these concepts is provided on the CERN Dark Matter webpage:

"Dark energy makes up approximately 70% of the universe and appears to be associated with the vacuum in space. It is distributed evenly throughout the universe, not only in space but also in time – in other words, its effect is not diluted as the universe expands. The even distribution means that dark energy does not have any local gravitational effects, but rather a global effect on the universe as a whole. This leads to a repulsive force, which tends to accelerate the expansion of the universe." {14}

SLT suggests that the occurrence of thermal photons and antigravity Aa inclusions, as discussed in previous sections, might provide mechanisms to answer the still unsolved gravity distribution questions and lead to approaches to detect SLT photons and antimatter. For example, the concept of thermal photons opens up the possibility that many of them might agglomerate. Without atomic structure, they would group into very small objects, entirely bonded by gravity. They would not be visible in the conventional sense because they would be so small, and because they would not absorb or reflect light.

11.5 Big Bang and gravity waves

In the discussion of gravity waves, it was mentioned that a Big Bang event might offer an alternate source of strong waves for gravity wave detection. SLT suggests that very strong Lattice distortions occur during a Big Bang event, as a large space void is produced and then closes up. The distortions would thereby create very large gravity waves, initially as antigravity due to the compression of the Lattice during void expansion, followed by a gravity overshoot as the void collapses. The initial waves would be followed by many echo waves, each with lower magnitude, finally settling into a normal gravity residual state representing the mass created during the process.

Such gravity waves, caused by numerous Big Bang events beyond our visible universe, would travel through the great universe crossing visible universes and thereby be capable of detection. They would appear to come from super large explosions. Their period, however, would be very long, on the order of the visible universe formation time. This would be approximately the maximum void radius divided by the Lattice relaxation rate "c".

11.6 Black holes and antimatter mirrors

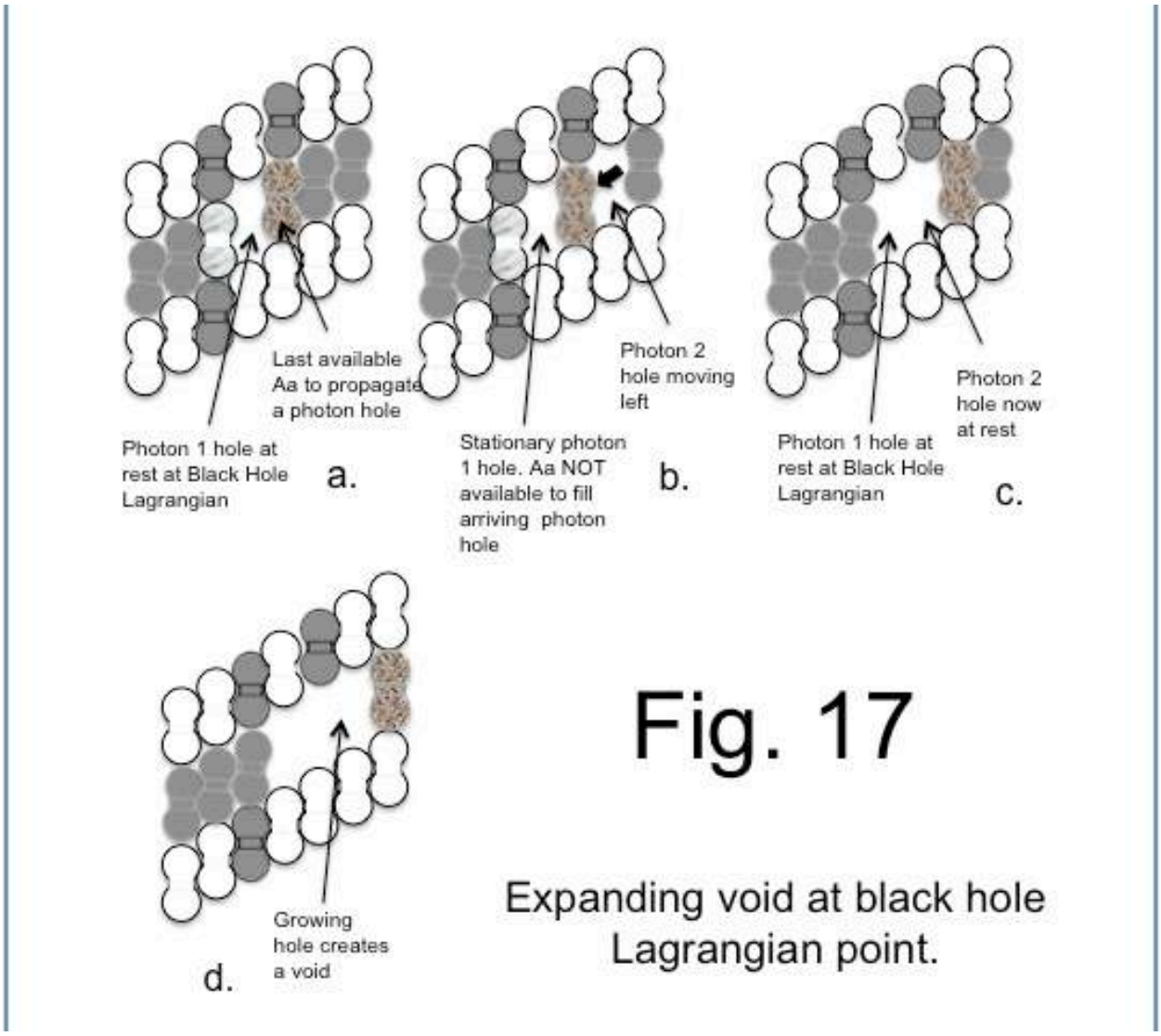
Black holes

It is important to start the discussion of black holes with the clarification of the $1/r^2$ relationship for gravity discussed in "Gravity vs. distance". Using Newton's Shell Theorem, the gravity field magnitude at the center of a black hole is **zero**. It is not infinity as many current models state. This also brings into question the possibility of an "event horizon", also referred to as the SCHWARZSCHILD RADIUS ($r_S = 2\,G\,m/c^2$) (S-r). While the S-r can be calculated for all collections of matter, the question becomes, is the gravitational field of the matter within the S-r capable of compressing the structure of the matter within the S-r sufficiently to achieve the required mass / volume ratio. Since

the Shell Theorem shows that gravity decreases with depth within spheres, the compression of material has to come entirely from the integrated gravitational effect of the "overburden".

Typical examples simplify the calculation by using the assumption of uniform density. For example, using matter with the density of water, a Schwarzschild radius occurs when an object reaches 136 million solar masses. Objects estimated at over 10 billion solar masses have been observed. {McConnell 2011}

Considering the SLT model for a black hole, an interesting picture emerges. The black **hole**, while observed as an agglomeration of dense **conventional** mass, is also a collection of holes, due to the SLT model that mass is due to dislocations. This, ironically, produces a low Aa density Lattice structure inside the object (being filled with holes), surrounded by the higher density Aa structure of less-perturbed space.



Photons, which transport mass, would be directed by the gravity of the black hole toward its center. According to Newton's Shell Theorem, the center of a black hole

would have no gravitational field. That is, the Lattice at the center of the black hole would not be gravitationally distorted. Instead, it would appear like a Lagrangian libration point – a BLACK HOLE LAGRANGIAN (BHL). Such a structure could initiate a multi-step process:

BHL initiation - step 1:

Assume that the dislocation of photon 1 has come to rest at the BHL as shown in Figure 17-a above. The speckled Aa to the right of the hole becomes the last available Aa to the right of the hole to propagate the arrival of another photon hole from the right.

Photon destruction – step 2:

In Figure 17-b, photon 2 is shown arriving from right to left. When it collides with the last remaining Aa in its path before encountering the stationary hole, the photon hole exchanges places with the last Aa resulting in the geometry shown in Figure 17-c. Since there is no Aa available for continued motion, the photon is destroyed and its energy packet released into the Lattice as thermal energy.

Void creation – step 3:

Figure 17-d shows the result of photon 3 arriving. It has also caused the speckled Aa to move again. Since Aas are not available to propagate photons through the BHL, a BHL **void** would form and grow as continued photons arrived.

Void collapse – step 4:

Voids are not a stable Lattice structure. The Lattice would eventually **adjust** to fill the void by pushing Aas into it. This would cause at least the following 8 outcomes:

Effects in the surrounding Lattice

1. Lattice bending: The Lattice could bend into the void. That would increase the gravity field around the BHL and attract more photons and mass to the void.

2. Void edge collapse: Aas near the void edge would be pushed into the void by the pressure of void-edge Aa rearrangement.

3. Photon production: If an Aa is energetically pushed into the void, a new "rebound" photon going outward in the opposite direction will be created. Due to the gravity field and mass density, the photon would eventually scatter back into the BHL.

4. Matter migration: Matter in the form of atomic particles or subatomic fragments could enter the void. Their arrangement of dislocations and associated Aas would be lost as the near field structure of the particle entered the void. Their dislocations would enter the void expanding it.

Effects in the void:

5. Void structure: The void has no gravity field. Aas pushed into the void just move around due to the inertia of the event that caused them and thermalization with other Aas. The void would be dynamic and remain relatively small.

6. Destruction of mass and matter: When "mass" enters the void, ironically, all that actually enters the void is the dislocations. That is, the "mass" effect is just the accumulated distortion in the Lattice produced by the dislocations. So as a "mass" moves toward the void, the Aas structure that defines the mass adjusts, but the Aas

don't move with the dislocations. This is similar to waves on water. The water adjusts but it does not move with the waves. So, ironically, as "mass" (i.e. dislocations) enter the void, the void grows, just as it does for photon capture.

7. Matter creation: Multiple Aas falling into the void could be trapped in odd arrangements, forming both stable and unstable particles. The particles, each of which must include a dislocation, would be ejected into the Lattice becoming new components of the black hole. However, due to the local gravity and mass around the BHL, this created mass will typically scatter back into the void.

8. Lattice healing: Due to the self-organizing property of the Aas, many of the Aas that enter the void from its edge will re-organize into **undisturbed Lattice**.

This model produces a interesting outcome. The result of steps 1-4 is that a BHL void creates a conveyor belt of inflowing dislocations from photons and matter. The inflowing matter and photons would essentially be torn apart and the misalignment of the Aas that defined their matter would eventually be returned to a Prevailing Lattice structure – i.e. converted back into Lattice. As the matter of a black hole is converted back to Lattice, the gravitational field of the black hole would decrease. This process could continue until the black hole wasn't "black" anymore if there was **insufficient** influx of matter and photons to sustain the BHL.

The concept of thermal photons opens up a new possibility for black holes. If thermal photons can assemble into small objects, many might agglomerate, without atomic structure, into very heavy objects. Due to the lack of atomic structure, the mass of these objects could be huge in proportion to their size, far exceeding the density of neutron stars, for example. They would be invisible through conventional light sensing methods.

In summary, SLT suggests that a black hole, through the mechanism of the BHL, becomes an annealing furnace to turn matter back into Lattice.

SLT therefore suggests that black holes are a process that destroys what Big Bangs create.

A corollary is that the mass of black holes has a finite limit which occurs when the BHL annealing rate balances the black hole matter plus photon capture rate.

In summary:

1. The magnitude of gravity at the center of a black hole is zero, not infinity.

2. Even at the highest levels of gravity near the periphery of a black hole, that level is limited by the ability of the Lattice to bend without breaking its structure, which would just result in a Lattice reorganizational process.

3. Black holes may have a Black Hole Lagrangian (BHL) at their center.

4. The BHL may enable a process that turns the matter of the black hole back into regular Lattice.

5. The BHL may in fact exist in mass concentrations below the amount needed to create a Schwarzschild sphere.

6. The mass of a black hole is finite. As the concentration of matter increases in density, the efficiency of BHL processes at its core to convert mass to Lattice will improve and

limit its growth. The mass of a black hole is the integral over time of the balance between matter and photon influx vs. the BHL conversion rate.

7. As a steady state mass eater, black holes just reverse the process of visible universe creation in a great universe of cyclic Big Bangs and black holes.

Antimatter Mirrors

SLT discussed antimatter in the previous section on gravity and antimatter. While antimatter does not appear to be able to form anti-atoms, SLT suggests that antimatter does appear to have a stable structure in the bare Aa form. But, unlike the force relationship between electrical charges, among which opposite charges attract and like charges repel, conventional matter is known to attract matter like itself. As described in the section on gravity, SLT suggests that antimatter will also attract antimatter similar to itself. So, given its possible stability and affinity to attract like material, there might be cases for an agglomeration of antimatter to form. If such an agglomeration were to occur in a very large amount, it might "seem" obvious to describe it using a term opposite to a "black hole" such as a "white hole". This would be misleading.

Here are some properties that SLT suggests a very large antimatter object might have:

1. Its gravity field would be "antigravity" rather than "normal gravity" as we see with a black hole.

2. Antigravity would **repel all conventional matter** and only attract antimatter objects like itself.

3. It would repel conventional photons. It would repel conventional electromagnetic waves.

4. With sufficient material, it would also have a Schwarzschild radius. At that radius, **no** conventional photon or any conventional object could penetrate its "event horizon".

There is a phenomenon in the physics of light, related to reflection, that states: objects that are insulators, such as porcelain, reflect light predominantly in wavelengths related to their own chemistry; objects that are conductors, on the other hand, such as mirror surfaces, reflect images predominantly in wavelengths related to the source light's color. With this model, the use of black and white to distinguish super massive objects is misleading. The "anti" version of a "black hole" would be better described as an ANTIMATTER MIRROR.

Looking for one in space, we should be looking for a small perfectly silvered sphere. It would be relatively small in diameter because the antimatter Aas would not appear in atom sized form. So they would be agglomerates of bare photon sized "particles". The object would appear as a "fisheye" mirror that presents us with a spread out view of the universe **behind the viewer**, although through an aperture only the size of its gravity field out to a range capable of diverting passing light rays.

If we relax the requirement of having sufficient material to achieve a Schwarzschild radius, what other properties would a sizable antimatter object have?

1. It could exist at sizes much smaller than required to produce an "event horizon".

2. It would be subject to substantial erosion by scavenger photons and therefore have a relatively short lifetime.

3. It would not easily collide with conventional matter, but push away from conventional mass.

4. It could easily pass through collections of conventional mass like galaxies without collisions. (This sounds suspiciously like a neutrino? For fast moving single Aas, they also beg to be seen as antiphotons?)

5. If it passed through interstellar clouds, it could leave "contrails" of swirling eddies.

6. It could exist as a binary with another antimatter object or form galactic type structures.

7. These "antigalaxies", while not being able to emit conventional photons, would be able to emit electromagnetic waves (which SLT views as different from photons), including some into the visible and higher frequencies.

In summary:

1. Since a large antimatter object would repel conventional matter, including photons, and electromagnetic waves, such an object would appear as a mirror in space.

2. The diameter and shape of the mirror would depend on the gravitational field strength of the object.

3. If the object had a Schwarzschild radius, no object or photon could penetrate its event horizon. It would become a perfect mirror for conventional objects, including photons.

4. Large antimatter objects could exist at sizes smaller than black hole equivalents. They would easily pass through collections of conventional mass and would repel conventional mass as they passed.

12 Electromagnetics

Electromagnetics – introduction

ELECTROMAGNETICS is a term that categorizes phenomenon referred to as electrostatic fields, electromagnetic fields, and the behavior of electric charges and magnetic dipoles in those fields. These fields interact with charges and magnetic monopoles in the manner we interpret as an electric force or magnetic force. SLT suggests that all three fields (gravity, electric, magnetic) are distortions in the same Lattice structure. That is, all are structured distortions of Aa relationships. The manner in which the fields interact with hole dislocations, charges and magnetic dipoles, however, is completely different.

A new term, "ELECTROMAGNETIC CHARGE"(EMC), is suggested to replace the conventional term "electric charge" because SLT suggests that a creation of the source of conventional electric charge simultaneously creates and includes a magnetic monopole.

1. SLT suggests that **all** electromagnetic fields are caused entirely by **structural bending distortions** of the Aas in the Space Lattice. Electromagnetic fields use the same Lattice components (Aas) as gravity. They cause different effects because their Lattice distortion shapes are different. The fields therefore do not interact to first order.

2. **All** electromagnetic forces are due to the **interaction** of electromagnetic **fields**.

3. Electric charges and magnetic "sources" are caused by a newly proposed property of matter call a **Lattice Twisting Structure (**LTS**).** This Lattice twisting distortion is distinct from gravity distortion.

4. SLT suggests that both magnetic dipoles and magnetic monopoles exist.

5. Lattice Twisting Structures occur in two general forms: plus and minus. Each of these occurs in both static and dynamic forms.

6. Electromagnetic distortions in the Lattice can be observed in 5 general forms: 1. "Electromagnetic charge" (static); 2. Magnetic monopoles (static); 3. magnetic dipoles (static), 4. electric waves (dynamic) and 5. magnetic waves (dynamic).

Electromagnetic charge (EMC**)**

An EMC is not an infinitesimal point, but has finite volume. An EMC is shown functionally in Figure 18 below. Figures 18 a-h only show a depiction of the **near field** function. Figure 18 –I depicts the far field structure.

During charge creation, adjustments of the Aas in the Lattice introduce **twisting** in the Lattice which introduces **sheer stress** in the Lattice. This twisting is referred to as a Lattice Twisting Structure (LTS). The term "**twist**" means that, in a single electromagnetic charge, the Aas along various long-structure paths passing through the charge bend both CW and CCW around a virtual "axis" in the charge. Twist is introduced because the paths curve at **different** points on the axis.

7. Electromagnetic charge is both an electric charge and a magnetic monopole.

8. The electric field and magnetic monopole field of an electric charge are **inherent** properties of a particle.

9. The electric field of an electric charge is not spherical, but has a pancake shape in the near field. The magnetic monopole field has two opposing "funnel-fields" that start broadly spread in the pancake, spiral radially inward and turn axially outward parallel to the pancake axis.

Figure 18-a shows a view of a particle directly along an X axis, which will be used to define an axis that is axially symmetric with the disk of the pancake. Figures 18-b and c show the "a" view rotated about -20 and -60 degrees around Z. It is important to stress that the pancake shape is **not** a suggested hard volumetric shape for a charged particle. No hard boundary exists in SLT for any particle. The pancake geometry is an accurate functional portrayal of a charge's electromagnetic field.

The surfaces of all views depict the long structure lines of the original rectilinear Lattice which have been "twisted" during the charge's creation process. The twisting occurs around the X axis. In this figure, the twist is shown CCW on the nearest visible section plane and CW on the far plane. The amount of twisting in the figures is, potentially, exaggerated to allow easier visualization of the twist function. SLT does **not** indicate a magnitude of the twist.

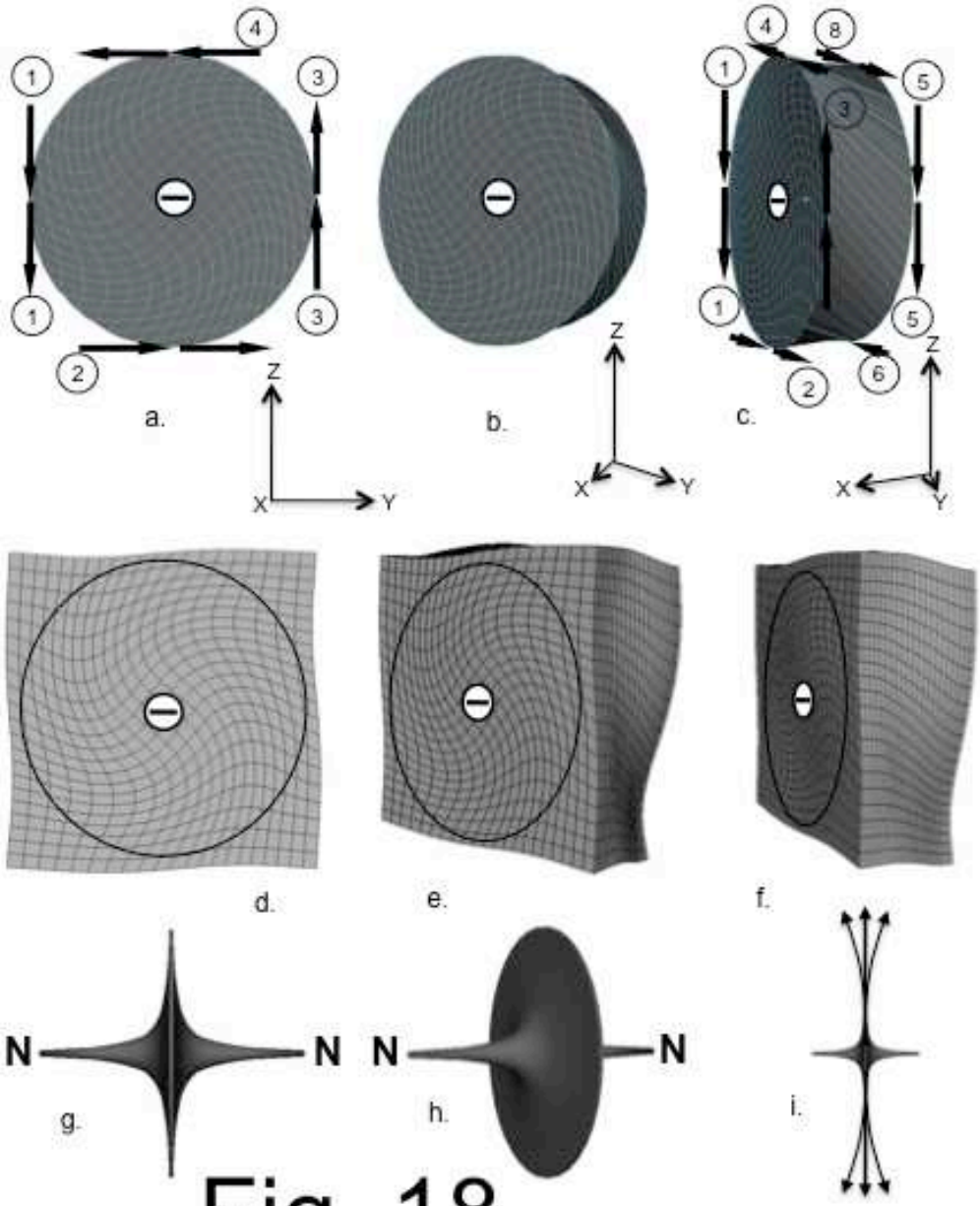


Fig. 18

Electro-magnetic Charge -
Functional Perspective Views

The torques of the twist net to zero around the axis, thereby not introducing a net torque on the Lattice in the far field. The result is that the LTS creates a sheer stress in the Lattice with a net Aa **density** change of zero. In contrast, a "mass", creates an Aa density gradient, but no sheer stress or twist. This difference allows the two fields to cause distinct effects in the Lattice while overlapping in geometry.

The twisting imparted to the Lattice can have two distinct (bi-polar) helical forms when viewed along the charge axis: clockwise and counterclockwise. These distinct forms produce the positive and negative presentations of the electric field and the north and south presentations of the monopole magnetic field. All six views show a negative sign at the center of the pancake circle projection. Analysis in the full paper shows that the CCW twisting structure shown is consistent with what is classically called a negative charge. The magnetic axes fields for this twist would both be north, thereby creating a north monopole. The numbered arrows show Y and Z torque components that are matched with follow on figures.

Consider many negative electromagnetic charges that have been forced onto a very thin flat wire. The wire is wide enough to allow charges to separate horizontally (Y axis) but not vertically (Z axis). SLT suggests that the charges will align with each other. They will space themselves uniformly due to the mutual repulsion of their electric fields and magnetic monopoles based on the conductivity and geometry of the medium they are in. This arrangement is depicted in Figure 20 below. Only the near field portion of the charge is shown in Figures 20 a-c. Figure 20-d shows a far field section view. Due to the mutual repulsion of the negative charges, the far fields, which each spread out with distance as depicted in Figure 18-i will spread into each other and force additional bending of their fields.

10. SLT suggests that not all electromagnetic phenomenon have a common foundation, as is assumed in classical physics. In SLT, photons are energy pulses that, specifically, transport matter through their associated dislocations. True bending waves, however, also appear in the Lattice. These appear as electromagnetic because they do not have spherical symmetry. They are distinct from photons because they do not cause mass transfer.

11. The frequency / wavelength range for bending electromagnetic waves, photons, mechanical, and gravitational waves can overlap over a large range.

12. Fields, being a strain distortion of the Aas that pervades the entire universal Lattice, exhibit a **field inertia** based on the inertia of all the Aas in the universe. This inertia is the basis for the impedance space presents to the generation of electromagnetic waves. Energy is required to generate and stop wave motion.

Magnetic fields

The concept of a magnetic monopole was presented as an inherent component of electric charges in the discussion of static electric charge. While SLT suggests the existence of such monopoles, SLT also suggests that monopoles are **not** involved with the creation of **significant** magnetic fields nor magnetic effects. SLT suggests that significant magnetic fields are all produced by the **motion** of electromagnetic charges and that significant magnetic fields are entirely due to dynamic modifications of the electric field. Specifically, this implies that electric and magnetic fields are **not** distinct, but rather, variations of the same field structure.

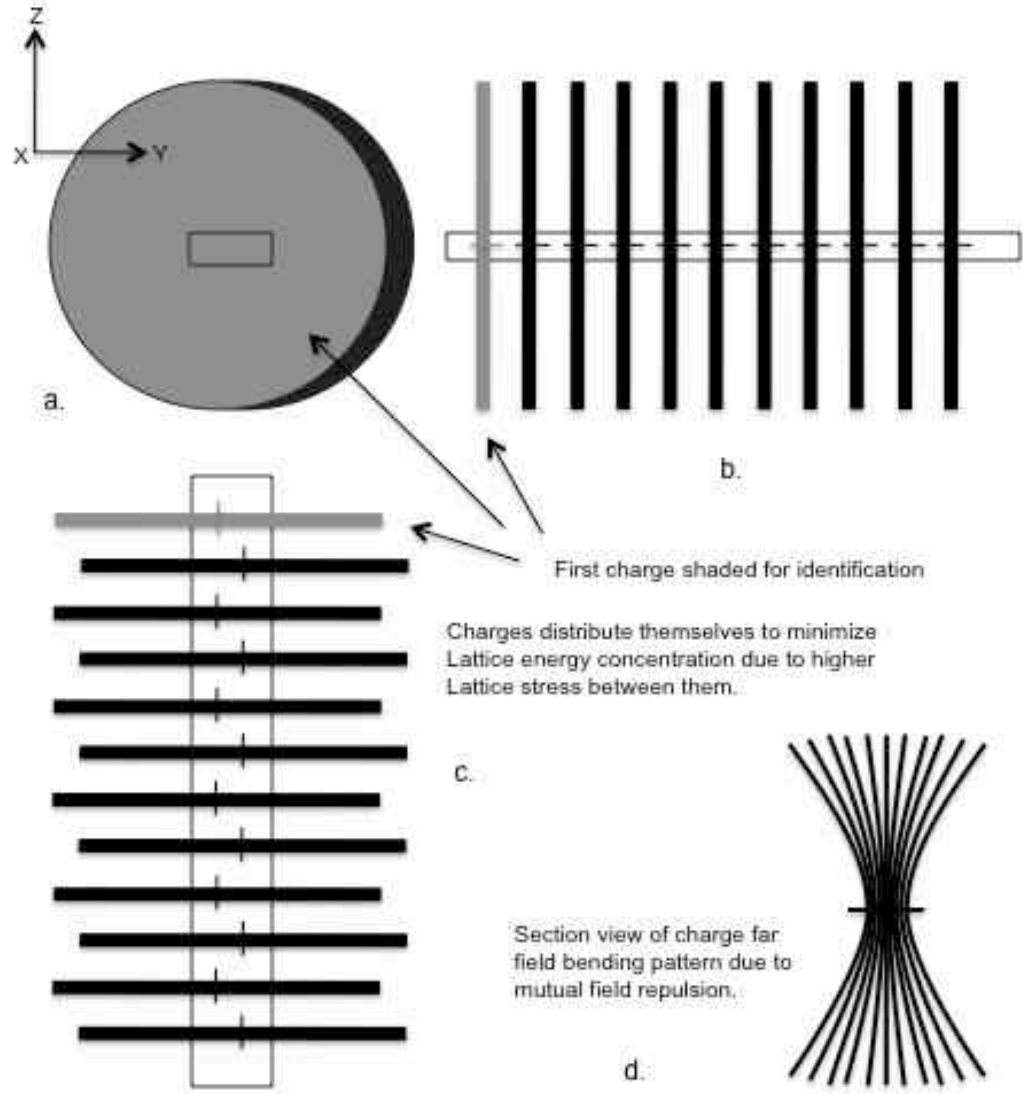


Fig. 20

Electromagnetic charges on a wire – three Cartesian views

Electromagnetic charge – dynamic field

Now, consider the negative electromagnetic charge depicted in Figure 18-c in non-accelerated linear motion through the Lattice along the X axis in the +X direction. SLT suggests that when a charge is in motion, the charge "weathervanes" to an orientation such that the charge's X axis always aligns with the direction of motion. The pancake surface that faces the direction of motion will be referred to as the "forward" face. The surface facing aft, the "rear" face.

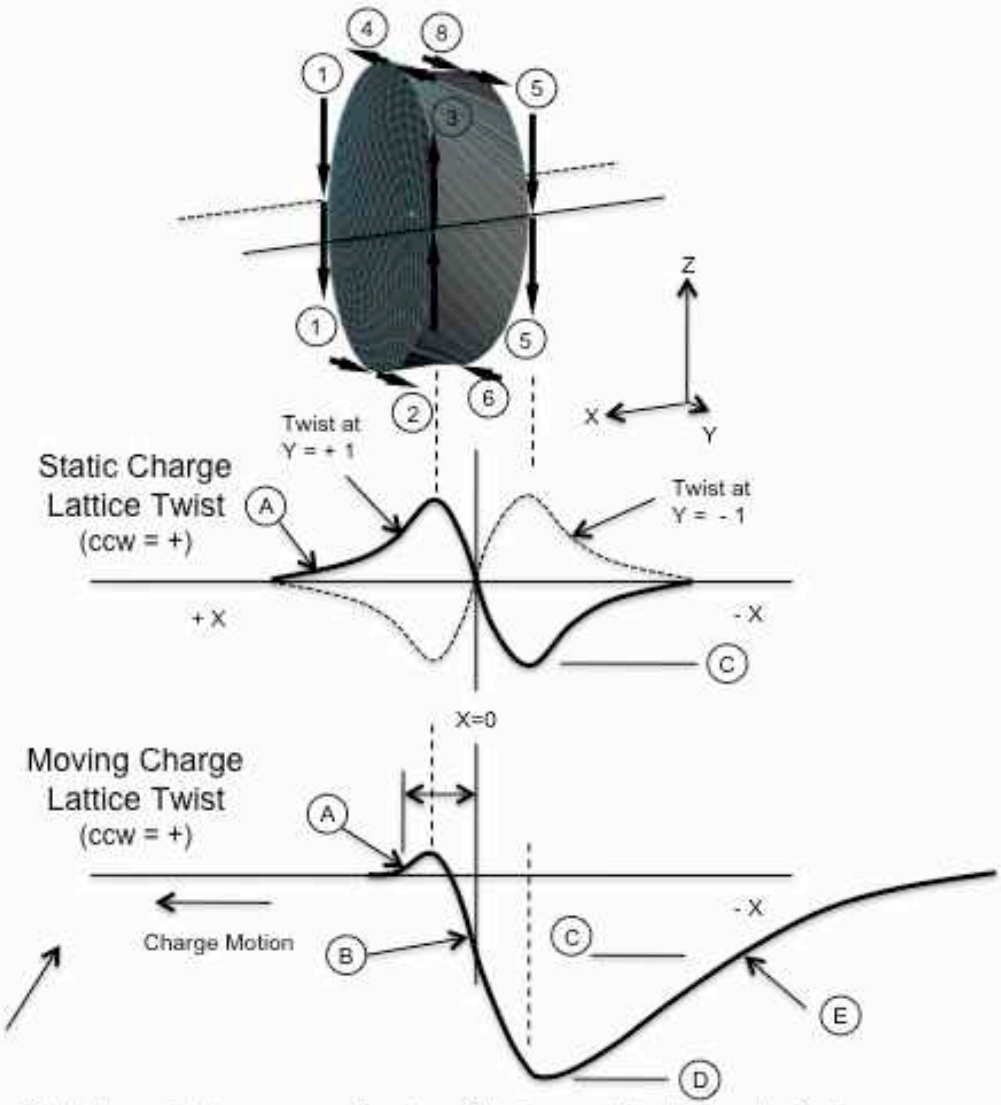
For the charge to move through the Lattice and its dislocation structure to remain intact, the Lattice disturbance related to that charge, throughout all of space, has to undergo a reorganization as the charge moves through it. This applies to both the gravitational and electromagnetic fields. Considering only the electromagnetic field here, for a slow moving charge, Lattice approaching the charge forward face must first **twist** CCW. As the front face passes, the twisting must reverse and turn CW returning to its pre-charge-arrival twist as the center of the charge passes and then continue turning CW to a full counter twist at the rear face. As the charge passes, the twist again turns CCW to return the Lattice to pre-charge-passage conditions. This behavior is shown in Figure 24 below for the twist magnitude vs. position curve labeled "Static charge Lattice twist".

To provide a visual concept for this twisting phenomenon for a charge moving at high speed, Figure 25 below presents a functional representation of the dynamic twisting function using an aerodynamic vane model. Figures 25 -a, b, and c show three rotated views of the EMC pancake structure first introduced as Figure 18-c. The Figure 18-c view is reproduced for comparison as Figure 25-d. Its torque vector identifiers are removed and the twisting lines on a radially projected surface are enhanced. In Figure 25- a, b, c, the charge "pancake" is portrayed in semi-transparent form to show a set of 4 aerodynamic vanes inside. These vanes represent a simplified functional model of the twisting function that would produce the 4 twisting vectors shown in Figure 18 .

The graphic shown as Figure 25-e represents how each vane would "deflect" the Lattice as the charge moved through it. The combined deflection of "vanes" spread around the charge, at a finite distance from the X axis, but parallel with the X axis, would twist the Lattice.

The moving charge response, unlike the equilibrium static twist curve, is dominated by Lattice dynamic response. Using Figure 24 above, due to the inertia of the Lattice, the twist approaching the charge, point A, will lag and be less. Going from the +X entry point of the charge to the –X exit point of the charge, the velocity of twist of the Lattice will be higher, and exceed the maximum twist observed for the static case and reach a **much larger overshoot value** (D) on the moving charge curve. This overshoot phenomena is critical because it will **dominate** the behavior of a fast moving charge. As the charge passes, the Lattice will **recover** based entirely on the LRR (point E). The recovery, however, would occur after the charge passed, being farther from the rear face of the charge than in the static case.

What happens when the charge density (current) is increased? In this case, a new charge will enter the overshoot field of the charge ahead of it before the Lattice has time to recover, both further increasing the twist and crowding its field into the volume around the wire.



The twist magnitude curves are aligned as if the view was directly along the Y axis.

Fig. 24

Static Electro-magnetic Charge - Lattice distortion function - skewed

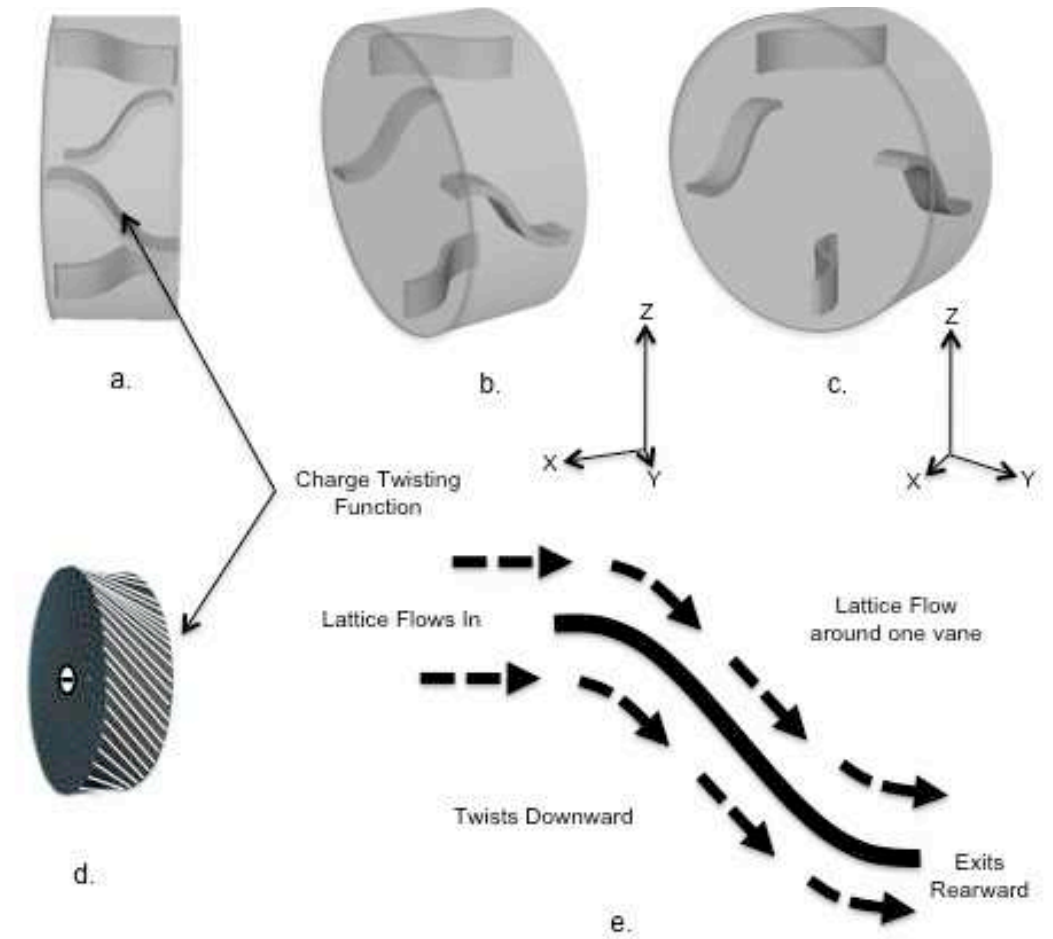


Fig. 25

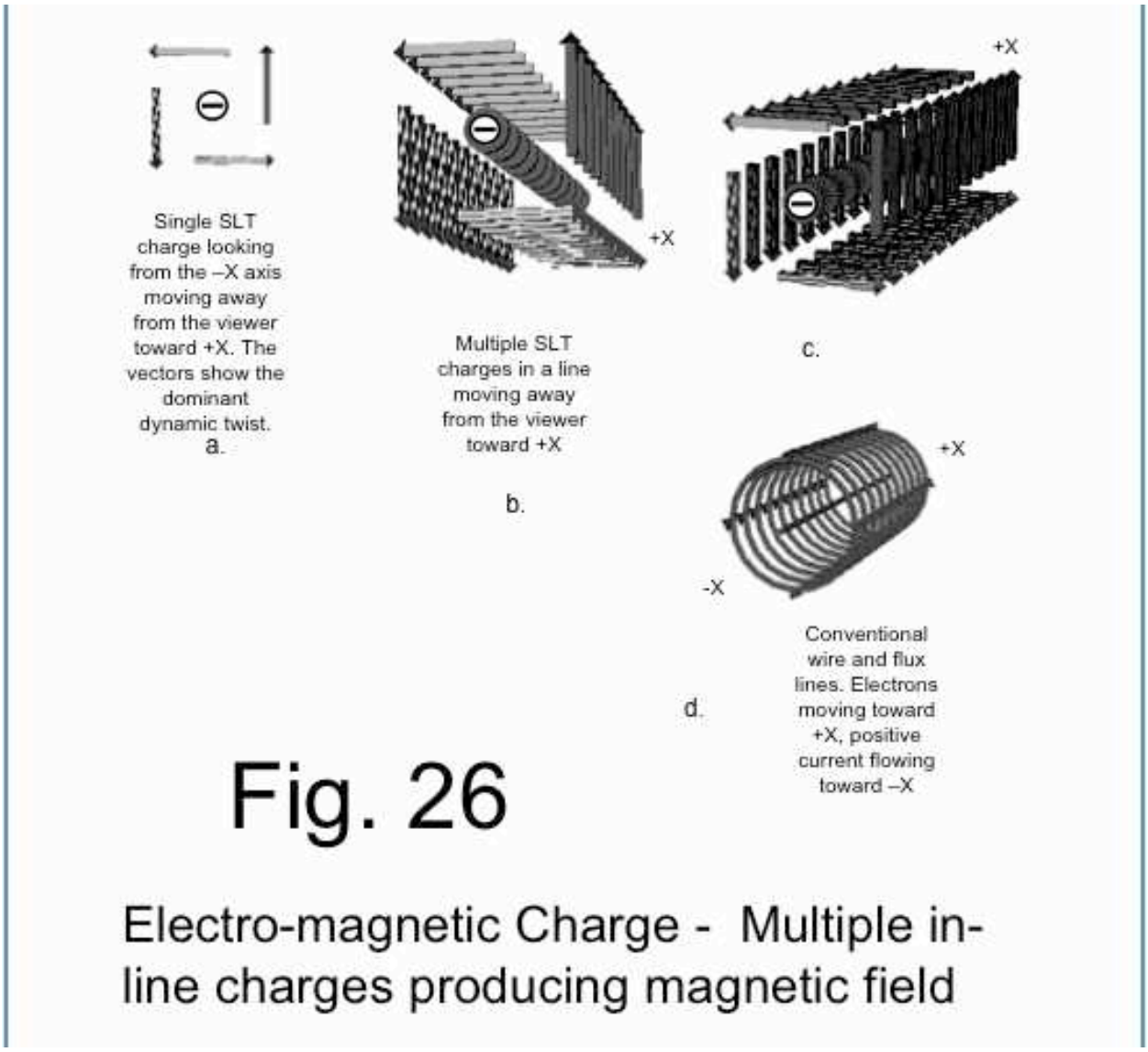
Electro-magnetic Charge - Dynamic Twist Function Perspective Views

Large volumes of space which surround the wire will exhibit an electromagnetic disturbance which represents the density of the combined fields of the individual charges moving, and the overshoot that each creates. The magnitude of the field will be related to the charge **current** and the speed of the charges.

The electromagnetic disturbance can not be persistent without being sustained by a continuous replenishment of moving charges. Once the charges slow down and stop, all of their conical fields will return to a static, overlapping radial geometry, perpendicular to the aligned charge axis.

The classical magnetic field around a wire is explained by this process as shown in Figure 26 below. In the figure, the aerodynamic vane model of individual moving

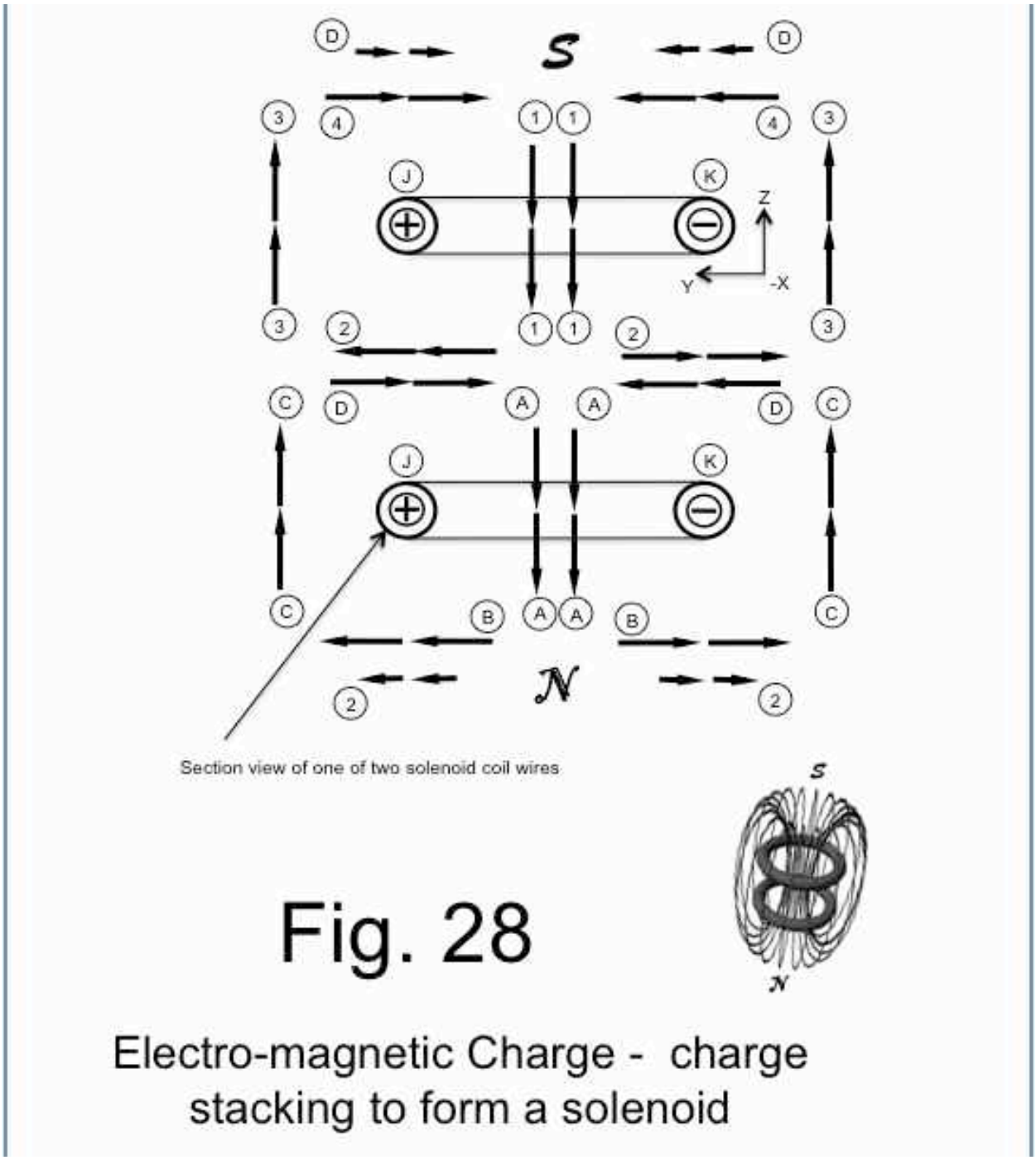
charges is simply repeated for many closely packed charges moving along a straight wire. When the wire is bent into the shape of a solenoid, the result is the field shown in Figure 28 below. The magnetic dipole then occurs and its magnitude is the measure of **twist** the moving charges have introduced into the Lattice.



13. A magnetic dipole field is **not** an inherent component of a particle. The field is produced by electromagnetic charges in motion and is entirely due to dynamic summation of circulating electric fields.

14. A **static** magnetic field is a twisting distortion of the Lattice that, due to the rate of repetitive twisting, and the damping of the Lattice Relaxation Response, appears to have a "steady state" twist distortion in the far field.

15. Energy is not lost by a **static** field, even with moving charges, because of the "steady state" nature of the far field.



16. The magnetic dipole field of a superconductor appears lossless because: a. it has no Ohmic loss, and b. it's far field is static. However, upon precision examination, it would be found to have "ripple" losses.

17. SLT suggests that **inductance** is an electromagnetic measurement of the Lattice's fundamental elastic constant in twisting.

18. SLT suggests that **inductive impedance** is an electromagnetic measurement of the Lattice Relaxation Response in twisting.

Electromagnetic energy forms

19. SLT suggests that electromagnetic waves and pulses are explained as simple true bending waves in the Lattice, not photons.

20. SLT suggests that visible light is not a single phenomena, but rather a combination of electromagnetic waves, photons, mechanical Lattice bending, and mechanical Lattice density (gravity) vibrations.

21. SLT suggests that the term "thermal radiation" not be limited to wavelengths of infrared light. A new term, "Lattice vibration" would apply to the full range of energy in the form of Lattice vibration.

13 Nuclear Physics

Restudy the atom

1. In SLT, atoms are collections of the classical fundamental particles: protons, neutrons and electrons.

2. The structure proposed by SLT for electromagnetic charges can provide new alternative concepts to address the challenges to the Bohr model.

3. For the Cloud Model, the pancake structure of the electric field, and the pancake magnetic field formed when the electric field moves in the Lattice, add limitations on the degrees of freedom allowed for electron motion in atoms. The limitations may help explain the quantization of orbits and the lobed structure of the cloud model.

4. In SLT, electrons are not necessarily required to "orbit" around a nucleus. The electrons, which have "near field" pancake structures, may form "structured domes" that continually reorganize their pancake field with each other, and the similar pancake jumble of the protons in the nucleus.

The atomic nucleus

5. SLT does not agree that the fragments of particles observed in accelerator experiments are elementary **sub-components** of neutrons, protons and electrons. Rather, SLT suggests that these observations are unstable **conglomerations** of fragments of the stable particles, not basic building blocks.

6. SLT suggests that the strong force is caused by the inherent Lattice pressure acting on "bridging arch" structures that are part of the structure of protons and neutrons. This is pictured in Figure 29 below.

7. In high energy collisions, the Lattice can be torn apart, creating micro voids. Aas can drift into the voids in any orientation.

8. As the Lattice reforms under the universal pressure, many Aas will self-assemble as pure Lattice. But new particles may form as well. The particles that form may have structures that are marginally stable.

9. As the Lattice squeezes back together, newly formed particles can be ejected from the closing void. The length of time they persist depends on their structure and the field and dislocation environment they pass through.

10. Other marginally stable particles can be trapped in to closing void volume. These can be destroyed as the closing void pressure increases.

11. Those particles that survive the previous situations are then susceptible to being broken apart by other Lattice processes.

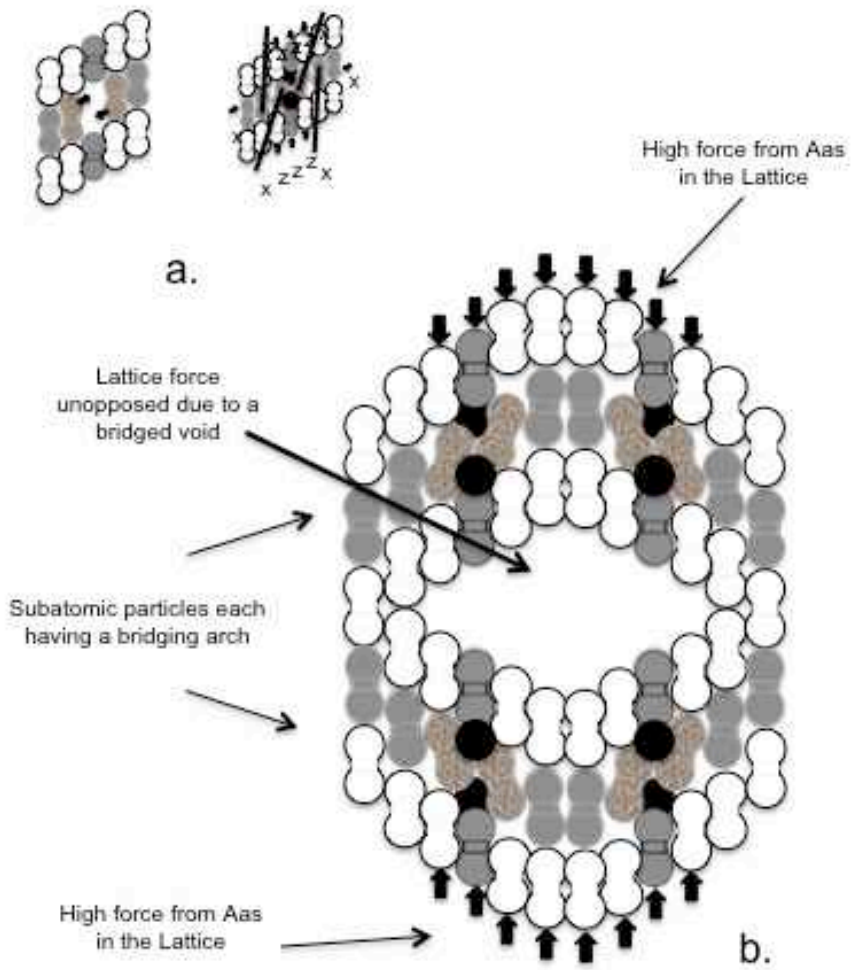


Fig. 29

Strong Force – particle bridging structure

14 Problems with Existing Theories

14.1 The Speed of Light Problem

1. The source / medium / receiver controversy about the fundamental nature of light transmission has existed as an established scientific challenge for over 24 centuries.

2. The latest attempts to resolve the physics of light transmission have been rife with error. There is substantial support for the existence of an aether that transmits light. SLT suggests that the aether is the Lattice.

3. The Michelson-Morley experimental design and results have been misrepresented by both the media and the scientific establishment. The result has been "to lock physics into more than a hundred years of nonsense about the nature of time and space."{Cahill 2005}

4. SLT presents a functional explanation that is testable. This is discussed in the section on suggested experiments.

14.2 Special Relativity

1. SLT rejects the suggestion that the speed of light is constant with respect to all observers. In SLT, the speed of light is only constant with respect to the LATTICE.

2. SLT suggests that historical observations are correct that state Einstein wrote the Special Relativity paper, not to support a relativistic light speed phenomena, but to discredit it using an indirect proof.

3. Observations of phenomenon made using light that suggested measurements are subject to SQRT(1 − v2/c2) distortions preceded Einstein's paper, having been made earlier by Lorentz and others. SLT suggests that the Space Lattice presents and describes a mechanism that supports and explains Lorentz contraction, but based on a tangible universal reference frame rather than a purely relativistic model.

4. SLT suggests that the Twin Paradox, Light Transition History Paradox and multiple observer paradoxes of SR arise due to the misleading attempt to support an observer referenced light speed constancy. SLT does not produce any of these paradoxes.

5. SLT suggests that the basic Maxwell magnet-conductor interaction model is incorrect, and provides a functional explanation for an alternative model.

6. Unlike Special Relativity, which produces universe descriptions individualized for multiple observers that cannot be resolved into an absolute model of the distribution of matter, SLT produces a model that supports a single absolute universe.

7. SLT supports the SR claim that **relative** motion drives the interaction of magnets and conductors, but does not agree with SR's description of why the Maxwell model fails. SLT suggests that Maxwell's model for electromagnetic field interactions will not hold for fast moving fields because such field will be distorted by the Lattice Relaxation Response.

8. SLT does not require different field models for magnets or conductors either stationary or in motion relative to the Lattice. That is, SLT provides a unified theory for electric and magnetic fields.

9. SLT suggests that light transmission conforms to simple transmission principles based on the Space Lattice.

10. SLT disputes the analytical conclusions of moving atomic clock time changes made by Hafele and Keating and shows, using their primary data, how the measurements are accurately explained by the Lattice model.

11. SLT provides examples for light beams on water, rainbows and images that appear to be "observer preferential" but explains how the preferential observations are illusions.

12. SLT discusses the mathematical foundation of spatial absolutes, and resolves the asymmetry of constant linear motion introduced by SR by giving constant linear motion an absolute reference: the Lattice.

14.3 The General Theory of Relativity

Failure to justify a mechanism for a field in space

In Einstein's paper titled Relativity: The Special and General Theory (GR) the opening paragraph of the General Relativity section on the gravitational field states, (p57)

"If we pick up a stone and then let it go, why does it fall to the ground ? The usual answer to this question is: 'Because it is attracted by the earth.' Modern physics formulates the answer rather differently for the following reason. As a result of the more careful study of electromagnetic phenomena, we have come to regard action at a distance as a process impossible without the intervention of some intermediary medium. If, for instance, a magnet attracts a piece of iron, we cannot be content to regard this as meaning that the magnet acts directly on the iron through the intermediate empty space, but we are constrained to imagine — after the manner of Faraday — that the magnet **always calls into being something physically real in the space around it**, that something being what we call a 'magnetic field.' In its turn this magnetic field operates on the piece of iron, so that the latter strives to move towards the magnet. **We shall not discuss here the justification for this incidental conception**, **which is** indeed a **somewhat arbitrary** one. We shall only mention that **with its aid electromagnetic phenomena can be theoretically represented much more satisfactorily than without it**, and this applies particularly to the transmission of electromagnetic waves. **The effects of gravitation also are regarded in an analogous manner.**"

Einstein explains this field concept in relation to gravity in more detail:

"The body (e.g. the earth) produces a field in its immediate neighbourhood directly; the intensity and direction of the field at points farther removed from the body are thence determined by the law which governs the properties in space of the gravitational fields themselves." {Einstein 1916}

What neither Einstein, nor science, has yet provided is a tangible description for the "something **physically real**" in Einstein's description for either electromagnetism or gravity. In fact, he honestly attempts to avoid providing a justification, saying, "We

shall not discuss here the justification for this incidental conception, which is indeed a somewhat arbitrary one." But, immediately after this statement, he does provide a justification for using the concept of a "**field**" stating, "with its aid electromagnetic phenomena can be theoretically represented much more satisfactorily than without it." While reinforcing the pragmatism of using field mathematics, this "justification, is no different from the justification for the concept of a "vacuum". Given that a vacuum has been determined to be a "non-entity", this justification by GR can in no way be used to **support** the existence of a field.

Failure to prove the generalizability of the relativity concept

Einstein presents an example of a man in a box being accelerated by an outside force that is compared to observations of a similar man-box experiment done in a gravity field. He shows that the results are indistinguishable. From this example, he concludes: "We have thus **good grounds** for **extending the principle of relativity** to include bodies of reference which are **accelerated** with respect to each other, and **as a result** we have gained a **powerful argument** for a **generalised postulate of relativity**."

This SLT paper suggests that Einstein's comparison is misleading and his conclusion is incorrect due to the following problems:

1. The inconsistent use of the term "relativity". The principles in SR that underlie observations of light speed for observers based on relative measures are fundamentally different from those in GR that underlie observations of accelerations and forces.

In the first case, "relativity" is used to describe how measurements of **light speed** are to be **interpreted** with regard to **each** of **many** observers. This use states that all of these measurements must be interpreted to have the same value "c" thereby causing measures of distances, masses and times of all object observations to be altered.

In the second case, "relativity" is used to **focus our attention** on a **single observer** who is making measurements of **acceleration** and **gravity** in the presence of a gravity field. This use states that the measures of acceleration and gravitational force cannot be distinguished, implying that any attempt to distinguish them will fail. There is no single tangible principle presented by which these two very different uses can be logically compared to support a generalization.

2. Using the example Einstein gives in a slightly altered form produces a result that does not support generalizability. Using the example of the closed box, if a rope is wound around the outside of the box, rather than attached at a point near the center, the box would spin; the spin would be easily detected; and the "generalizability" postulate would fail.

3. Einstein, himself, recognized a number of problems to generalizing relativity. He specifically pointed this out, titling a section of his paper, "In What Respects are the Foundations of Classical Mechanics **and of the Special Theory of Relativity** Unsatisfactory?" He summarizes these problems as follows:

"We have also repeatedly emphasised that this fundamental law **can only be valid** for bodies of reference K which possess certain **unique states of motion**, and which are in **uniform translational motion** relative to each other. Relative to other reference-bodies K the law is not valid. Both in classical mechanics and in the special theory of relativity we therefore differentiate between reference-bodies K relative to which the recognised "

laws of nature " can be said to hold, and reference-bodies K relative to which these laws do not hold."

That is, Einstein, himself, understood that "relativity" is **not** a general theory, but a special theory applicable only to the special case of **uniform translational motion**. This is important because it relates to his SR analysis as an indirect proof to reject light constancy with respect to the observer.

4. Einstein has provided no explanation to explain how either of the "relativity" phenomena work. So, even if the term "relativity" were used consistently, the cases where it was found to apply could as easily be addressing a coincidental indirect connection to some second principle, as the discovery of a new generalized principle.

5. There is a serious logical fault in Einstein's example of two pans on a gas range from which steam is coming only from one. He says,

"I shall remain **astonished** and **dissatisfied** until I have discovered some **circumstance** [i.e. tangible, verifiable principle] to which I can attribute the different behaviour of the two pans. Analogously, **I seek in vain** for a **real something** in classical mechanics (or in the special theory of relativity) to which I can attribute the different behaviour of bodies considered with respect to the reference systems K and K'…"

Not being **aware** of a principle that meets the criterion of his sought-after "real something", he claims:

"It [the dissimilar-pan like behavior of different reference systems] can only be got rid of by means of a **physics** which is conformable to the **general** principle of relativity, since the equations of such a theory hold for every body of reference, whatever may be its state of motion."

This conclusion is, of course, absurd, stating, in short: 'if **I'm not aware** of any other way to explain this, my **complex** and **nonsensical** approach **must be right**.'

Based on these five unresolved problems alone, without regard to many other challenges presented by others, this paper suggests that Einstein's comparisons are misleading and his conclusion is incorrect.

Directly addressing problem four, SLT does provide a "**real something**" explanation for the questions that led to Einstein's study of light speed. Using the Lattice as a basis, explanations are provided for why the gravity and acceleration observations do not apply to things like rotation.

SLT also addresses the real-life differentiation between gravity and acceleration. Acceleration applied to an object, such as Einstein's box, can not duplicate **real** gravitational fields (as opposed to hypothetically uniform gravitational fields) because gravity will always have a gravity gradient which could theoretically be measurable, and be different from an external acceleration. The SLT gravity model supports this.

Relativity and the bending of light

In the GR section titled: "A Few Inferences from the General Principle of Relativity", Einstein applies his observation of the behavior of an observer measuring forces in a closed box to explain the bending of light in a gravity field. He claims: a. an observer in an accelerating box must observe an object moving in rectilinear motion to appear to

move in a curved path; b. the observer is unable to distinguish gravity from mechanical acceleration; c. light moves in a **rectilinear path**; therefore d. gravity bends light.

This logic can be easily shown to be unsupportable. Assume the acceleration "observer" is an instrument. What if the sensing portion of the instrument and the box are made from a magnetic material and placed in a magnetic field, rather than a gravitational field. Then the observer would not be able to distinguish acceleration from magnetism. Does that automatically imply that light would bend in a magnetic field? No, it doesn't, and we do not observe such an effect in physics.

SLT suggests Einstein's explanation of the curvature of light by gravity is **not** due to a need for all reference frames to be equivalent in a "relativistic" sense, but rather, that mass produces a gravity field in space. The gravity field will bend light passing through it. To be consistent with the SLT description of "light", the gravity field must bend the path of two forms of light: photons and waves.

1. The gravity field will bend the path of photons toward its source mass due to the mass property of the photon core dislocation.

2. The bending of true light waves, however, is caused by a different mechanism: refraction. As stated earlier, SLT suggests that light refraction occurs within dense materials due to longer Lattice path lengths in the materials. The longer path lengths are due to the Lattice distortions caused by gravity field creation. If the structure of a gravity field is mapped based on wave path length, it appears as a "strain gradient". The longest path lengths (greatest elongation of Aas), occur at the highest gravity field strength, which occurs at the surface of a massive object. The Aa elongation decreases in direct proportion to the gravity field to a minimum in the vacuum of space. True Lattice waves are bent by refraction due to this gradient just as they would be due to path length changes in dense matter.

Ironically, this "equivalence" of effect for two different "light" phenomenon, gravitational bending of photon paths, and refractive bending of waves by gravitational field distortions, creates a new subject for investigation just as Einstein's questioning of inertial and gravitational mass. SLT provides an advanced start on these investigations because it explains the mechanics of gravity creation on Lattice distortion. In contrast, considering magnetic field formation, SLT suggests why neither the paths of photons nor waves will bend toward a magnetic source, while the twisting nature of the magnetic field will cause other effects for both the photons and waves.

Existence of a "Newtonian" great universe

In the section of GR titled: Cosmological Difficulties of Newton's Theory, Einstein rejects the existence of a "Newtonian" great universe with a generally uniform mass distribution. He bases his rejection on a **model** for the phenomena of mass and gravity whereby the: "number [quantity] of 'lines of force' coming from infinity and terminating in a mass m is proportional to the mass m." Field strength is equated with line count per unit area. A geometric analysis using this model rejects the model based on it producing infinite field strength with decreasing r. This method of rejection was disputed in many ways as summarized by Norton {Norton 1999}. It is also clearly disputed by Newton's shell theorem which produces zero field strength at r=0.

SLT provides additional suggestions to dispute the rejection of a "Newtonian" great universe:

1. Field strength in SLT is related to the amount of bending in the Lattice. This suggests a continuous function for field strength, rather than the quantization of "lines of force".

2. The fact that bending is limited to maintain Lattice continuity, suggests there many be nonlinearities introduced by the Lattice at high levels of field strength.

3. The Lattice is quantized at the Aa scale. Fields that combine in space are not simple additions of independent "lines of force" as if the lines were tangible entities emanating from a mass. The wave nature of fields in SLT requires **all** additive components of fields to resolve at every point of interaction. For example, two strong fields pushing in opposite directions, do not, as would be suggested by the Newtonian model, created a jumble of crossing field lines, but rather, result in a section of the Lattice with very little disruption from undistorted Lattice.

So, with all these challenges to Einstein's basic assumptions about the shape of the universe, GR can not be used to discount the Newtonian conclusion of an infinite 3-D universe with extensively distributed mass.

Problems with experimental confirmations

Concerning the experimental confirmation descriptions in appendix III of the GR reference, Einstein's following words are an important guideline:

"Corresponding to the same complex of empirical data, there may be several theories, which differ from one another to a considerable extent. But as regards the deductions from the theories which are capable of being tested, the agreement between the theories may be so complete that it becomes difficult to find any deductions in which the two theories differ from each other… up to the present we have been able to find only a few deductions from the general theory of relativity which are capable of investigation, and to which the physics of pre-relativity days does not also lead, and this despite the profound difference in the fundamental assumptions of the two theories."

In other words, science has amassed a great amount of empirical data. Science has also produced many theories that are very different from each other and come to very different conclusions. But because of limitations in what can be tested, at the time GR was published, there were only a few of its conclusions that were different from classical physics which could be tested.

The history, in this regard, is not good for the following reasons:

1. Errors interpreting GR and SR principles. Relativity is conceptually difficult at the detail level. Due to the difficulty of the math involved, the impatience of scientists to get quick results, and the inability of a competitive education system to work together with strict integrity toward the goal, the rigor needed to get clearly discriminating well supported results has not been applied. The result has been the introduction of massive confusion and disagreement into the process.

2. Errors in the understanding of classical physics, errors controlling experimental error, failure to adequately research primary sources, and the lack of independent verification using alternative methods. This is the classic case of Michelson – Morley and the history of follow-up verifications discussed elsewhere in this paper.

3. Distortions in the popular media. Not willing to put in the effort to adequately understand scientific results and wait for independent verification, the media has

misreported and incorrectly explained observations. Scientific impatience has led to reliance on media misinformation, further confusing the science. Again, the Michelson – Morley saga is the poster child for this problem.

4. Cases of scientific fraud (e.g. Eddington)
5. Control of scientific research by big money with no peer oversight.

This means, it is important that a few **apparent** confirmations not be accepted as confirmation of **generalizability**, especially in light of the challenges discussed in this section of this paper as well as other sections. Again, in Einstein's words:

"I shall remain astonished and dissatisfied until I have discovered some circumstance to which I can attribute the different behaviour of the two pans. Analogously, I seek in vain for a **real something** in classical mechanics (or in the special theory of relativity) to which I can attribute the different behaviour of bodies considered with respect to the reference systems K and K'…"

14.4 The Standard Model

The term "Standard Model" is used to describe a current list of subatomic particles and their interactions. Details of the SM were discussed previously. There are significant shortcomings with this model as presented in the following summary:

"The Standard Model of particle physics is a theory concerning the electromagnetic, weak, and strong nuclear interactions, which mediate the dynamics of the known subatomic particles. It was developed throughout the latter half of the 20th century, as a collaborative effort of scientists around the world. The current formulation was finalized in the mid-1970s upon experimental confirmation of the existence of quarks. Since then, discoveries of the top quark (1995), the tau neutrino (2000), and more recently the Higgs boson (2013), have given further credence to the Standard Model. Because of its success in explaining a wide variety of experimental results, the Standard Model is sometimes regarded as a 'theory of almost everything'.

The Standard Model falls short of being a complete theory of fundamental interactions. It does not incorporate the full theory of gravitation as described by general relativity, or predict the accelerating expansion of the visible universe (as possibly described by dark energy). The theory does not contain any viable dark matter particle that possesses all of the required properties deduced from observational cosmology. It also does not correctly account for neutrino oscillations (and their non-zero masses). Although the Standard Model is believed to be theoretically self-consistent and has demonstrated huge and continued successes in providing experimental predictions, it leaves many phenomena unexplained…

There are also important questions that it does not answer, such as "What is dark matter?", or "What happened to the antimatter after the Big Bang?", "Why are there three generations of quarks and leptons with such a different mass scale?" {38}

SLT does not deny that rigorous observations have been made upon which the suggested list of particles in the current model and the magnitudes of forces in their interactions have been made. SLT does suggest, however, that the physics of how particles are created and interact is incorrect and hopelessly complicated on all accounts for reasons described in the sections of this paper about particle accelerators and

elementary particles. Hopefully, the new concepts presented here will lead to experiments that can provide accurate understandings of the physics involved.

14.5 Cosmic Microwave background

SLT does not support the physics describing the Cosmic Microwave Background (CMB). According to the current standard model,

"The cosmic microwave background (CMB) is the thermal radiation left over from the 'Big Bang'… When the Universe was young, before the formation of stars and planets, it was denser, much hotter, and filled with a uniform glow from a white-hot fog of hydrogen plasma. As the Universe expanded, both the plasma and the radiation filling it grew cooler. When the Universe cooled enough, protons and electrons combined to form neutral atoms. These atoms could no longer absorb the thermal radiation, and so the Universe became transparent instead of being an opaque fog… The photons that existed at the time of photon decoupling have been propagating ever since, though growing fainter and less energetic, since the expansion of space causes their wavelength to increase over time (and wavelength is inversely proportional to energy according to Planck's relation." {11}

The biggest problem with CMB theory is that the empirical observations are too closely tied to theoretical development. If the experimental observations try to "prove" the theory, and the theory tries to "model" the observations, it is easy to get fooled by islands of local "reinforcement", which miss the true nature of the problem. Alchemy and "angels dancing on the heads of pins" were prime examples. Once the "3 Degree Kelvin Background Radiation" is associated directly, and exclusively, with the "Hot Big Bang" model, then both theory and experiment are driven to support their association and exclude other options. In the case of CMB, there are many inconsistencies:

1. "The local group of galaxies, to which the Earth belongs, is moving at about 600 km/s with respect to the background radiation. It is not known why the Earth is moving with such a high velocity relative to the background.." {10}

2. The "Hot Big Bang" model requires the universe to **somehow** "expand". The theory behind this is that, "the expansion of the Universe for 15 billion years … causes the radiation originally produced in the big bang to redshift to longer wavelengths…" The term "expand", and the related principle of "expansion cooling", however, relate to a concept taken from thermodynamics in which the temperature of molecules in a closed volume changes if the volume is changed. BUT, the change in molecular temperature is related to "the attractive part of the **intermolecular force**…" "expansion causes an increase in the potential energy of the gas…" To maintain conservation of energy, the increased potential energy results in, "a decrease in kinetic energy and therefore in temperature." {25} None of these phenomenon apply to electromagnetic phenomenon. The concept of an "expanding universe" more specifically referred to as the "metric expansion of space" is without a fundamental foundation in physics.

3. The measured CMB distribution "is homogenous and isotropic, but only on very large scales. For scales the size of super clusters and smaller the luminous matter in the universe is quite lumpy…"{10}

SLT provides a number of new suggestions related to understanding the Cosmic Microwave Background:

1. SLT provides multiple energy exchange alternatives for the CMB, including both heating and cooling models. SLT provides a visualizable foundation for the expansion and contraction of space, that does not contradiction basic physics principles.

2. The SLT Big Bang would have caused huge disturbances in the Lattice, with multiple reverberations. These reverberations would have been distorted by mass expanding in the Lattice. At our current point in time in visible universe development, the CMB could be residual Lattice response from that event. This view is consistent with current cosmology.

3. SLT suggests that the visible universe is not alone. Therefore, disturbances from other Big Bangs long before our own, and far away from our own, could be providing some of the CMB we see.

4. SLT supports the loss of energy for all motions of matter or energy that move in non-steady state patterns. For example, charged particles that move in circles and create "steady state" magnetic fields lose little energy to the Lattice. However, every charged particle moving through the Lattice in a straight line or far field curve will dissipate energy to the Lattice. Photons and light moving through the Lattice will dissipate energy. SLT suggests that this phenomenon would appear as Lattice vibration energy, and become a sustaining energy sources for the CMB.

5. Due to continuous energy loss of photons, those that aren't captured by matter may eventually drop to such a low energy state that they can no longer be captured. That means, they are doomed to bounce around the visible universe, or leave the visible universe and travel to other local universes until they are captured by black holes and destroyed. As they are pulled into a black hole, they would heat up the Lattice they pass through.

6. SLT suggests that the Lattice supports vibrations that can be detected as radio waves or light waves which are not photons. These waves always lose energy passing through the Lattice and can decay to zero energy. These losses would heat the CMB.

14.6 Dark Matter, Dark Energy

The concepts of Dark Matter and Dark Energy have been suggested to explain observations of cosmic behaviors that can't be otherwise explained by prior theories. For example, the concept of Dark Matter was suggested to explain observations of galaxies that are, "rotating with such speed that the gravity generated by their observable matter could not possibly hold them together; they should have torn themselves apart long ago."{14} The addition of matter to the galaxy could create the additional gravitational field to balance the high rotation speed. The needed matter is called Dark because, if it is there, it is not visible. "Dark matter seems to outweigh visible matter roughly six to one, making up about 26% of all the matter in the universe. Here's a sobering fact: The matter we know and that makes up all stars and galaxies only accounts for 4% of the content of the universe!"{14}

The suggestion for Dark Energy arose to provide an energy source to explain the observed acceleration of expansion of the universe. {13}

SLT suggests two concepts related to this phenomenon.

1. The suggestion that photon "red shift" could remove enough energy so that the photon can no longer be captured except by black holes begs two questions: where are these photons as they roam around the universe waiting to be captured; and how many of them are there? The importance of these questions for Dark Matter is that, SLT's suggestion that low energy photons carry true mass that is not detectable could provide an explanation, as long as a sufficient amount is available.

2. The SLT models for red shift and the Big Bang could alter the suggestion that the visible universe is expanding, or at least expanding at a high rate. That being the case, a Dark Energy model is no longer needed, independent of the need for Dark Matter.

14.7 Radiation belts around the earth

In the discussion of the light transmission controversy and SR, SLT suggested that large masses, like the earth, which rotate in space, can entrap the Lattice, forcing it to rotate with their mass.

The far field Lattice must be stationary in rotation with respect to the **distant** stars. This is due to the fact that the speed of **any** object or energy in the Lattice is limited to "c" by the LRR. The corollary is that the linear velocity of the Lattice, with regard to any object, must also be less than "c". Using a very distant star as a reference, the maximum speed of the rotational component of the Lattice must not exceed the speed "c" perpendicular to the line of sight to the distant star, at the distance of that star. Using a distance of 13.8 B light years as a minimum value (there are many larger estimates), the rotational rate of the Lattice with respect to the "distant" stars, as viewed from any point in the visible universe, is less than $360/(2\pi \times 13.8B) = 4.15 \times 10^{-9}$ degrees/year. This is negligible compared with the rotation rate of the earth, for example, which is 15 degrees / hr .

The analysis of the Hafele and Keating atomic clock data suggested a Lattice drag of 30mph at a latitude where the earth rotation was 832mph = 0.5 degrees per hour sidereal time. This is against the zero degree rotation of the Lattice. There should be observable consequences for this rotational difference because there must then be some **transition zone** between the fast rotation of Lattice entrapped by the earth and the stationary Lattice.

In such a "transition zone", the Lattice can **not** be continuous, but must continually break and reform long structure elements. It is logical to expect that such a process would not allow the perfect reformation of structural lines without the introduction of some new dislocations into the Lattice. This would appear as radiation, specifically, photons, which would carry the mass produced by the dislocations.

This SLT observation could be supported by research done at Los Alamos:

"According to Dr. Geoffrey Reeves of Los Alamos National Laboratory and an investigator for ISTP, the solar wind and Sun are insufficient sources for the radiation belts. 'There are just not enough high-energy electrons in the solar wind to explain how many we observe near Earth.' " {17}

Theoretical SLT observations for radiation belts around the earth:

1. All objects in space, which have rotational rates exceeding on the order of 10^{-9} degrees /yr. relative to the distant stars, that have enough mass for their gravity

field to rotationally entrap Lattice, will cause radiation generation in their vicinity due to the disruption of Lattice long structure lines.

15 Recommended Research

15.1 Speed of light challenge

The controversy over the nature of light is one of the most important current issues for physics to resolve to set a broadly agreed to stage with **no** loose ends for a better understanding of the fundamentals of matter. To resolve the disagreements related to Special Relativity, **breakthroughs** will be needed in the understanding of the most basic fundamentals of matter and energy.

To this end, I propose the following experiment. The goal of the experiment is to devise an arrangement of instruments and test protocols that will **resolve** one of the oldest and most important questions of physics: how is light transmitted. The proposed experiment attempts to resolve which of the 3 classical transmission models are correct as the determinant of light speed: source, medium or observer. If the experiments are still not conclusive, this would force research along some new lines of thinking.

It is important that the experiment be designed with two overarching goals: 1. To test, and discriminate, all three possibilities **simultaneously** so that no confusion remains. 2. To involve **researchers** from around the world to suggest relevant considerations for the test so that all objective views of the phenomenon can be addressed and extenuating circumstances dealt with.

I used the term "researchers" specifically so input will not be limited only to academic institutions. Much of the controversy is raised by people who have left academia due to suppression of their views. Others are working in industry, without academic standing or support for publication, but who have extensive knowledge and insight into the problem. Another necessary approach is to avoid using measurement tools developed for one model, SR specifically, as the tools to make measurements for the other models. SR, for example, employs light beams for synchronization of clocks and the lengths of objects, which send the reference beams through the same environment that carries the test beams. This is not necessary if the clocks and measuring rods can be brought close enough together so the test and reference beams have radically different paths.

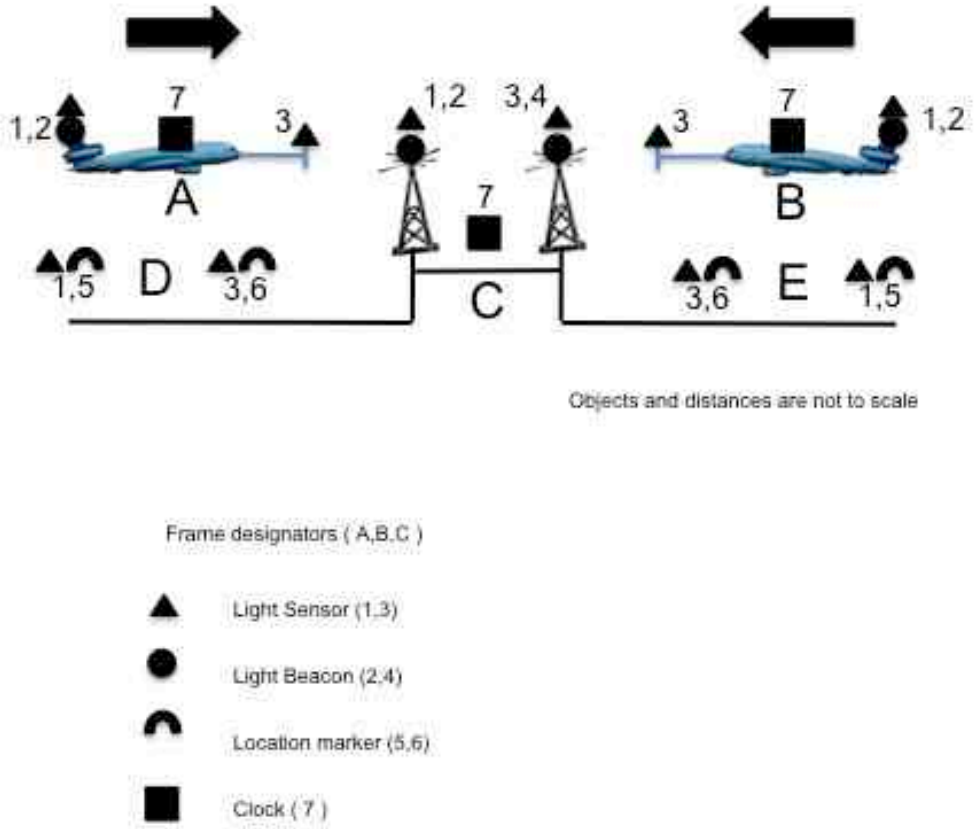


Fig. 30

Experiment to resolve the mechanism of the speed of light

Comprehensiveness, also requires that **all** measuring concepts be applied to all three models for comparison.

Figure 30 above shows a "hypothetical" test setup. It is beyond the scope of this paper to develop the details needed for this arrangement. The setup attempts to create 3 reference frames – A, B, C - so that for each test run, each of these frames, which reference one of the transmission methods: source, medium, observer; can be examined as a frame of reference for itself plus the other transmission frames. However, with the suggested setup, all three reference frames are valid because they are in constant speed linear motion.

The elements of the setup are: light sensors 1,3 (items marked 1 and 3 in the figure); light pulse beacons 2, 4; location markers 5, 6; clocks 7. Stations D and E are part of frame C. The distances A2-A3, B2-B3, C2-C3 and C4-C1 form mechanically rigid rods in frames A and B. The distances D5-C1 and E5-C3 form rigid rods in frame C. These rods are adjusted to have approximately the same length in a static ground synchronization at station C. There are 3 high precision atomic clocks located at A, B and C.

To test each of the transmission models, a procedure would run similar to the following:

1. All equipment would be brought to the towers and calibrated with zero relative motion between the frames.

2. The planes take off, and maneuver at low speed to the alignment shown with the planes still far apart. They accelerate to the same high speed attempting to achieve a spacing whereby A1-C1 is approximately equal to B1-C3 when the aircraft cross their "ground truth" markers D5, D6, E5, E6. Distances of 1 to 100 miles would be reasonable for this spacing. Multiple distances should be tested.

3. A number of beacon flash sequences are run and the timing of pulses detected by all the sensors is collected.

4. The data is analyzed and the controversy is resolved.

The basic protocol

1. Focusing on aircraft A for this example, as the aircraft passes over fan-beam marker D5, the beam is detected by sensor A1 to initiate the setting of parameters t_0 and d_0. The detection of the fan beam initiates a light pulse from beacon A2. The pulse is detected by both sensors A1 and D1 setting a time stamp for the aircraft being at location D1.

2. Sensor A3 detects the light pulse from beacon A2. Clock A7 uses time measurements from both A1 and A3 to determine the light transit time for measured rod length A2-A3 in the moving coordinate frame A.

3. Fan beam D6 plus sensor D3 are used with sensor A1 and beacon A2 to get a second time and position measurement for the aircraft to get precise ground referenced speed measurements not dependent on electro-magnetic readings (radar or Lidar) along the axis of motion. Clock A7 also records the time of this event.

4. C1 receives the light pulse from beacon A2 and sets a time mark referenced to the "ground truth" data from D1 on clock C7. The reception of the light pulse by C1 triggers beacon C2.

5. C3 receives the original light pulse from A2 plus the new pulse from C2. For each pulse it fires beacon C4. Clock C7 captures all event times.

6. A3 will eventually receive the pulses transmitted by C2 and C4, plus two pulses from B2 on the other aircraft. These are all captured by clock A7.

7. A1 will then also receive the pulses from C2, C4 and B2 and save the times on A7.

There are a number of key elements for this arrangement:

1. The aircraft would be flown at relatively low altitude over flat terrain. The role of the fan-beam ground position markers D5 and E5 are to measure the t_0 d_0 positions of each aircraft during the test. The fan-beam markers communicate with the aircraft using a very short light path which does not need to infer time and distance measurements from reference light beam measurements that use the same path as the speed test path. Since the distance from the aircraft beacon A2 to the ground sensor D1 would be small compared to the experimental distance A2-C1, timing error contributions are small. Also, the direction of light travel from A2 to D1 is orthogonal to the primary experimental transmission direction A2-C1, thereby not incurring either SR or Lorentz contraction; i.e. very small time transit or frame drag error would be incurred. Of course, verified time offsets would be accounted for based on known equipment delays and the calculated duration of vertical light travel.

2. The purpose of sensors A3 and B3 are to measure the light transit time for the pre-measured rod lengths A2-A3 and B2-B3 in the moving coordinate frames. **This is needed to discriminate an Aether model from SR**. Time delay differences of approximately 0.2 ns for a 200 foot spacing of A2-A3 and B2-B3 are expected.

3. The purpose of fan beams D6 and E6, plus sensors D3 and E3, are to get a second time and position measure for the aircraft to get precise ground referenced speed measurements not dependent on electro-magnetic readings (radar or Lidar) along the axis of motion. If the vertical distance becomes a problem, or the precision of the fan-beam is too low, balloon bourn sensors and beacons can be used as the ground truth point because they can be precisely located using ground based Lidar in a stationary position scheme that does not involve balloon speed considerations.

4. The purpose of sensors C1 and C3 are twofold. When C1 receives the pulse from beacon A2, it sets a time mark. Comparing this with the "ground truth" data from D1, a **discrimination between a source model and medium model can be made.** A medium controlled transmission phenomena would produce a light speed of c. A source controlled transmission phenomena would produce a light speed of c+v. These values are not subject to square law. So for a 10 mile D1-C1 separation, with 700 mph aircraft (just below mach 1), v / c = 1.046 e-6. Portable atomic clocks are now available with precisions in the 5 e-11 range. {3} The corresponding measurements between B2 and C3 allow aether drift speed and direction to be determined.

5. C1 and C3 perform a second function. Since the same pulse from A2 will be detected first by C1, then detected by C3, the speed of the pulse between the two sensors can be measured, giving a ground referenced measure of the speed of the pulse as it passes. It's important to state that the light pulse being measured is not regenerated by another instrument. It is the same light pulse that was used by the source aircraft to make parameter measurements.

6. A3 would then receive the pulse transmitted by aircraft B. This is used to determine the transit time over the long "ground truth" distance between the aircraft.

7. A1 would then also receive the pulse from the other aircraft. As is the case for key element 5 above, this light pulse is the original pulse from the other aircraft. It is **not** a regenerated pulse. This provides two results. The first is to confirm the measurement done in step 6, with a small time correction for the A1-A3 length. But, most important, the setup would produce the data to discriminate one of the three models. By knowing the transit time of the pulse from aircraft B as it passes across the local reference frame A, the result clearly selects one of the models. If the transit speed is c, then it confirms SR. If the speed is c+va+vb, it confirms the source model. If the speed is c+va, it confirms the medium (aether) model for a medium stationary with respect to the earth surface. If the result is another value, but can be expressed using data from aircraft A and B as c+ va+vb +s and c+ va+vb –s , then it is a possible confirmation of the medium model for a medium with a drift rate s. Other results would obviously point to unanticipated models or complications like atmospheric effects.

1. Two discriminate the 3 transmission models, consensus and dissenting assumptions should be collected to create test hypotheses along the following lines:

2. Source model: The source determines the transmission speed. A light pulse is launched ballistically into space from the source with velocity c relative to the source. Space is empty and Newtonian. The observer is just an arbitrary ballistic object in space. Any motion of the observer does not affect the speed of the light pulse in the source or ground frames. The speed of the light pulse with respect to the observer, that the observer measures in its own frame, is the Newtonian sum of the motion of the source, plus light speed c, minus the speed of the observer as observed by the source. The time history of transits of the light pulse past objects in the observer's universe is the Newtonian sum of the motion of the source, plus light speed c, adjusted for the locations of objects in the universe as determined by the source. (The towers of reference frame C act as transit objects.)

3. Medium model: Space is filled with some light transmitting medium. The motion of the medium is inherent to itself. A light pulse is initiated by a source through vibratory interaction with the medium or launch of a light "particle" into the medium. The light pulse travels at the speed c with respect to the medium. Any relative motion of the source or the observer, with respect to the medium, has no effect on the speed of the light pulse in the medium. The speed of the light pulse with respect to the observer, that the observer measures as it is observed, is the Newtonian sum of the light speed c, minus the speed of the observer with respect to the medium. The time history of transits of the light pulse past objects in the observers universe is the Newtonian sum of the light speed c, adjusted for the locations of objects in the universe as determined by the medium.

4. Observer (SR) model: A light pulse is initiated by a source. Space is empty. The speed at which the light pulse moves through space is indeterminate until it is observed. The speed of the source has no effect on the speed of the light pulse. The speed of the light pulse with respect to the observer when it is observed, is the speed c. To determine the time history of source initiation and transits of the light pulse past objects in the observers universe, the locations of all the objects in the observer's universe are adjusted so that the light pulse appears to have traveled from the source to

the observer at the speed c relative to the observer's motion. This time transit history can be constructed by assuming a source model, making the observer the source, and running the universal clock backwards. The transit history should confirm SR contraction of ground distances and source dimensions.

15.2 Field Structure Theory

In the field magnitude discussion, the concepts physics uses for "r", the distance parameter, the "2" exponent which is generally applied in field magnitude fall-off equations, and the equivalence of both of these parameters for all field types, are questions that need significantly more research. Specific questions:

1. How is "r" measured for both a hypothetically "static" universe, and for a fully dynamic universe? Whether an SLT or SR model is assumed, the integrated time dependent field paths between objects are very complex. A key factor to resolve this is resolving the speed of gravity, which has many current challenges. {37} SLT suggests gravity adjustments are controlled by the LRR, as are all field phenomenon, and propagate at the speed "c". But cosmology, and **Newton's equations**, generally present distances to objects as measurements made using straight instantaneous "God's eye view" lines. This approach is not supported by either SLT or SR.

2. The negative "2" exponent field magnitude decay has been assumed to apply **precisely** for both gravity and electro-magnetic phenomenon. SLT challenges this for near and very far fields due to the breakdown of Lattice structure in those ranges, and for all ranges due to the LRR. Instruments now available may be able to test specific SLT predictions for field behavior.

15.3 Static Magnetic Ripple Studies

The electromagnetic charge model discussed in section 12 suggests that superconducting magnets and atomic orbiting electrons do not emit Maxwell radiation loss because the Lattice Relaxation Response produced by the inertia and elasticity of the Aas damps the far field Lattice motion. This observation suggests experiments to verify this principle by observing very low current levels. When the currents in magnetic loops approach single electrons, or low current speeds, appreciable ripple should be observable in the magnetic field. The occurrence of that ripple should generate significant electromagnetic energy loss. The result would appear as an inability to maintain very low magnetic fields. As the current drops, a point will be reached when the energy loss increases and kills the field quickly.

16 Conclusions

The purpose of the theoretical explorations discussed in this paper were to study the implications of the four assumptions presented at the beginning of the paper. The assumptions set out new, but potentially plausible concepts for a very different fundamental foundation of the basic elements of the universe. As the studies progressed, it became apparent that the main concept, modeling matter as dislocations in a structured universal Lattice, could produce a **simple**, yet **comprehensive** set of entities and interactions which could provide both simple visualizations and functional

explanations for most of the concepts of physics, including many that are still considered unanswered.

While the suggested models are yet to be empirically tested, data from prior experiments by others addressing similar issues can be used at greatly reduced cost and time. One empirical test of this type is shown in the paper showing consistency with the Space Lattice Theory model related to time contraction. The models also present new concepts to rethink the composition of fundamental elements of the universe. One of the new concepts is a model for the Grand Unification of the forces and matter in the universe. This is significant, not just because it may possibly be a true description, but because it presents a model for how the elements of a comprehensive Grand Unification concept might look.

And finally, the concepts of the study suggest empirical experiments that can be done with existing technology to settle unaddressed disagreements in the scientific community over very basic and fundamental issues.

17 Glossary and Abbreviations

17.1 Abbreviations

BHL Black Hole Lagrangian
CERN the European Organization for Nuclear Research
CMB Cosmic Microwave Background
EM Electromagnetic
ESD Expanding-Shell Discontinuity
GR Einstein's General theory of Relativity
LRR Lattice Relaxation Response
LTS Lattice Twisting Structure
QM Quantum Mechanics
RF Radio frequency
SLT Space Lattice Theory
SM Standard Model
S-r Schwarzchild radius
SR Einstein's Special Theory of Relativity

17.2 Glossary

The follow definitions are provided to clarify the specific understanding of these terms as used in the paper. (#) after a term shows the first section in the document where a **working** definition of this term is provided. It may not be the first occurrence in the document.

Aa: (1) The Aa is a small object that is the basic constituent of the universe. The object is unique - there is only one form in the universe. The entire space Lattice is constructed of Aas and nothing but Aas. There is nothing between the Aas and no special forces such as fields exist between or within the Aas.

Action at a distance: (1) The occurrence of a force between two objects, either attractive or repulsive, that are separated by a void; i.e. are not in physical contact.

Antigravity: (10) A gravity field, which must have a source composed of antimatter, that will cause a test mass composed of Dirac matter to move away from it.

Antimatter: (10) In SLT, the distortion of the structure of the Lattice caused by the insertion of an extra Aa into the Lattice. Such an insertion produces **negative mass** and **negative gravity**. These inverted properties are not associated with electrical properties and do not cause negation of charge or other properties.

Antimatter Mirror: (11) The antimatter opposite of a Black Hole. Rather than capture conventional mass and photons, an Antimatter Mirror reflects them. The antimatter mirror, however, will capture antimatter the way a Black Hole captures conventional mass.

Bending (Lattice Bending): (2) A bending distortion occurs when Aas in the Lattice, viewed over a region of the Lattice, vary in position from expected positions, but the regular geometric structure of the Lattice can be traced from the far field through the displaced Aas without encountering a disruption, i.e. any loss of structure.

Big Bang: (11) The Big Bang Model is a broadly accepted theory for the origin and evolution of our universe. It postulates that 12 to 14 billion years ago, the portion of the universe we can see today was only a few millimeters across. It has since expanded from this hot dense state into the vast and much cooler cosmos we currently inhabit.

Black Hole Lagrangian (BHL): (11) A stable void at the center of a Black Hole that converts incoming photons and matter into structured Lattice.

c-Threshold Energy: (7) For any form of matter, the minimum pulse driving energy required for that matter to move at the speed "c".

Dislocation: (2) A disruption in the Lattice in which the normal continuous repetitive structure of the far field Lattice is disrupted by a localized absence, addition or misalignment of one or a small number of Aa elements. The localized disrupted area is referred to as the near field. Directly surrounding the near field, the Lattice structure is continuous. A dislocation is a confined disruption.

Dislocation near field: (9) A volume of the Lattice surrounding a dislocation or a field generating collection of dislocations, within which Aa orientations are disrupted from the undisturbed Lattice structure. This volume may extend from a small to large spatial range, possibly 2 to 1000 Aa lengths. The near field does not have a specific shape. The boundary which discriminates the near field from far field is referred to as the near field transition.

Dislocation Structure: (2) A collection of dislocations, and particularly the stress-strain state in the Lattice caused by that specific collection of dislocations.

Disrupted Far Field: (9) The virtual volume of a source's field, which once had a long-structure distortion pattern established by the passage of an ESD, but which has become "effectively" disrupted by the passage of a large number of disruptors.

Disruption: (2) A disruption is an uncontrolled environment that occurs when the prevailing Lattice structure breaks down and makes one or more long-structure lines discontinuous. The disruption is resolved when the Lattice pressure and inherent "self-assembly" properties of the Aas reassemble the Lattice forming continuous long-

structure lines or confine the disruption within continuous long-structure lines. A dislocation is a confined disruption.

Distortion: see Lattice distortion.

Electromagnetic charge: (12) A new term for the source of conventional electric charge because the SLT charge structure simultaneously creates an included magnetic monopole.

Electromagnetic field noise: (9) The ESD energy from electromagnetic field source motion or magnitude change that is transferred into far field disrupted Lattice.

Electromagnetics: (12) Phenomenon referred to in physics as electrostatic and electromagnetic fields, and the behavior of electric charges and magnetic dipoles in those fields.

Energy: (2) Properties of matter, gravity and electromagnetic phenomenon that can be transferred between them and ultimately converted into mechanical work without changing their basic structures. In SLT, energy appears in only two forms: 1. Potential energy – which is the elastic energy of the Aas in compression as axial or radial compression or bending; and 2. Kinetic energy – which is the dynamic energy of Aas in motion due to their speed and inherent inertia.

Entropy: (5) A dynamic mechanical principle based on the concept of cause and effect. It explains that, for every event that disturbs the Lattice, energy will be lost to the Lattice through a diffusing process of strong, discrete, simple events creating infinitely diverse, infinitesimally small, **complex** results. In conventional physics, it is a mechanical thermodynamic principle.

Expanding-Shell Discontinuity (ESD): (5) The leading edge of a disturbance in the Lattice caused by some discrete event, which expands spherically in the form of a shell at the speed "c". Behind the disturbance shell, changes from the disturbance have been communicated; ahead of the shell, no information related to the disturbance is present.

Far field: (9) The virtual volume of a source's field, outside its particle near field, which has a long-structure distortion pattern established by the passage of the source's ESD.

Field: (9) In physics, a region in which a particular condition prevails, especially one in which a force or influence is effective, regardless of the presence or absence of a material medium. In SLT, a field can only exist as an arrangement pattern of the Aas.

Functional depiction: (1) A stylized representation of the components of an object that attempt to describe how the depicted components functionally interact with other physics elements. Only the components important for the interaction are depicted. The depiction does not attempt to present physical realism.

Fundamental Particles: (4) The smallest possible stable assemblies of dislocations which combine to produce all forms of matter.

Funnel-field: (12) Magnetic monopole field lines of an electromagnetic charge that exhibit a funnel shape. The field lines start as radially spread out lines in the electromagnetic source pancake, spiral radially inward and turn axially outward exponentially collapsing to a single line that will define an axis for the source charge.

General Theory of Relativity (GR): Einstein's General Theory of Relativity

Grand Unification: (1) A theory that provides a single, all-encompassing, coherent theoretical framework of physics that fully explains and links together all physical aspects of the universe

Gravitational Mass: (10) The strain removed from the Lattice by the reduction of strain in the Lattice due to the introduction of a Source Structure Disruption Volume.

Gravity (Gravity Field): (10) The mechanical shrinkage pattern in the Lattice, which is a mechanical stress-strain field in the Lattice, produced by a mass forming Source Structure Disruption Volume.

Gravity noise: (9) The Expanding-Shell Discontinuity energy from particle motion that is transferred into disrupted Lattice.

Great Universe: (1) The volume of space, considered infinite, which contains all matter and energy without limit. The term "universe", when used without qualification in this paper implies the Great Universe.

Latice: (2) In physics, a regular repeated three-dimensional arrangement of atoms, ions, or molecules in a metal or other crystalline solid. The use of the term "Lattice" in SLT captures the regular repetition of the Aa structure.

Lattice Distortion: (2) A change in the shape or scale of the Lattice from theoretical Pristine Lattice, but no long-structure lines are broken. All distortions in the Space Lattice can be categorized as bending.

Lattice healing: (2) The property of the Lattice to reform its long-structure pattern due to the self-organizing property of the Aas.

Lattice Relaxation Constant: (5) The speed at which a wave produced by a dislocation jump, in a "quiet" volume of space, would propagate through the Lattice determined by the LRR. This speed would equal the speed of light "c" as is conventionally measured.

Lattice Relaxation Response (LRR): (5)The rate limited movement of Aas that result from a disruption in the Lattice, which attempt to minimize the strain in the Lattice. The relaxation response rate is responsible for many Lattice phenomenon.

Lattice Twisting Structure (LTS): (12) A dislocation structure in the Lattice characterized by a twisting in the Lattice which creates the properties referred to in conventional physics as electric charge and magnetism.

Linear structure: (2) Field lines remain straight in the Lattice unless bent by a gravitational field or electromagnetic source other than their own source.

Long-structure: (2) A property of the repeating geometrical pattern of Aas whereby an element of one geometric pattern must touch a corresponding element in an adjacent pattern, which has an identical overall pattern, in such a way that a single, non-branching, non-converging path can be followed indefinitely throughout space.

Magnetic field: (12) A twisting distortion of the Lattice that, due to the rate of repetitive twisting, and the damping of the Lattice Relaxation Response, appears to have a "steady state" twist distortion in the far field.

Mass: (4) A property of matter that is quantified through measured interactions between matter and forces: e.g. gravity, mechanical interaction, chemical interaction and electromagnetic interaction.

Matter: (4) A general term to describe physical phenomena which occupy space and possess rest mass.

Near field: (9) A term which collectively applies to both the Dislocation Near Field and Particle Near Field.

Near field transition: (9) the virtual surface defined by the outer edge of the Aas surrounding Lattice dislocations that can be observed to break from the Lattice long-structure.

Non-captured (near field): (11) A large void for which the near field for any point in the void is also void. Such void spaces will have no reference to the far field Lattice. Voids of this type will have dimensions at least many Aa units across, and may have very large dimensions on cosmic scales.

Normal gravity: (10) A gravity field, which must have a source composed of Dirac (normal) matter, that will cause a test mass composed of Dirac matter to move toward it.

Object: (1) A composition of matter that can be visualized and interacted with in a mechanical sense. This definition varies from common usage which defines an object as a material thing that can be **seen** and **touched**. In SLT an Aa is referred to as an object, even though it can't be seen or interacted with due to its small size, because it is visualizable and undergoes interactions that are comparable to simple mechanical interactions.

Pancake field: (12) A volume of Lattice that is twisted, producing the appearance of a flattened circular pancake in the Lattice. The field lines from the twisting transmit a twisting structure radially out from the twist area to infinity with a magnitude that decreases with distance.

Particle: (4) A collection of one or more dislocations that move together as a unit, remain as a stable collection over time, and exhibit an identifiable set of properties related to interactions with other particles or fields. (Compare to Source Structure Disruption Volume)

Photon: (7) Photons are the combination of single Aa dislocations in the Lattice, that are not components of complex stable particles, and an accompanying pulse envelope.

Pictorial: (1) a drawing that could possibly represent the actual geometry of an object.

Prevailing Lattice: (2) The geometry of the universal space Lattice at any point just prior to being affected by an approaching particle or field.

Pristine Lattice: (2) The geometry of a universal space Lattice that would occur in a theoretically static undisturbed uniformly pressurized universe. There may be no occurrences of pristine Lattice in the universe.

Pulse: (7) A dynamic adjustment of Aas in the Lattice that move through the Lattice as a group like a single period wave moves across a water surface. A pulse can be generally quantified by: magnitude, velocity, width, and shape. The shape can take many forms, varying along all 3 spatial dimensions. However symmetries are constrained by the velocity vector.

Quantum: (4) a property of some phenomenon that only allows that property to exist in discrete units. The smallest theoretical unit is referred to as a "quantum".

Scavenger photons: (11) Low energy photons, which no longer have the ability to interact with matter, can perfectly interact with SLT antimatter. The interaction results in destruction of both the photon and the antimatter particle leaving only energy.

Schwarzschild Radius: (11) The radius of a non-rotating sphere which contains mass m. At points within the sphere, gravity is "calculated" to be strong enough to make the escape velocity greater than the speed of light "c". ($r_S = 2\ G\ m/c^2$)

Space: (1) The entirety of the great universe, as well as the smallest volumes within the universe.

Space Lattice Theory (SLT): (1) The collection of theoretical observations and principles which are suggested in the paper by the hypothetical application of dislocation theory concepts to a universe densely filled with small objects that form a structured lattice framework.

Source Structure Disruption Volume (SSDV): (4) the virtual volume in the Lattice that contains a collection of dislocations that move together as a unit and remain together as a stable collection over time. Different collection arrangements produce discrete particles. The collection arrangements also produce the properties we know as mass, charge, the strong force, and weak force.

Special Theory of Relativity (SR): (1) Einstein's 1904 theory on electromagnetics

Standard Model: (13) The current theory that neutrons, and protons are composed of subatomic particles, and that there are 61 such elementary particles, is known as the Standard Model (SM).

Structured Lattice: (2) an organization of Aas that form a simple repeating geometrical pattern that continues in all 3 dimensions through the infinite expanse of the great universe maintaining long-structure characteristics.

Strain: (3) In an elastic material, the relative displacement of a point in the structure in relation to the surrounding material due to a change in the pressure field on the material surrounding that point.

Stress: (3) In an elastic material under pressure, the pressure at any local point.

Tensile force: (1) the ability of any entity A to interact with another entity B by causing a force in B that is directed toward A based on development of a tension state in entity B.

Thermal photons: see Scavenger Photons

Time: (5) In SLT, time has no substance or tangible existence of its own. It is a convenient mathematical tool for measuring the relative rates of interactions of matter and energy which are controlled by the Lattice Relaxation Response.

Ultraviolet threshold: (7) The energy of photons above which they are able to transfer mass through nuclear processes in conventional matter or to electrons.

Universe: (1) The volume of space, considered infinite, which contains all matter and energy without limit. The term "universe", when used without qualification in this paper implies the Great Universe.

Visible Universe: (11) The volume of space we are able to observe through scientific instrumentation.

Visualizable depiction (pictorial) : (1) A drawing that could possibly represent the actual geometry of an object

Void: (1) In conventional science, a volume of space that does not contain matter. It may contain a "field". In SLT, a void is a volume of space that does not contain **structured** Lattice. It may be as small as the interstitial space between closely packed Aas, or as vast as a galaxy. For small voids, they are totally empty. For large voids, they may contain freely floating Aas. In SLT, voids can not contain a field.

Wave: (7) A periodic geometric disturbance of the elements of a substance that may be propagated without net movement of the elements, in which the periodic nature is characterized by multiple repeats of a similar disturbance geometry. In SLT, the elements are the Aas in the Prevailing Lattice structure.

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19 Acknowledgments

Lee Smolin: For his encouragement to continue research on this idea in 2004, very early in the effort.

Steven Shulgach: Provided guidance for the use of graphic tools for the figures.

20 Author Background

Experience related to the topics in this paper

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Space Lattice Theory has been under development since 2002