SEE, — **HOW** the complexities of **FIELD THEORIES HID** from us, the fact that **relative motion** (phase) between all these spinning entities, in the micro & macro universe, gives us **all** the attractive and repulsive **Fundamental Forces**.

Oct-29-2018.

Field Theories in html: *http://rbduncan.com/fieldtheory.html*

Also, **Field Theories** in Word: *http://rbduncan.com/fieldtheory.doc*

& **Field Theories** in Adobe pdf: *http://rbduncan.com/fieldtheory.pdf* **Fitzpatrick's** 1966 book showed the **relative motion** laws of **A. Ampère** unified the forces.

Fitz's first book in 1966

Fitz's 1966 book in PDF

EVERYTHING *on these links* herein are **FREE**, & **NO** pop up ads with these either.

This was the way the site --below-- looked many years ago. - - Dan Fitz.

web page

Fitz & Milo Wolff

Space Resonances will someday - with future super-computers - be the most accurate way to describe the universe.

We have a problem with them today though because our peer group - as always - is behind the times.

So how do we get this present peer group to see this?

OK

There is more than one way to skin a cat.

We must picture it in terms these affen understand.

You need to paint a simple picture.

Show the entire universe.

Show our inertia (mass) is really binding (minimum amplitude principle or Ampere's law) with the rest of the universe.

Show ALL energy is a binding change with the surroundings.

Show this is why you can have both fission and fusion energy.

But Milo here's what you don't see.

ALL PARTICLES and their conglomerations are SPACE RESONANCES.

ALL space resonances ACT THE SAME.

But you are not going to see this with your subset math and subset science laws.

The FREE electron repels other like sized FREE electrons for the same reason that FREE stars repel other FREE same size stars.

WHY ?

Here's why:

Our inertia and gyroscopic inertia are ALSO frequency interactions of space resonances.

Drop your prejudices, Milo, and see the electron having gyro torque and inertial qualities but in it's own frequency space-time realm.

NOW WATCH

Because of your minimum amplitude principle these space resonances will begin to attract each other whenever their closest sides are going in parallel geodesics (waves are in phase)

BUT

We have imparted ALL space resonances with gyro torque.

Therefore each closest pair of space resonances - whether they are electrons, stars or galaxies - will both twist 90 degrees away from this initial attracting position and align themselves more in a direction where they repel each other.

This IS Einstein's cosmological constant.

This IS charge.

The string theorists don't see this yet and I don't think you do either.

That's why I said when you do, it's going to hit you like a ton of bricks.

Fitz

Over 4 Decades of Daniel P. Fitzpatrick's Books, Papers and Thoughts

Milo Wolff tells about Space Resonances

California, Irvine, CA

Spin, the Origin of the Natural Laws, and the Binary Universe

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Abstract: The goal of classical philosophical physics was to identify 'Physical Reality', sought for many centuries. The natural philosophers believed that there is a physical reality of nature which when we find it will tell us the origin of the natural laws and the connections between microphysics and cosmology. Richard Feynman wrote of this, in connection with the Conservation of Energy. He said, "Nature has a hidden accountant who keeps honest books of energy input and output but we don't know how she does it."

The great philosophers of cosmology, Clifford, Mach, Einstein, Wyle, Dirac, Schroedinger, and others have pointed out that only a *wave structure of matter (particles)* can conform to experimental data and fulfill the logic of reality and cosmology. Such a Quantum Wave Structure of Matter

(WSM) has been found in the last decade (see references). Since the WSM provides a quantitative origin of the fundamental natural laws, it becomes the basis of *everything* in science. It is Physical Reality. It is described here.

Only three basic principles of Nature underlie the structure of matter - reviewed here. For the electron, the structure is a pair of spherical outward and inward quantum waves, convergent to a center, existing in ordinary *space* and termed a *space resonance*. This wave pair is also the physical origin of the previously unknown electron quantum spin - described here. Spin occurs when the inward quantum wave undergoes *spherical rotation* to become the outward wave. These <u>two</u> waves are a Dirac spinor satisfying the theoretical Dirac Equation. Thus the space resonance has a binary basis like computer hardware.

Each space resonance shares its wave structure in an infinite space with all others, creating an inter-connected binary universe. The significance of the WSM on communication, our life, and our place in the binary universe is discussed.

Part I - Introduction

Our knowledge of science and the universe is based on a few natural laws that govern the behavior of particles. These laws

are the rules for calculating electricity, gravity, relativity, quantum mechanics, and conservation of energy and momentum. The origins of these laws was unknown. Now for the first time the origin of the natural laws is found to be a quantitative result of the WSM.

The origins of the laws had been sought for centuries. Finding all of them at the same time and place is a philosopher's dream come true. It is an astonishing breakthrough of great importance to science because the natural laws and spin determine the structure of the Atomic Table which dictates the varied forms of matter: metals, crystals, semi-conductors, and the molecules of life. The deep understanding of basic physics that is revealed opens another door to broad fields of applied technology such as integrated circuits, photonics, and energy storage.

Finding these origins was very simple. You simply replace the ancient Greek notion of a point particle with a *spherical wave structure* which had already been predicted by Einstein and Irwin Schroedinger, seventy years ago. Nothing complex but it is different because it reveals a universe of real quantum wave structures that we live in but seldom see.

Why had this not been found before? Because no one had looked! Unfortunately, the Democritus particle, 1600 B.C., agreed with human emotional experience (but not logic) so most people were satisfied with it. Engrained habits are hard to displace.

Nature has made the true structure of 'particles' like the electron, proton and neutron very simple, typically a pair of spherical waves whose center is the location of the particle. The proof of this natural truth is that all the natural laws can be obtained mathematically from only <u>two</u> basic principles describing the wave space medium..

We don't easily see the space medium because our survival as an animal species depends mostly on our ability to fight with other animals seeking food, and to compete for mates that produce children, not closely related to the space medium. In our self-focused human perspective few of us are even aware of the wave medium in which we exist. For survival, it doesn't matter what space is, or whether we can observe it - it is there willy-nilly. This situation is much like the life of a fish who cannot comprehend the existence of water because he is too deeply immersed in it."

Like the fish, traditional science has tended to comprehend the universe in terms of our own local experiences. For example, science has assumed that matter particles are like tiny grains of sand - an idea proposed by the Greek philosopher Democritus many centuries ago. As microscopy improved, we created models of matter which subdivided grains into more grains - ad infinitum. But only a few people like Einstein saw that grains were impossible or ever asked how the grains communicate forces - unexplained by the old science. Formerly forces were 'magic' or 'faith' or the word of God depending on your taste.

Human perspective has another bias. We tend to see space as three rectangular dimensions, one of which is the vertical gravity vector of Earth, plus two other vectors perpendicular to it, shaped like the earthly houses we live in. On the other hand, the true shape of the enormous universe is *spherical* whose important dimensions are *inward* and *outward*, the direction of waves in space. In the vast expanse of the real universe, gravity occurs so rarely, that its direction is inconsequential in the larger scheme of things, despite its local importance to us.

The probability that this wave structure of matter is wrong is

very small because it is simple and matches experimental laws. In contrast, conventional physics required dozens of assumptions plus many more arbitrary constants to explain the operation of some of the laws. Even then some laws, like spin, were a puzzle and no origin known. The comparison of the old physics with its new wave structure can be compared to the theory of epicycles of the planets around the Earth before Copernicus and Galitleo found that the planets traveled around the Sun.

1. A True Science Odyssey

The discovery of the wave structure of the electron and other matter is a beautiful adventure in which you find the origin of the natural laws, a new powerful tool of science, and an exciting window on cosmology as well as ourselves. But old ways of thinking must be discarded. For instance, a well-educated quantum physicist expects that all quantum phenomena <u>must</u> derive from Schroedinger's Equation or QED. No! He must learn instead, that these older rules are derived from the quantum wave structure of the universe. It is the other way around!

Every electron, proton and neutron is structured of quantum waves. Thus, understanding the physical world demands learning new quantum wave rules. They are few and simple, but one has to think anew and discard false rules, such as the material point particle. In their place we must deduce, as did

Schroedinger, that location, charge and mass are properties of the wave structure. This can now be proved.

It is useful to learn from anthropology, that understanding the quantum wave universe is not as helpful to survival of our personal genes as recognizing apples we can eat and avoiding tigers who want to kill us. We need to recognize those quickly. But nature has not equipped us to observe quantum waves easily. Lacking personal experience of quantum waves, some people choose to imagine that the electron is a "particle," like a baseball. Laboratory evidence does not support this human-oriented idea. Accordingly, scientists must change their belief from particle to wave structure. The difficulty of changing one's belief is shown in the story below:

Imagine that <u>you</u> are the commander of the fifth inter-galaxy survey unit and your survey leader is speaking,

"They're made of meat."

"You mean, *meat*?"

"There's no doubt about it. We picked several from different parts of the planet, took them aboard our recon vessels, probed them all the way through. They're completely meat."

"That's impossible. What about the radio signals? The messages to the stars?"

"They use radio waves to talk, but the signals come from machines."

"So who made the machines? That's who we want to contact."

"They made the machines. That's what I'm trying to tell you. Meat made the machines."

"Ridiculous! You're asking me to believe in sentient meat."

"I'm not asking you. I'm telling you the results of our research."

"Maybe they're like the Orfolei. You know, a carbon-based intelligence that goes through a meat stage."

"Nope. They're born meat and they die meat. We studied them for several life spans."

"Okay, maybe they're part meat, like the Weddilei, a meat head with an electron plasma brain inside."

"Nope. We thought of that, since they do have meat heads. We probed them all the way through."

"No brain?"

"Oh, there is a brain all right. It's just that the brain is

made out of meat!"

"So... what does the thinking?"

"You're not understanding, are you? The meat brain does the thinking."

"Thinking meat? You're asking me to believe in thinking meat?"

"Yes, thinking meat! Conscious meat! Loving meat! Dreaming meat."

"Really? You're serious then. They have brains made out of meat."

"Finally! Yes. And they've been trying to contact us for a hundred of their years."

"So what does the meat have in mind?"

"It wants to talk to us. Then I imagine it wants to explore the universe - contact other sentients, swap ideas and information. The usual."

"They actually do talk, then. They use words, ideas, concepts?"

"Oh, yes. Except they do it with meat."

"I thought you just told me they used radio."

"They do, but what do you think is on the radio? Meat sounds. Singing meat."

"Omigosh! Singing meat! This is too much. Is there normal life in the galaxy?"

"Yes, a rather shy hydrogen core cluster intelligence in a class nine star in G445 zone. Was in contact two galactic rotations ago, wants to be friendly again."

"And why not? Imagine how unbearably cold the universe would be if one were all alone."

New truths of science are often unwelcome. Emotional rejection occurs if the new truth conflicts with established belief. Max Planck once said, "New scientific truth does not triumph by convincing its opponents, but because the opponents die and a new generation grows up unopposed to the new idea."

2. History of the New Wave Structure of Matter

A wave structure of matter was proposed 120 years ago by the famous English geometer, William Clifford[2], who wrote in 1876, "All matter is simply undulations in the fabric of space."

In Clifford's thoughts, the mass and charge substances we assume, do not exist but are properties of a wave structure in space. In short, space waves were real, while mass and

charge points are mere appearances of the wave structure, "Schaumkommen" in the words of Schroedinger[1].

Their proposals were consistent with quantum theory, since quantum mathematics does not depend on a belief in particle substance or charge substance.

Ernst Mach and Bishop Berkeley had proposed about 1890, that the law of inertia depended on all the matter of the universe. This was known as *Mach's Principle*. Their friend Albert Einstein was greatly influenced by this when he deduced the General Theory of Relativity (GTR). Now, Mach's Principle in a more exacting form has become Principle II of the Wave Structure of Matter (WSM) and the GTR can be obtained from the WSM, both reviewed below..

General Relativity has been succinctly described*: 'All the matter of the universe tells space what it is. Then space tells the matter of the universe how it must behave.'* This reciprocity in the universe is the heart of the WSM. You will see this when they are reviewed below.

Einstein and Ernst Mach reasoned that particles must be "spherically spatially extended in space." Einstein wrote, "...*Hence the material particle has <u>no</u> place as a fundamental concept in a field theory."*

Paul Dirac was never satisfied with the point particle because the Coulomb force law had to be corrected by

"renormalization." He wrote[3], *"This is just not sensible mathematics. Sensible mathematics involves neglecting a quantity because it turns out to be small, not neglecting it because it is infinitely large and you do not want it!"*

Wheeler and Feynman[4] (1945) modeled the electron as spherical inward and outward *electromagnetic* waves, seeking to explain radiation forces. Unhappily they failed because there are <u>no</u> spherical solutions of <u>vector</u> electromagnetic wave equations. Nevertheless, their work pioneered the concept that every particle sends *quantum* waves outward, and receives an inward response from the universe. In hindsight, if they had used <u>scalar</u> quantum waves instead, this paper would have appeared 55 years ago!

After 1945, research on wave structure stopped until 1985 when Milo Wolff [6,7], using a *scalar* wave equation with spherical quantum wave solutions, found the Wave Structure of Matter described here. It successfully predicted the natural laws and all of the properties of the electron, except one - its spin. Below, this paper reviews the WSM and provides a new physical origin of spin that accords with quantum theory and the Dirac Equation.

Part II - Review of the Wave Structure of Matter

The wave-structured particle, Figure 1, is termed a *space*

resonance (SR). The medium of the waves, and the leading player in the new scenario, is *space*, that supposed void of which we formerly knew little. The properties of space resonances and the laws that they produce are derived from properties of space. Thus, this single entity, space, described by two principles, underlies *everything*.

3. Principle I - A Wave Equation

This Principle, an equation, describes how quantum waves are formed and travel in a space medium. If the medium is uniform, typical nearly everywhere, only *spherical* waves occur. The wave amplitudes are scalar numbers. If observed

in relative motion, Doppler modulation and elliptical waves appear. If the medium is locally dense, as in the central region of a <u>proton</u>, waves *circulate* like sound waves in a drum or sphere. Principle I is:

Quantum matter waves exist in space and are solutions of a scalar wave equation.

The wave equation is: $(\mathbf{grad})^2(\mathbf{AMP}) - (1/\mathbf{c}^2)\ \mathbf{d}^2(\mathbf{AMP})/\mathbf{dt}^2 = \mathbf{0}$

Where **AMP** is a scalar amplitude, **c** is the velocity of light, and **t** is the time. Its solutions are a <u>pair</u> of spherical in/out waves which form the simple structure of the electron or positron. The waves extend from center to infinity and decrease in intensity with increasing radius, like the forces of charge and gravity. The mathematical and physical properties of a space resonance display the laws of mechanics, quantum mechanics, special relativity, and electromagnetism. All properties of the waves depend on the medium, *space*. This dependence on media is not unexpected since it is a well-known characteristic of oscillators of all kinds, from violins to Christmas bells.

There are <u>two</u> combinations of the basic waves: electrons and positrons, which have opposite phase and spin rotation. Thus matter is constituted of <u>two</u> *binary* elements - like computer hardware Although the variety of molecules and materials

populating the universe is enormous, the basic building bricks are just two. Is there a profound meaning to this?

4. Origin of the Natural Laws.

The two combinations contain all electron-positron properties. Charge depends on whether there is a + or - amplitude of the IN wave at the center. If a resonance is superimposed upon an anti-resonance, they annihilate. The amplitude at the center is finite as observed, not infinite as in the Coulomb rule. They obey Feynman's Rule: "A positron is an Electron going Backward in Time." See this in the Math Appendix.

The properties of quantum mechanics (QM) and special relativity (SRT) are the result of the motion of one SR relative to another, which produces a *Doppler shift* in both the IN- and OUT- waves. All parameters of QM and SRT for a moving particle; that is, the deBroglie wavelength of QM and the relativistic mass and momentum changes, appear as algebraic factors in the Doppler-shifted waves exactly as experimentally measured. Details are in the Math Appendix.

5. Energy Transfer and the Action-at-a-Distance Paradox

The energy exchange of forces implies deeper meanings than are provided in the classical force laws. Experience tells us that communication or acquisition of knowledge of any kind occurs only with an *energy transfer*. Storage of information,

whether in a computer disk or in our brain, always requires an energy transfer. Energy is required to move a needle, to magnetize a tape, to stimulate a neuron. This rule of nature is embedded in biology and our instruments. Thus, a major deficiency of the classical force laws is that they have <u>no physical</u> <u>mechanism</u> for <u>energy</u> <u>transfer</u>. The formulas contain only constants, "mass" and "charge," - no mechanism. This is the fault of the <u>static</u> point particle model. We conclude that finding the energy transfer mechanism between particles is essential to understanding the natural laws.

Ernst Mach[9] observed the mechanism of cosmological energy transfer in 1883. He noticed that the inertia of a body depended on the presence of the visible stars. He asserted: *"Every local inertial frame is determined by the composite matter of the universe"* and *"When the subway jerks, it is the fixed stars that throw you down*." His deduction arose from two different methods of measuring rotation. First, without looking at the sky one can measure the centrifugal force on a rotating mass m and use the inertia law f=ma to find circumferential speed and position, as in a gyroscopic compass. The second method is to compare the object's angular position with the fixed (distant) stars. Both methods give exactly the same result!

Mach's Principle was criticized because it appeared to predict instantaneous *action-at-a-distance* across empty space. How

can information travel from here to the stars and back again in an instant? The answer lies in the energy exchange mechanism of the space resonance particle whose oscillating waves extend throughout space. Space is not empty because it is a quantum medium created by waves from every particle in the universe (Principle II below). Then, inertia is a local interaction with the space medium. There is no need to travel across the universe.

6. Principle II - Space Density Principle (SDP)

This principle defines the quantum wave medium - space. It is fundamentally important because properties of waves depend on properties of the medium. But, since the natural laws depend on the waves we deduce that the natural laws depend on the medium. Thus, space - the medium - is the well-spring of everything.

Principle II is:

> ***At each point in space, waves from all particles in the universe combine their intensities to form the wave medium of space.***

The medium = space density ~ mc^2 = hf = k'[SUM OF:{$(AMP_n)^2$ x $(1/r_n^2)$}]

In other words, at every point in space, the frequency of the mass **m** of a particle depends on the sum of squares of all

wave amplitudes, **AMP$_n$**, from the **N** particles in the Hubble universe, which decrease inversely with range **r$_n$** squared. This universe exists inside a radius R = c/H, where H is the Hubble constant.

This principle contains a quantitative version of Mach's Principle because the space medium itself is the inertial frame of the law F=ma. When mass or chrage is accelerated, energy exchange takes place it and the surrounding space medium. Incidentally, this is the mechanism of charge radiation, unsuccessfully sought by Wheeler and Feynman[4] (1945), They focused e-m waves instead of quantum waves.

Because there are a large number of particles, N = 10^{80}, in the Hubble universe, the medium is nearly constant everywhere and we observe a nearly constant speed of light. But near a large astronomical body like the Sun, the larger space density produces a measurable curvature of the paths of the inward and outward waves and thus of matter and light. We observe these as the effect of *gravity* described by Newton's This effect is also found in Einstein's general relativity.

7. The Energy Exchange Mechanism and Charge

Note that the self-waves of a resonance are counted too. Thus space becomes dense near the resonance centers due to their own large wave amplitude. Space becomes non-linear at the

central region, which produce the *coupling* between two resonances that allows energy transfer. We observe this process and call it "charge."

Can this mechanism be tested? Yes. If a resonance's self waves dominate space density at the center, then the intensity of self waves at some radius, **ro**, must equal the total intensity of waves from the other **N** particles in the Universe. Evaluating this equality yields

$$\mathbf{ro^2 = R^2/3N}$$

This is called the *Equation of the Cosmos,* a relation between the size **ro** of the electron and the size **R** of the Hubble Universe. Astonishingly, it describes how all the **N** particles of the Hubble Universe create the space medium and the "charge" of each electron as a property of space.

The best astronomical measurements, $\mathbf{R} = 10^{26}$ meters, $\mathbf{N} = 10^{80}$ particles, yield **ro** $= 6 \times 10^{-15}$ meters. This should be near the classical radius, $e^2/mc^2,$ of an electron, which is 2.8 $\times 10^{-15}$ meters. The test is satisfied.

8. The Conservation of Energy.

The transfer mechanism between combinations of resonances is a result of the dense (non-linear) space at resonance centers which permits coupling or exchanges of waves. When the waves of a potential source pass through a

potential receiver, MAP finds a way to minimize amplitudes. In the source, an electron's frequency (energy) shifts downward. In the receiver, there is an equal shift upward. Only oscillators with similar frequencies 'tuned' to each other can couple and shift frequency. Accordingly, the frequency (energy) changes must be equal and opposite. This is exactly the content of the *Conservation of Energy law*. The origin of this universal law is reduced to the matching of waves of two particles - not too different from tuning up an orchestra matched to the 'A' played by the first violin!

9. Principle III - Minimum Amplitude Principle (MAP)

This third principle can be obtained from Principle II, but because it is a powerful law of the universe, which determines how interactions take place and how wave structures will move, we write it out separately:

> ***The total amplitude of all particle waves in space everywhere***

always seeks a minimum.

This principle is the disciplinarian of the universe. That is, energy transfers take place and wave-centers move in order to minimize total wave amplitude. Amplitudes are additive, so if two *opposite* resonances move together, the motion will minimize total amplitude. For example, "Like charges repel and unlike charges attract" because those rules minimize

total amplitude. The MAP produces the *Heisenberg Exclusion Principle*, which prevents two identical resonances (fermions) from occupying the same state. This is not allowed because total amplitude would be a maximum, not a minimum.
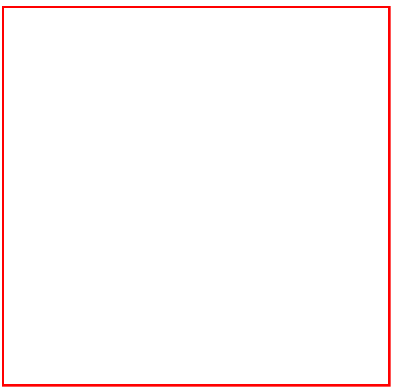
The operation of MAP is seen in ordinary situations like the water of a lake, which always levels itself. Also in the flow of heat that always moves from a hot source to a cold sink.

10. The Origin of the IN Waves and the Response of the Universe

At first thought, it is puzzling where the IN waves come from. The puzzle is a result of studying the waves of <u>only one particle</u>, and ignoring the waves of all other particles in space. That is oversimplified. To find reality, we must deal with the *real* wave-filled universe. When we answer this question[13] we find a rational origin of the inward waves:

Two hundred years ago Christian Huygens, a Dutch mathematician, found that if a surface containing many separate wave sources was examined at a distance, the combined wavelets appeared as a single wave front having the shape of the surface. This wave front is termed a 'Huygens Combination' of the separate wavelets (Figure 2). This mechanism is the origin the in-waves, as follows:

When an outgoing wave encounters other particles, their out-waves are joined with part of the initial out-wave. These waves arrive in phase at the initial center. Then out-waves from all other particles can form a Huygens Combination wave front that is the in-wave of the initial particle. This occurs throughout the universe so that each particle depends on all others to create its in-wave.

We see it is wrong to imagine each particle as one pair of in- and out-waves, because one pair cannot exist alone. We have to think of each particle as inextricably joined with other matter of the universe. Although particles are widely separated, they are one unified structure. Thus, *we are part of a unified universe and the universe is part of us*

Part III - The origin of the electron's spin

11. The Dirac Equation

The physical nature and cause of electron spin was unknown before the WSM. However, a successful *theoretical* theory of spin had been developed by Nobel laureate Paul Dirac in

1926, which is nicely described by Eisele[10]. It theoretically predicted the *positron*, found in cosmic rays five years later by C. D. Anderson, with a spin of h/4pi angular momentum units.

Dirac was seeking the connection between the conservation of energy given by

$$\mathbf{E}^2 = \mathbf{p}^2 c^2 + mo^2 c^4 \quad (1)$$

and Schroedinger's quantum theory. The procedure which had been found to work is to use an energy relation for a particle, like (1) and change it to a wave equation. Then the solutions will describe the amplitude of waves of the particle. No one knew why this worked but the results for the H atom are amazingly accurate so it is trusted. The usual way to change the terms for energy $\mathbf{E}$ and momentum $\mathbf{p}$ into two wave equation operators using,

$$\mathbf{E} = (h/i)\, [d\, \mathbf{AMP}/dt] \quad \mathbf{p} = h[d\, \mathbf{AMP}/dx] \quad (2)$$

Where **AMP** is the amplitude of the Schroedinger wave function sought.

Unfortunately for Dirac, Eqn (1) uses squared terms whereas Eqns (2) cannot be squared. He had a new idea, "Try replacing Eqn (1) with a matrix equation."

$$[Identity]\mathbf{E} = [alpha]\mathbf{p}c + [beta]\text{mo}c^2 \quad (3)$$

This avoided squares of **E** and **p** but placed severe restrictions on the new factors [*Identity*], [*alpha*], and [*beta*] which are matrix operators.

Dirac saw that Eqn (2) is similar to squaring the sides of a triangle. Therefore in Eqn (3) the equivalent of squaring has to become part of the matrix algebra. Dirac felt that this was possible. He found that solutions existed if **E** and **p** had fixed values. These values matched experiments and his Equation (3) became famous.

Dirac also noticed that only two functions were found in the electron's solution. So Dirac simplified the algebra by introducing number *pairs*, termed *spinors*, and 2x2 matrices *called spin operators* creating a two-number algebra instead of a four-algebra or our common one-number algebra. His theoretical *spinor* algebra produced correct values of the electron's energy and spin but gave no hint of the physical structure of the electron. Now we shall see below that the in/out wave pairs of the WSM are <u>real</u> physical spinors, the counterpart of Dirac's theoretical spinors.

12. The Mechanism of Spin

Spin occurs when the IN-wave arrives at the center and *rotates* continuously in order to become the OUT-wave. This is easy to say, but there are strict requirements on the

amplitudes and polarity of the in and out waves. Rotation cannot be allowed to twist up space without limit. The spherical waves must <u>continually</u> and smoothly change amplitude while changing direction of motion. It turns out there is one way to do this with either CW or CCW rotation.

Batty-Pratt & Racey[12] (1980) analyzed a known[11] property of 3D space called *spherical rotation* in which space returns to its initial state after <u>two</u> turns. They showed that any exponential oscillator, e^{iwt}, was a spinor. Wolff[8] realized in 1988 that the exponential in-out waves of the WSM were the <u>real</u> physical spinors satisfying the Dirac Equation.

In spherical rotation there is <u>no</u> fixed axis like *cylindrical* rotation of a wheel. Spherical symmetry is preserved because the center of rotation is a *point*. It is significant that only 3D space[11] has this unique property. If this remarkable geometric property of 3D space did not exist, particles and matter could not exist.

The rotation and reversal of the inward wave amplitude at the center is can be represented by Dirac's spinor algebra. One direction of rotation produces the electron; the other, the positron. This is why every charged particle has an anti-particle. It is easy to calculate that rotating an in-wave two turns each cycle produces an angular momentum of $\pm$ h/4pi thus obtaining Dirac's result very simply.

13. The Equivalence of the WSM and the Dirac Equation Procedures.

Although results are the same for both WSM and Dirac methods: that is, electron spin = ± h/4pi and energy = mc^2, it is educational to see why they are the same.

Actually, they are not quite the same. The energy given by the Dirac Equation is ±mc^2, Dirac was forced to interpret the puzzling negative energy as an unseen "sea of positron particles" . These have never been observed. This strange concept has since been abandoned but the reason was unknown until the WSM. Now we see that if the sign of the product of energy and time is negative, -wt = -Et/h, this is the same as exchanging the in-wave with the out-wave of a space resonance, This changes the electron into a positron. Check this in the Math Appendix.

Batty-Pratt[12] showed (pp 453-455) that rotation of the in/out waves of a resonance (see Appendix), when written as spinors, produce the Dirac Equation. The Dirac Equation does <u>not</u> describe the WSM, only rotation at the center.

14. Spherical Rotation at the Wave Center

What are the geometric requirements on the wave motion which does not destroy the continuity of the space? The coordinates of the space must participate in the wave motion without discontinuity. This requirement according to the

group theory of 3D space is satisfied by stating that the allowed motions must be represented by a compact simply-connected group. The most elementary such group for motion with spherical symmetry is named SU(2).

15. A Model of Spherical Rotation

SU(2) motion can be modeled by a ball held by threads inside a cubical frame. The threads represent the coordinates of the space and the rotating ball represents the space at the center of the converging and diverging quantum waves. The ball can be turned about <u>any</u> axis starting from any initial position. If the ball is rotated continuously it returns to its initial configuration after every two rotations.

Using the ball or its in/out wave equivalent, we can *reverse* the spin axis, by reversing time (t --> -t) or by reversing the angular velocity (w --> -w). Both are equivalent to exchanging the outgoing spherical wave of an electron with the incoming wave. In spinor notation, the change would be,

$\{$amplitude$\} = e^{iwt}$ --> e^{-iwt}

0 0

Dirac matrices also perform geometric operations. For example

inverting a spin state is produced by the inversion matrix operating on the spinor,

$\{amplitude\} = \begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix} \begin{pmatrix} e^{iwt} \\ 0 \end{pmatrix} \rightarrow \begin{pmatrix} 0 \\ e^{iwt} \end{pmatrix}$

NOTE: The rule of matrix algebra is to multiply and add the *row* elements of a *spin operator* by the *column* elements of the initial spinor. Each result is the new element of the final spinor.

In these two examples, note that inversion and spin reversal are <u>not</u> the same. They are different than our human view of cylindrical rotating objects. The difference is characteristic of the quantum wave electron and is important to understand particle structure.

A rotation in the spherical mode can be represented by any operator that will transform one spinor into another position. It is usual to assign a unit radius to spinor amplitudes. Then the rotations can be described by the mathematics of the SU(2) group. The notation of some spinors invented by Dirac are shown in TABLE I.

TABLE I: Properties of Spherical Rotation for an Electron in the SU(2) Representation

OPERATION	Operator	Initial spinor	Final spinor
Leaves space as it is.	1 0	1	1

[Identity operator] 0 1 0 0

Rotates space 180º 0 I 1 0

about the x-axis. i 0 0 i

[spin-x operator]

Rotates space 180º 0 -1 1 0

about the y-axis 1 0 0 1

[spin-y operator]

Rotates space 180º i 0 1 i

about the z-axis 0 -i 0 0

[spin-z operator]

For example, a ball in laboratory space can be rotated 180º about the z axis by the operator (spin-z). Such a z-axis is <u>marked</u> onto an object by humans in human coordinate systems. However the spherical waves of a resonance travel in universal cosmic space which has spherical symmetry. No x-y-z axes exist. Thus only *spherical rotation* around the wave *center* is meaningful.

Nevertheless, if a laboratory magnetic force (field) or electric force (field) is applied to an electron, or if the observer is moving with respect to the electron, an axis is <u>created</u>. In this

case, the in/out waves are changed into an elliptical form by the applied external effects - creating an axis along the ellipse. Then, spin effects can be measured with respect to that created axis.

Remember being puzzled in your college course on QM101? Why did the spin z-axis appear without geometric reason? The above clears up that confusion found in quantum physics textbooks which, not knowing the cause, glibly skim the "z-axis".

16. Connecting Natural laws and the Physical Electron Spin

Before the WSM, there had been no known physical reason for the theoretical mass increase of relativity. Likewise there were no physical reasons for quantum theory or spin. Were these apparently separate laws connected or not? Indeed, many theorists proclaimed that these phenomena were irreconcilable! Few had thought about a connection because most physicists were satisfied with the separate but accurate theoretical reasons for each.

Dirac's work might have been seen as a clue that they are connected because all three were joined in Dirac's work, albeit theoretically. The WSM now provides a simple physical connection due to the wave structure of matter.

Recall, that the relative increase of mass (energy or

frequency) of a space resonance is due the Doppler increase of frequency seen by a relative observer. This immediately results (Wolff 6,7,8) in the conservation of energy equation used by Dirac

$$\mathbf{E}^2 = \mathbf{p}^2 c^2 + m_o^2 c^4 \quad (1)$$

Likewise, the deBroglie wavelength $L = h/p$ is also a Doppler change of wavelength seen by a relative observer, shown below, and it leads to the Schrodinger Equation.

The union of spin, mass increase and quantum theory are found in the spherical rotation at the wave center.

Part IV - Conclusions

We can have confidence that the Wave Structure of Matter is the true physical reality of the universe. The logical proof of the WSM is that the experimental evidence which empirically founded the natural laws, must necessarily agree with the laws predicted by the WSM. It does.

There is further confidence because empirical evidence agrees better with the WSM than with conventional rules. For example, an infinity of charge potential at r=0 in Coulomb's law does not occur experimentally; in agreement with the WSM. There are more examples: Conventional physics has no explanation for the energy exchange mechanism of forces, or the Pauli Principle, or spin, or

charge attraction and repulsion. These are now direct conclusions from the WSM.

The philosophical conclusions are fascinating, particularly the connectedness of the universe which asserts: *Everything we are and observe here on Earth, matter-laws-life, necessarily depends on the existence of all the matter in the universe*. We must conclude, if the stars and galaxies were not in the heavens, we could not exist!. *Thus, we are part of the universe, and the universe is part of us*.

But the practical value of the WSM theory is the insight it provides. It will allow scientists to deeply analyze quantum wave structures, the cosmos, and the natural laws. In the R&D laboratory, the new insight may advance electronic applications, especially IC and memory devices because their tiny transistor elements use quantum effects to control the flow of currents.

The new knowledge may improve communication and the efficiency of energy transmission. Conduction of electric energy along a wire is a quantum energy transfer process between SRs that was formerly unknown. Now, energy losses may be greatly reduced, perhaps at low temperatures, permitting the use of smaller conductors for longer distances.

17. Less Certain Conclusions

Is it possible the nature has made use of the fact that each

particle contributes to the in-waves of others? Researchers often find a new discovery, only to realize later that the discovery already existed in nature. "Nature did it first!" is a common occurrence. We can speculate that this inter-connectedness could affect human thinking, physiological, psychological, or genetic processes. That is, quantum energy transfers, as a requirement of the MAP, could create hidden communication links between parts of our bodies or with neighboring matter, like computer circuitry.

What is the mechanism of these matter wave connections? Each atom of our body structure arranges its waves to form minimum amplitudes that satisfy MAP. In the process, each of its neighbors makes a contribution to its in-wave structure. If one atom is disturbed, others must be affected. This is an elementary bit transfer. Since every body cell contains the holographic image of waves from other parts of the body, each cell is a memory device. So the apparatus of computation appears to be there but whether or not nature has arranged our body cells into a physiological computer we do not know. Indeed, the mechanism of ordinary sensory communication in the nerves of the body, and in brain function are still poorly known. We won't know much about quantum communication without more laboratory work..We need to find out how 'the meat' does it!

Interested readers may continue the study of the quantum

universe in references 7, 8 and 13 , and at the "Quantum Science Corner" web site: http://members.tripod.com/mwolff

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V. Mathematical Appendix

19. Solutions of the Wave Equation (Principle I)

The wave equation must be written (following Wolff 6,7,8) in spherical coordinates because universal space has spherical symmetry. Uniform density of the medium (space) is assumed which yields a constant speed of the waves (and 'light'). Then the only two solutions describe the *charge waves* of common charged particles including the electron, positron, proton, and anti-proton. They are:

IN-wave = $(1/r)\{$**A**-max$\}$ exp $(iwt + ikr)$ (a)

OUT-wave = $(1/r)\{$**A**-max$\}$ exp $(iwt - ikr)$ (b)

where **A**= wave amplitude, wave number k=mc/h , w=2Àf, r= radius from wave center, and energy is hf= mc^2.

Joining these two as a standing wave produces the electron or the positron space resonances. The only two ways they can be joined is to rotate the in-wave at the center to become the out-wave. Rotation can be either CW or CCW. These rotation directions are shown as **Rccw** or **Rcw**

The electron **E(-)** = $\{$- IN-wave + OUT-wave$\}$ **Rccw** (c)

The positron **E(+)** = $\{$+ IN-wave - OUT-wave$\}$ **Rcw** (d)

You can experiment with particle inversions by changing the signs (+ or -) in the amplitude equations. To perform a **T**ime inversion change t to -t, which converts the positron into an electron.. To perform a mirror inversion (**P**arity), imagine that the waves are viewed in a mirror. You will see that a positron is a mirror image of the electron. To change a particle to an anti-particle (**C**harge inversion), switch the in-waves and the out-waves, and the spin direction. Successive **C**, **P**, and **T** inversions returns to the initial state which is a <u>proof</u> of the empirical-theoretical **CPT** rule, now seen to be a property of the wave structure.

If you add the electron structure to the positron structure, the

resulting amplitude is zero or *annihilation*.

20. Origin of Special Relativity (SRT) Mass Increase and the DeBroglie Wavelength of QM Theory

Write the equation of a SR, as seen by an observer with relative velocity b = v/c, as shown in Wolff[8]. Then, insert relativistic Doppler factors, g = $[1-v^2/c^2]^{-1/2}$. The final received amplitudes are,

Received amplitude = 1/r {(2 **A**-max) exp [ikg (ct + br)] **x** sin [kg (bct + r)]}.

This is an *exponential* oscillator modulated by a *sine* factor. This equation shows the origin of QM and SRT, as follows:

In the *exponential* factor:

Wavelength = h/mvg = <u>deBroglie wavelength</u> with <u>relativistic</u> momentum.

Frequency = kgc / 2Å = gmc^2 / h = mass frequency with <u>relativistic</u> energy.

And in the *sine* factor:

Wavelength = h/mcg = Compton wavelength with <u>relativistic</u> momentum.

Frequency = b gmc^2/h = b x (mass frequency) = <u>relativistic</u> momentum frequency.

Thus the space resonance *physically* displays all properties of an electron: QM, SRT, forces, annihilation, conversion to a positron, and **CPT** relations between **C**harge, **P**arity (mirror image) and **T**ime; all of which were formerly theoretical properties. These properties depend on the spherical wave structure and ultimately on the wave medium.

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