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S.W.A.P. Theory: Implications of a Relativistic Extended Electron Model.

Spherical Wave / Particle Theory

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Abstract.

S.W.A.P. The General Theory provides a framework that allows various models to be used together in the search for a unified field theory by providing points of reference between them. This allows fields like, Q.M., to use some of their methods outside their normal range, helping in the search for a connection. A classical approach is used whenever possible as this leads to a more intuitive grasp of the model. But with the aid of reference points, it can be viewed from several perspectives at any point.

Why do we need an intuitive model? *"At the opposite extreme one can take a stand "against interpretation." and argue that none of these effects* ***require*** *us to think in terms of vacuum fields, or source fields, and that for the purpose of calculation all we need to know about is Schrödinger equation and the other tenets of quantum theory. Such an approach, though perfectly rational,...but also contrary to the way physics has for the most part developed - intuitively and with physical images...most physicists would agree on the value of a single concept that provides intuitive explanations...that the quantum vacuum is just as valuable when we broaden our perspective to include relativistic effects."* p.295 **[6]**

The base of this framework starts with the electron. Standard models are not used so that new ground may be covered in less space, but any model of the electron can be used instead. It begins by correcting the particle persistence problems common to standing wave theories so that classical intuitive framework can be established. Q.E.D. is also used to keep a balanced flow of logical connections to related fields. Connections are found that allows work in Q.M. to have relevance within this framework, and links to Special Relativity established. Even some non - mainstream theories like Mach's principle, of which there are many, are looked at if they have some relevance, and if they provide accurate predictions.

The classic electron orbit model is reexamined and reconciled with the quantum model. Then Quarks and the nucleus are examined along with the strong nuclear force and the meson cloud. Gravity is touched on briefly towards the end along with some close thoughts on Mach's Principle. It ends with some implications for cosmology.

This approach helps unite aspects of Relativity, Classical Wave and Quantum Theory, even Mach's Principle and others, that at first do not seem related into a basic framework. This is hopefully a first step in unifying these fields of study. It should also be a useful tool in comparing models, refining current models, or developing new ones.

The end result is not a perfect fit for all the various models. It does broaden the range of each field's application for future research. Some conflicts are solved, others remain. So it is hoped that a number of researchers from different fields of study may find this model useful.

S.W.A.P. Theory

Section 1: The Electron

Peter W. Milonni states in his book; The Quantum Vacuum: *"The relativistic theory of an extended charged particle has evidently not been developed. Such a theory would be very complicated because the assumption of a **rigid** charge distribution as earlier is inconsistent with special relativity."* p.168 **[6]** There is such a model for the electron, which is why we chose it for a unifying framework.

Rhodes Scholar Dr. Milo Wolff made such a model for the electron. It has a **non-rigid** structure and charge distribution that is wavelike as well as a "point particle" aspect, the finite center amplitude. Milo also used Q.E.D. in the model, helping to bridge the gap between Q.M. and relativity.

This paper can only hope to provide a framework as a guide or inspiration for such a complex theory, based on a relativistic extended charge model for the electron. Here then is the start of Milo's electron and our model.

"The Wave-equation for the electron, in spherical coordinates, is:

$$d^2(AMP)/dr^2 + 2/r\{d(AMP)/dr\} - 1/c^2 x\, d^2(AMP)/dt^2 = 0$$

*where **AMP** is a continuous scalar amplitude with values everywhere in space and **c** is the propagation speed. This equation has two spherical wave solutions for the amplitude **AMP**: One of them is a converging IN wave and the other is a diverging OUT wave."*

De Broglie also saw this in his "principle of the double solution" as it has been called by some. It implied the existence of two sinusoidal solutions having the same phase factor. One consisting of a point like singularity and the other a continuous amplitude. Which he felt expressed the "phase harmony" between the internal oscillation of a particle and the oscillation of an accompanying extended wave. p65 **[3]**

$$\boldsymbol{AMP}^{IN} = (1/r)\,\boldsymbol{Ao}\, e^{(iwt + ikr)}$$

$$\boldsymbol{AMP}^{OUT} = (1/r)\,\boldsymbol{Ao}\, e^{(iwt - ikr)}$$

*"The IN and OUT waves combine to form a standing wave. **w** is the frequency characteristic of an electron proposed by de Broglie and Schrödinger. k the wave constant. The amplitude of the continuous waves is a scalar number, not an electromagnetic vector. At the center the standing wave amplitude is finite not infinite, in agreement with the observed electron.*

A standing wave results by combining them with their amplitudes opposing at r = 0 , to get

$$\boldsymbol{AMP}^{STANDING} = \boldsymbol{AMP}^{IN} - \boldsymbol{AMP}^{OUT} = (1/r)\,\boldsymbol{Ao}\, e^{(iwt + ikr)} - (1/r)\,\boldsymbol{Ao}\, e^{(iwt - ikr)}\ "$$

By replacing t with -t in the above equation you obtain the equation for a positron, as Feynman rule states; a positron is an electron going backwards in time, with the result of exchanging the places of the In wave and Out wave at formation. There are two solutions, just like de Broglie's concept of "phase harmony" would suggest. Louis de Broglie's Pilot Wave Theory, which regarded electrons and photons as both particles and waves, is another useful link between our framework and quantum theory. Einstein also worked on what appears to be a pilot wave theory, but withdrew it from publication. The paper remains unpublished, but its contents are in manuscript version in the Einstein archive for those who might want to look into this line of research. p276 **[3]**

*"The equation, Energy = mc^2 = h**w** , converts units of energy into units of frequency. Thus mass is*

proportional to frequency of the electron's resonance oscillator: $\boldsymbol{w} = 2\ pi\ mc^2\ /h$*.... This frequency is the universal cosmic clock which regulates the laws of nature and our sense of time....*

This equation becomes clearer when changed to a simpler exponential function,

$$\boldsymbol{AMP}^{STANDING} = \boldsymbol{Ao}\ e^{(iwt)}\ sin(kr)/r$$

The exponential factor is an oscillator. The sine function modulates the rapid oscillator waves with a standing wave of wavelength 1/k which surprisingly is the Compton wavelength of the electron. The intensity is the envelope of $\boldsymbol{AMP}^{*}\boldsymbol{AMP}$*, which decreases as* $1/r^2$ *away from its centers.*

The amplitude, $\boldsymbol{AMP}^{STANDING}$ *corresponds to the electric potential of the electron. The amplitude at the center is obtained by taking the limit as r --> 0 in sin(kr)/r in the equation above and is equal to* $\boldsymbol{Ao}$*. This finite amplitude explains why 'renormalization' in QED theory works. Renormalization boils down to an arbitrary cut-off of the Coulomb electric potential to avoid an unwanted infinity at the center when r --> 0. Avoiding the infinity because it is was annoying was Dirac's complaint.... Now, since experiments show extremely accurate verification of the cut-off, one can regard the cut-off as an observed correction to the electron potential, which elsewhere is the well-known* $1/r^2$ *. The space resonance structure correctly shows the origin of the correction, the finite center amplitude."* **[1]**

In short it is a description of the electron as that of a standing wave. Now the concept of standing waves is not a new concept. Schrödinger also developed a standing wave model, as did many others back to classical wave models of the Aether. The Q.E.D. standing wave model presented by Milo has some advantages when examined that other standing wave models do not have.

This process of In and Out waves explains the source of oscillations that create the frequency of waves required by Quantum theory, which is given in the equation $f = m\ c^2 / h$. These harmonic oscillations of the In and Out waves are the internal clock of particles. It also shows another link between Quantum Mechanics and Special Relativity. Each electron receives a QM de Broglie wavelength from the other, which was the original experimental basis of quantum theory, and shows the mass/time dilation of Special Relativity, as will be seen in the section on energy transfer mechanism of standing waves.

Without going any farther, this approach explains the *preacceleration* problem with the Abraham-Lorentz equation. It is ignored for practical reasons as the order of time that it occurs in is equal to the time for a wave at the speed of light would to cross the electron's radius. "*Dirac suggested that preacceleration might be associated with a failure of the theory when applied to the interior of the electron."* p.156-158 **[6]** Another approach to solve this problem is to reject the classical model of the electron as a point charge and use a shell model. Such a method was used by regarding the electron as a charged shell as put forth by Bohm and Weinstein, Herglotz, and later Wildermuth. p.165-172 **[6]** Even Van Kampen's thesis which puts forth a structureless electron has some relevance in this framework. It assumes that the electrons charge density is taken as being spherically symmetric, and can be spatially extended. p.172-178 **[6]** Relativistic Q.E.D. also supports the spatially extended charge and a mobile finite point model, as it gives a spread-out electron of length m^{-1} which is its Compton wavelength, just like we see in Milo's electron. p.400-403 **[6]**

When an external In wave is in phase with the electron's own In wave, the two will couple at the boundary of the electrons standing wave as in shell models. The electrons In wave then reaches the finite center amplitude in the time predicted by point models as the electrons In wave is 1r distance and the wave is traveling at the speed of light. The *preacceleration* is *expected* because the information has already been passed to the electrons own In wave at the boundary of the standing wave. Our model of the electron does have a structure; charge density is spherically symmetric and spatially extended with the Out wave.

Is there any other evidence to suggest that the electron has an internal structure? Robert Galloway in his paper titled "Refracting saddle wave model of stable fundamental particles" thinks so. **[4]** In his model the internal structure contributes to the electrons/positrons persistence. The 1927 paper by Broglie "Wave mechanics and the atomic structure of matter and of radiation" puts forth a theory of particles as moving singularities. In regards to this singularity, it occupies a well defined position in space and as a result the

wave amplitude must be singular, or take large values in a small region within the extended wave. p. 62, p.75 **[3]** Which would be the finite center amplitude of our model and its spatially extended field of waves. Natarajan in his paper *"Do quantum Particles Have A Structure?* Also reached the same conclusion, that an extended, relativistic electron model is needed. **[14]**

This model of the electron also helps to explain the infinite electromagnetic mass in Q.E.D. theory, and the physical reason why Beth's Mass Renormalization was the proper course of action. *"In particular, we should **subtract** the "additional" contibution...that we incur after coupling the electron to the field...This is exactly what Bethe did in order to reduce the order of divergence..."* p.89 **[6]** In this model, when mass is added from the coupling to the EM field, the extra mass is carried away by the Out waves, and does not contribute to the observed mass of the electron. This does not exclude any of the solutions already in use to explain this issue. They would just mean that the Out wave had less mass, so this is of importance in determining the overall energy contained in the Out waves.

The electron sheds a small amount of its mass/energy with each Out wave, 1r apart. Any individual Out was has negligible mass, but the spatially extended waves combined could be significant. Eventually this energy will be absorbed by other particles, until then a significant amount could exist in space at any one time. Could this account for the Dark Matter/Energy some are looking for?

So within our framework a standing wave model of the electron can be swapped out for point models, shell models, extended models, internal structure models, or exotic models of the electron. However it seems that an electron model with an internal structure and that is spatially extended fits into a unified field model better than those that do not have these qualities.

The Finite Center Amplitude of the Electrons Standing Wave:

"Classically, of course, a dipole in the vacuum is not acted upon by any "external" field: ...In quantum theory , however, there is always an "external" field, namely, the source-free or vacuum field...the free field is the only field in existence at t = 0." p.52 **[6]** In the electron wave equation, $t = 0$ at the finite center amplitude. Which makes the finite center amplitude our '*quantum point of reference within the wave'* for our model; it is the point of interaction and the only point where the electron can be detected.

Many theories can be linked to the finite center amplitude, in this example. D.B. Larson links charge and spin to a force he calls Rotational vibration, which is spherical scalar motion with a vector added to determine rotation of the spherical wave. The coiled hairspring of a pocket watch would be a good comparison to this type of force. This type of force seems to only appear within a harmonic spherical wave, like a standing wave. This force can have both inward and outward directions, depending on the associated wave direction, and two possible directions for each. chapter 13 **[5]** From this description it looks like Larson is describing a van der Walls force divided into two components for each direction. It is useful as it allows us to define the direction of spin for the electron.

Milo has a different concept for the origin of charge and spin described here in The Physical Origin of Electron Spin, which is in agreement with Dirac's equation. **[2]** It arises in the complex spin at the finite center amplitude where the In wave becomes the Out wave. It is this rotational force which gives the standing wave its angular momentum and therefore its magnetic moment.

The finite center amplitude may also be the link with Mach's Principle. Einstein found an effect that he felt demonstrated this, and even wrote a letter to Mach about it. Consider a sphere in space that has mass and set it spinning. A Coriolis effect will cause a Foucault pendulum to be dragged around with it, with an extremely small angular velocity. This process is more commonly known as the Lense-Thirring or frame-dragging effect. In our framework, the spherical standing wave is spinning in space, with spinning spherical waves extending from it, the In waves the electron receives is calculated using Mach's Principle, and the Out wave is calculated by the classical method as in Bohr's model. This gives two frames of reference for calculating frame-dragging within the finite center amplitude. The force would be very small, but then so is the curvature at this point. This frame dragging effect could be the reason for the scalar rotational vibration force mentioned above.

The finite center amplitude can also be equated with the "smallest particle" proposed by some. It could also be the point where strings from higher dimensions could enter ours. The possible connections to other models are too many to count.

The finite center amplitude is a vital aspect of our framework, and a link by which divergent models can be compared.

The Energy Exchange Mechanism of the Electron:

There must be some means of exchanging energy within the electron itself.

"How does the charge mechanism operate? It is well-known that a-c signals flowing through a non-linear element in a circuit will mix. That is, if there is a two-signal input:

$$INPUT = A\cos(w_1 t) + B\cos(w_2 t)$$

then the output will be:

$$OUTPUT = AB[\ \cos(w_1 t + w_2 t) + \cos(w_1 t - w_2 t)\ ]\ /2 + \text{other components}$$

The non-linear element produces sum and difference frequencies of the original w_1 and w_2...

Similarly in space, different waves passing through the dense, non-linear region at the particle center will mix. If an input frequency and a particle frequency are similar, resonance can occur. An example of this is a tuned radio receiver. An energy (frequency) exchange between resonances behaves like two coupled oscillators in a circuit, or like two pendulums joined with a spring." **[1]**

Now that we have a means of energy exchange, we can move on.

Electron Persistence

Energy Transfer by Waves Create the Electron's Persistence as a Particle:

All matter emits these waves, so why can't the energy lost by the standing wave be replaced by the waves from other matter? With the energy exchange mechanism described above, and the interaction of In and Out waves between particles, Milo felt this solved the problem of electron persistence. It is a simple and elegant solution. Some however felt that it made the electron too dependent on other matter to explain its shear persistence as a particle. Those objections seem unfounded however in light of the research done in the field of Stochastic Electrodynamics.

Stochastic Electrodynamics Theory or S.E.D. for short was first put forward in 1963 and 1995 by Marshall. It sought to explain quantum effects with classical physics. S.E.D. Theory is useful as a computational tool as it uses classical electrodynamics in place of more esoteric quantum methods. In their model the electron emits Lamor radiation, causing it to spiral inwards, but absorbs energy from the waves of the zero-point energy. The loss and gain balances at the distance of Bohr's orbit. This explains why the orbital angular momentum of the electron is zero in its quantum ground state.

S.E.D. is very close to the model we use except the energy loss from Lamor radiation is also contained in the OUT wave in our model. Recent simulations have modeled the electron motion in the Coulomb potential of the hydrogen atom, and replicated the electrons probability density as predicted by the Schrödinger wave function. The "zitterbewegung" motion of the electron noticed by Schrödinger is caused by the electromagnetic zero-point fluctuations of S.E.D. theory, which remember are waves in space in both their and our model. It even suggests that the electron is mass less at one point, with the mass arising from some higher level of motion. The Calphysics Institute is a great source of information related to this work. **[7]**

S.E.D. then provides convincing support for our model also. In regard to the Larmor radiation of an

accelerated charge. *"The **"Schott energy"** ($2e^2 / 3c^3$) (**v** · **a**) has been interpreted either as part of the internal energy of charge (Fulton and Rohrlich, 1960) or as part of the energy of the field in the immediate vicinity of the particle (Coleman, 1961). It arises from the interface of the **"velocity"** and **"acceleration"** fields of a point charge."* p.163 **[6]** Coleman's work on the "Schott energy" also lends support to the concept of In and Out waves for the electron.

So string theories and others which use higher dimensions can still be included within the framework of our model. From the unlikely connection found by S.E.D., that mass may arise from some higher level of motion and the finite center amplitude.

Caroline Thompson saw this also when she said space was *"pervaded by very high frequency **longitudinal** 'psi-waves', these being emitted and recieved by all matter"* p. 2 **[13]** *"Matter itself is built of 'psi-waves', which make the equivalence of matter and 'psi-energy' self-evident.* p. 3 **[13]**

Electron Persistence, Another Quantum Approach:

Casimir developed an equation for the electron based on the zero-point field energy. The equation has proved useful, but not in the way he envisioned. He felt that the value of hc/e^2 had something to do with the compensation of the zero-point energy. In 1978 he put this idea forth. *"Suppose geometry involves a shortest length **R** and also a largest wave number **k**. The product **k R** would have to be of order unity, but its exact value would depend on the details of the theory."* p.286-288 **[6]** This idea of his is just that, but an interesting one. As our model has the electron being formed by a wave whose value is based on the mass and size of the universe, it could prove a fruitful line of research.

There could be more ways to account for persistence not yet conceived. Persistence alone is not reason to abandon a standing wave approach to the electron.

Electron Persistence, A Wave Approach:

The largest problem with wave models has been the medium for the wave propagation. Milo used the 'Space' of relativity in his paper, which is why he refers to a standing wave as a "Space Resonance (SR)". As for other mediums, a number have been put forth. The electron as a standing wave limits those choices. It medium must exist inside the electron and that only leaves one other option, the energy density of the electron itself. So to explore other options, let us consider this idea for awhile.

Postulate #1 Energy Density is the Wave Medium within Particles.

In particle collisions, regions of high energy density are formed. Most research has been on the particles formed within this region, but some observations have been made about this cloud of energy. This energy dense region acts like it was a perfect fluid with zero viscosity. It flows from dense regions to less dense, trying to establish a uniform density throughout. It can also be looked at as a gas.

With no mass to speak of, it has no inertia to speak of, so we have no loss of wave energy from inertia. No discrete particles mean no friction to rob a wave of energy either. Energy is homogenous in that there is no empty space between parts of it, like atoms in air, so there is no loss due to spacing between particles, as in other mediums. Energy is completely compressible and elastic, as seen from the extremes of the center of a black hole to the rarefied regions of deep space. A compressible and elastic fluid/gas with zero viscosity and inertia. It has the attributes of matter, without the drawbacks of matter. Energy density is the perfect wave medium for the In and Out wave within the electron, which are longitudinal waves, but as energy density acts like a fluid, transverse waves can be supported also.

From a Q.E.D. perspective this would be the *bare mass* of the electron. One half of the energy comes from the wave energy (source field), the other half comes frome the latent energy density (vacuum energy), or bare mass of the electron. Thus the two balance out.
Now we can return to the problem of electron persistence.

Postulate #2 Reflection of Wave Energy at the Boundary of the Electrons Standing Wave from its Out Wave Contribute to Electron Persistence.

What does the energy density of the electron have to do with electron persistence as a standing wave? Everything.

Just like with other standing waves, there must be a medium within the boundary of the standing wave that compresses and expands with the wave. How long a standing wave lasts is largely determined by how efficient this medium is. With a perfect medium, there would be no loss of wave energy in this process, and the standing wave would last indefinitely. The only medium that the electrons standing wave could have it its energy density. It is a perfect, or nearly perfect, medium for the electrons standing wave. The energy density of the electron is compressed down to the point. It then expands to the boundary of the standing wave, and repeats this process.

As we see from the study of waves, when a wave passes from one density to another, *Both* **Transmission** *and* **Reflection** of the wave's energy will occur at the boundary. The greater the difference in density the greater the difference between reflected and transmitted wave energy. This can best be expressed with the equation for wave intensity. $I = 2pi^2\ f^2\ A^2\ vd$ where I is intensity in watts/cm^2, f is frequency, A is amplitude, v is wave velocity, and d is density. As seen from this equation, density is but one value, but in this case it is multiplied by the speed of light. The energy density of space is very low compared to the density of the electron.

This means that as the Out wave from the electron reaches the boundary of the standing wave, The reflected wave will have a high intensity, the outgoing wave low intensity. The electron is recharging its own In wave at this point with the reflected wave energy at the boundary. This self-sustaining process enhanced by the efficiency of energy density as a wave medium contributes greatly to the persistence of the electron as a particle. What little energy is lost to the Out wave can be replaced by the In waves from other matter. Combine these two mechanisms and you have a very persistent standing wave, and persistence equals particle.

Motion of the Electron Standing Wave:

Let us consider two standing waves moving with relative velocity $b = v/c$. Each of them receives the Doppler shifted waves of the other. They are symmetrical. The IN waves are red-shifted and the OUT waves are blue-shifted by the usual Doppler factors, *"g(1+b) and g(1-b) which shift frequency and wavelength. The received amplitude of each standing wave is the sum of Doppler-shifted IN and OUT waves which reduces to, AMP = shifted* $\{AMP^{IN} + AMP^{OUT}\} = (2/r)\ e^{ikg(ct + br)}\ sin[kg(bct + r)]$*..."* This equation *"..is composed of an exponential carrier wave modulated by a sine function. The relativistic term,* $g = [1- (v/c)^2]^{-1/2}$ *, occurs properly to match experimental observation. It is a result of the Doppler effect on the combined IN and OUT waves. These matching results are:*

The parameters of the exponential oscillator are:
wavelength = h/gmv = de Broglie wavelength, L.
frequency = kgc/(2 pi) = gmc^2/h *= mass-energy frequency.*
velocity = c/b = phase velocity.

The parameters of the sine function are:
wavelength = h/gmc = Compton wavelength.
frequency = $gmc^2\ b/h$ *= b x (mass frequency) = "momentum frequency".*
velocity = bc = v = relative velocity of the two resonances.

"This clearly shows the origin of mass increase and the presence of quantum mechanics in the wave structure of matter. Compare the Equation for moving electrons with the Equation for a stationary electron. They are of the same form except for the velocity b = v/c and the related quantum and relativistic properties for moving particles." **[1]**

Now our internal clock of the particle is defined by $f = mc^2/h$***, so whenever we have a change in mass, there will be a change in the frequency of the particles internal clock, and the size of the standing wave itself.***

At speeds approaching the speed of light. The size of the standing wave will shrink until it is the size if the finite center amplitude while mass climbs, and with the resultant change in frequency. This is seen if the standing wave and the finite center amplitude are graphed together as in the light bubble model.

Pauli's Exclusion Principle and Milo's Minimum Amplitude Principle:

Pauli's Exclusion Principle. which states, No two electrons in an atom can have the same set of quantum numbers, has been a great aid to quantum theory. Milo's Minimum Amplitude Principle does much the same thing, but not exactly. *"But there has to be a law to determine whether two particles should move together or apart, or whether their frequencies will change up or down. One more assumption is needed that governs the behavior of energy exchanges within a group of particles. A Minimum Amplitude Principle (MAP) is found, described by INTEGRAL OF:* $\{AMP_1+AMP_2+ AMP_3 +... AMP_n \}^2 dx\, dy\, dz$ *= a minimum or,*

The total amplitude of particle waves in space always seeks a minimum.

In other words, all the waves of the total number n of particles inside the Hubble Sphere adjust themselves at each point to make total amplitude a minimum. To accomplish this, energy (frequency) exchanges take place, or wave-centers move in order to minimize the total amplitude. This principle is very powerful and predicts many observations. For example, waves of two electrons close together will have a higher intensity than electrons farther apart. Therefore two electrons must repel in order to satisfy the MAP. A positron and an electron will attract." **[1]** In addition, as the equation for pair production shows, the positron and the electron will attract and cancel each other out releasing energy. Particles with both different charge and amplitude will attract, but not share the same space.

Caroline Thompson also saw this at work in her "Psi-wave" theory in a little more derail. She looked at the effects of phase harmony between spherical standing waves. Her "Psi-waves" are an exact fit for Out waves in this model. *"**Wave centres approaching**: Phi-wave peaks arrive too frequently for resonance. If one arrives at the "right" time, the next will arrive too soon and be already past before the centre has reached maximum. The centre will tend to shift towards the position of resonance, i.e. away from the phi-wave source. There will be repulsion. (Distortion of waves on entering the high-intensity central regions is not shown. There will be a degree of focussing due to the higher refractive index of the medium there.)"*
*"**Separating wave centres**: These will exchange "softer" and lower-frequency phi-waves and the relative motion will slow until they are in resonance. There will be attraction. This may be simply a direct effect of the phase differences between arriving wave peaks and the centre's pulsation, but may be partly the net result of the pushing effect of waves from the rest of the universe. If the wave profile is non-sinusoidal, as shown, the waves will produce strong "forces" and firm phase-locking."*

"The rules for interaction of two wave centres in close proximity are quite simple, and covered by Figs. 2 and 3.(The two examples above). *If a neighbouring wave centre moves away, the phi-waves coming back from it will be red-shifted, the frequency too low for resonance with a stationary wave centre. Therefore it will be advantageous for the latter to follow. Likewise, if a neighbouring wave centre comes towards a stationary one and threatens to get too close, its phi-waves will be blue shifted and at too high a frequency for coupling. It will be advantageous to move away. The effects are achieved partly by a gradual adaptation to the phase of the incoming wave, partly by the net effect of other phi-waves."*

"These rules lie behind at least certain kinds of electric current, where wave centres follow each other nose to tail. They also account for the behaviour of electrons associated with atoms and the structure of the atoms themselves. Wave centres can exist for long periods most easily if they sustain each other in neat – or maybe not so neat – groups."

"The wave centres are effectively held in their relative positions by the requirement to stay in resonance with each other, so the "force" between any two is not simple attraction or repulsion. Boscovich had a similar idea a few centuries ago, now carried over into the quantum theory notion of "quantum wells" where particles can be in equilibrium." **[13]**

Caroline Thompson's is describing the "Zitterbewegung" motion of the electron when relativity at "rest"

with another particle.

In light of the usefulness of MAP, Caroline Thompson's Psi-wave and the exclusion principle, in the context of our framework it might prove useful to combine them.

The first principle quantum number describes the radius of the orbit. This principle quantum number corresponds to the energy levels of our model, just like it does with the current model.

The second, angular quantum number describes the magnitude of the angular momentum of the electron. This we can do by several methods.

The third, magnetic quantum number is related to the direction of the angular momentum. This can be determined from the scalar rotational vibration direction.

As we have all the values in our model to determine the quantum numbers, we can combine thes three and obtain:

The Minimum Amplitude Exclusion Principle. No two particles within a shared region of space can have the same set of quantum numbers, and the amplitude of those waves will always seek a minimum within the sphere of shared space. This modification will come in handy when looking at the nucleus and hadrons.

The Force Behind Pauli's Exclusion Principle:

Casimir developed a model of the electron that may shed light here due to its connection with zero-point field and the exclusion principle. Consider a spherical conducting shell of a given radius centered on a point particle, or in our case the finite center amplitude. The zero-point field energy can be expected to come from a limited number of frequencies. In 1968 Boyer discovered that this force was repulsive rather than attractive as expected, and in 1972 found it to be 12 times larger in magnitude. Two studies in 1978 confirmed this. In 1982 however, Candelas argued that these were in error. *"There does not appear to be any simple explanation for the repulsive character of the zero-point energy of a spherical shell"* p. 286-287 **[6]** If this force is indeed repulsive, then in our framework it would be the force responsible Pauli's Exclusion Principle acting upon the finite center amplitude within the standing wave to keep other finite center amplitudes apart from it.

The Photon:

Let's stop briefly on the subject of the photon before we continue. Within this framework, the photon is treated the same as in quantum models, it is a virtual particle. *"In a process in which a photon is annihilated (absorbed), we can think of the photon as making a transition into the vacuum state."* The finite center amplitude. *"Similarly, when a photon is created (emitted), it is occasionally useful to imagine that the photon has made a transition out of the vacuum state."* p.48 **[6]** The finite center amplitude, which is the smallest size that a simple harmonic oscillator can have.

The photon is emitted between two nodes of the spherical wave at the speed of light. The photon then is a *stationary* wave, of a given *frequency*, *relative* to the advancing scalar field. Thus it is in accord with relativity as the photons energy being contained in it frequency.

In de Broglie's pilot wave theory, the guiding wave was distinct from the electromagnetic field and played a similar role as the material ether did for Maxwell's Electromagnetic Theory. "It is thus possible through virtual oscillators and virtual radiation to reconcile the wave theory of radiation with the sudden absorption of energy, and hence to retain the idea of stationary states." The scalar wave can be used as in this example as a carrier wave, medium for EM waves. p.335 **[3]** S.E.D. assumes a fluctuating classical field that has a zero-point energy of *1/2* ***hw*** per mode, as long as Maxwell's equations are satisfied, there is no inconsistency with using that approach in this framework. p.290-294 **[6]** Lastly the energy density of space can serve as a medium in the classical manner, as we have done with the scalar waves also. Professor Caroline Thompson started work on her "Phi-wave" theory. She died of cancer in 2006 before her work was completed. It also had spherical waves spatially extended. In her model photons used the spherical

"Psi-waves" as a carrier wave. **[13]**

So within our framework, there is no reason why the photon cannot generate an EM field as it moves through space with the advancing scalar wave front.

The Electrons Orbit:

Most everyone knows Bohr's model of the atom and the electrons orbit. Bohr defined the orbit of the electron as a result of the angular momentum of the electron itself which gave orbits that were whole multiples of its wavelength. In his model the electron is at rest. Now his simple model did not work for larger atoms and has been modified. De Broglie's pilot wave theory proposed that the electrons orbits are only stable if they are in phase with the internal oscillations of the electron. p.39, 49 **[3]** From this he derives the Bohr-Sommerfeld quantization condition and is in agreement with our model.

But Bohr's his simple model will serve our discussion at the moment. However Bohr did not take into account the effects of the electrons spin and the electromagnetic forces involved. As seen in S.E.D., the electron will lose energy in the form of radiation, which the Out waves of the electron carry away. De Broglie also agreed with this approach. p.41, p331-334 **[3]** But this energy can be replenished by the Out waves of other particles. One electrons lost energy becomes the replacement for another electrons lost energy. This changes Bohr's model.

Bohr used the classic method to calculate angular momentum based on Newton's laws. There is however another valid way to calculate angular momentum using Mach's Principle to arrive at an orbit for the electron. **[8]** Our model shows that there is a van der Waals force at work due to the wave action that will contract the orbits slightly as the mass of the atom climbs with the number of 1/2 spin particles added. This method using Mach's principle seems to account for this force with less tedious calculations, so it is used here. The connection between Mach's principle and this force will be explored latter in this paper.

The use of Mach's Principle in finding the orbit of the electron gives us a slightly different picture, more so when combined with the model of the electron as a standing wave form composed of In and Out waves.

The electron is not at rest as in Bohr's model. The orbit of the electron corresponds to a wave node where the energy lost by OUT waves and gained by IN waves are the same. Particle like pockets formed by anti-node loops, stationary waves, represent the quantum packets of energy absorbed and emitted by the electrons from changes in orbit, the photons.

Mach's method also shows that as the mass of the atom increases, the orbits of the electrons will be affected also. It gives good results for atoms of all sizes.

So Bohr's method using Newton’s equations can be considered as the electrons OUT wave to the universe, describing its current internal state.

Mach's method can then be considered as the IN waves coming to the electron from the universe, adjusting its internal state to match current conditions, by the energy exchange mechanism.

When graphing this simple model, at the center of the atom, there is room for two particles, 1/3 the size of the electron, to reside comfortably, that is while obeying the Exclusion principle and MAP. The superposition principle tells us that the stationary waves of the electrons and the waves of the nucleons will combine to form a single stationary wave at the center of our atom. The region within this stationary wave represents a stable area for the nucleons to exist, the "Island of stability". The first magic number of the shell model of the nucleus and the "surface tension" of the liquid drop model is seen in the stationary wave boundary defining that region of space at the center. From a quantum approach, the "surface tension" can be treated as a Casimir effect. p. 261-265, 355-360 **[6]**

From a classical perspective, all liquids show surface tension. Energy density acts like it was a liquid, so at the boundary between two regions of varying density, we should expect an effect similar to surface tensions

in liquids. Surface tension causes a free liquid to assume a spherical shape. within our framework, the spherical wave, as it has a greater intensity than the medium it travels through, act like the surface tension at the spherical boundary between regions of various densities. Another contributing factor in the particle like behavior that is observed.

This stable region is roomy at first, and every new hadron adds to its size a little. but as particles like a little elbow room, the free space for new hadrons grows less and less despite this slight increase in size of this stable region. Very large atoms exceed this stable region, which becomes a factor in the decay of heavy atoms.

Now we have a basic description of the electrons orbit and the atom. Now that must be extended, just like Bohr's model was. The orbits of the electrons need not lie in a single plane as in the basic model. The obits can be tilted to any plane and can even be elliptical.

In this model of the electron's orbits and the atom so far, we have reconciled models of the atom and the need for some current corrections.

Size, Mass, and Charge of the Electron:

Here is how Milo tested his Space Density equation to arrive at the size, mass, and charge of the electron.

"If an electron's own waves can create a denser region near its center, then the intensity I of those waves at some radius of non-linearity r_o , must be comparable to the intensity of waves from all other N particles in the Universe. This requirement is written: Intensity $I = AMP_o^2/r_o^2 = SUM\ \{\ AMP_n^2/r_n^2\ \}$
$= N/V \times INTEGRAL\ OF:\{\ AMP_o/r_o\}^2\ 4\ pi\ r^2 dr$

where V is the volume inside the Hubble Sphere and R its radius. The integral, from r = 0 to R = cT = c/H, extends over a sphere whose expanding radius R depends on the age T of the particle. Thus T is the maximum range of the particle's spherical waves. This reduces to $\mathbf{r_o^2 = R^2/3N}$

Inserting values from astronomy measures, $R = 10^{26}$ *meters and* $N = 10^{80}$ *particles, the critical radius* r_o *equals* 6×10^{-15} *meter. If the assumption is right, this should approximate the classical radius* $r_c = e^2/mc^2$ *of an electron, which is 2.8 x 10-15 meters. The two values almost match, so the prediction is verified. Apparently dense centers do exist, and*

$e^2 / mc^2 = R / SQUARE\ ROOT\ OF: \{3N\}$

$\mathbf{r_o^2 = R^2/3N}$ *is a relation between the size* r_o *of an electron and the size R of the Hubble Universe. It is termed the* ***Equation of the Cosmos.***

"Combine the Equation of the Cosmos with the classical electron radius $r_o = e^2/mc^2$. *Eliminate* r_o *and obtain* $e^2 = mc^2\ R/SQRT\{3N\}$. *This shows that the charge* e^2 *is dependent on the total of all N particles. We also recall that charge always occurs in natural laws as* e^2 , *never as e alone. Thus, charge is a property of space and total matter, not of particles, and there is only one value of charge in nature* e^2 . *Conservation of charge follows from the anti-symmetrical structures of the SR and anti-SR described...above."*

"To see how the electron mass depends on other matter, combine Equation of the Cosmos with the Compton wavelength $r_o = r_c = h/mc$. *Eliminate* r_o *to obtain:*

$$mc^2 = hc\ /SQRT\{N/R\}$$

Again, confirming our logical deduction, we see that the electron mass like the charge is a property of the universe, that is the total particles N and its size R." **[1]**

Which came first, the particle or the wave, and how? This is what Milo tried to answer here; his solution can be looked at one of two ways. First. picture the early universe as a giant wave tank, a sea of dense energy. Random waves will be generated based on the size, mass, and density of this sea of energy. Thus the universe itself is the source of the first waves which kick started pair production. The amplitude of this

wave is equal to the amplitude of the waves responsible for electron/positron production. They determined the charge value and mass of those particles when created, depending upon the conditions at formation. The second way is to think of the universe as a giant standing wave, and the finite center amplitude would be the size of the electrons amplitude. Then the equation is applied to charge of the electron as well.

To Milo this implied that the electron was the basic particle of the universe. This is not what our framework implies, but it is close.

Postulate #3 All 1/2 spin particles that are not composite structures are Standing Wave Centers Created by the Waveform Responsible for Electron / Positron Formation.

If the waveform which created electron was the fundamental waveform of the universe, how did the other particles come to be? This claim must be supported, and it is, by relativity.

$E = mc^2$ is the *rest mass* of a particle. Any standing wave that forms within a given region of space will do so at its *rest mass* to be in equilibrium with its environment, which is the energy density of the region the standing wave forms in.

An electron changes its mass and size to compensate for high energy density due to acceleration and gravity, so it should do the same at formation. The particle is created at its rest energy, but 1/2 spin particles are never at rest from that time on. Any standing wave, 1/2 spin particle, not at equilibrium with its surroundings would be unstable and decay into a new 1/2 spin particle. In addition a non 1/2 spin particle can be emitted also. It is the energy unused by the new standing wave as it expands in size, with the resultant decrease in mass. The new particles combined energy must satisfy $E = mc^2$. This process also works in reverse. A 1/2 spin particle can absorb this emitted particle and increase in mass. If the new particle is unstable, the process can repeat.

This can also be approached from a wave viewpoint. The waves would be reduced in amplitude upon entering a dense region of space. Any standing waves that form will reflect this change in amplitude and be seen as smaller more massive particles. This approach is not as simple nor as elegant as using relativity to explain this, so we departed from wave theory here due to the clarity of relativity in this.

If we use Milo's Equation of the Cosmos, $r_o^2 = R^2/3N$ and apply it to the electron by making N=1 and R=2.8 x 10^{-15}, it will give us a particle 1/3 smaller than the electron with the mass increase of a factor of three, but that is still to large to fit into the hadrons. If we set N=2 we arrive at a particle that will just fit into a hadron at 1/3 the size of the electron and with a mass of 4.5 Mev. slightly less but very close to the 5 MeV given for the Up quark. A particle that was 2/9 the size of the electron would have a mass of 9 MeV, same as for the Down quark.

Section 2: The Nucleus

Quarks:

The quarks can be considered harmonic oscillators in our model. For them to couple with each other for efficient energy exchange, the wavelength of each should have a harmonic relationship with the other 1/2 spin particles around them and with the sphere defining their region of confinement.

Quarks are also 1/2 spin particles, which suggest that they are also standing wave centers, and would obey the same laws as the electron. Yet they seem to behave quite differently than electrons. As we will see, this has more to do with the high energy density within the region of space they reside in, protons and neutrons. As Milo applied QED in his work on the electron, it would make sense that his equations might apply to quarks as well. Problem is, we have no idea what causes charge, much less a fractional charge.

If we can solve this, it could answer a great mystery, *Where did all the positrons from pair production go to?*

If the charge value for quarks are taken into account with the electrons, this matter can be resolved. Overall

the charge value for all matter cancels out for a near zero net charge. If the quarks with positive charge values are the positrons from pair production.

Let's explore this line of reasoning within the framework of our model so far.

Asymptotic Freedom:

Unlike the electron, where there is a great difference in energy density between the electron and free space, the quarks environment is saturated with energy. Quarks do not have the internal wave reflection at their boundary to aid persistence. They are wholly dependent one each other for their continued existence. Asymptotic freedom can then be explained from this perspective. When the energy density of the region surrounding quarks is increased, they begin to act more like particles. This is what is termed asymptotic freedom. As soon as you start to change the energy density surrounding the standing wave centers, wave reflection at the boundary of the standing wave centers starts. The greater the difference in energy density at the boundary, the greater the amount of reflected energy. Just like with the electron, this process gives the quarks greater independence and persistence. In other words, they start acting more like particles.

Quark Confinement, Due to Energy Density:

As mentioned at the start of this paper, the repulsive Casimir force of a spherical conducting shell is also true when applied to Dirac's vacuum as shown in 1983 by Milton. In the MIT bag model the hadrons are treated as bags containing freely moving quarks. Quark confinement implies that there will not be any quark currents through the bag. The Casimir energy is associated with the bag confinement. p.355-360 **[6]**

Quarks are effectively confined by the high energy density of the region they are formed in. In the Anti-de Sitter Bag Model view, quark confinement in gauge theory is achieved by describing hadrons as strongly curved universes. In our model, the AdS bag model works because of the large amount of wave reflection at the boundary of the nucleon. For the sake of Mach's equations the boundary of the hadron can be considered the limits of the Hubble sphere. As wave reflection is occurring at the boundary of the hadron and not the boundary of the quarks, the quarks are dependent on this reflected wave energy and the waves of other quarks within the nucleon. So in a sense, every nucleon is its own small universe. This is because all of the particles within it are dependent on the wave energy of all particles within it.

Some bag theories try to link confinement with the color groupings of quarks. Although confinement is somewhat related, the grouping of quarks will be dealt with in its own section.

Quark Grouping, Why Three Particles?

A 2-D fluid model which looked at the life of eddies within a spinning sphere was the most informative of the models used. Over time, a group of three eddies proved the most stable. The most stable of which was a group consisting of two large eddies with the same spin and a smaller third one between them with a spin that was the opposite of the other two. The next most stable structure that would form had two small eddies of the same spin and a large one with the opposite spin between them. However a binary system of eddies would form fairly often, but was not as stable. Other combinations did arise, but were so unstable that they did not last for long. It seemed that *those combinations which effectively filled the space they existed within, with the least number of particles, were the most stable, and therefore favored in the formation process.*

This also supported the Minimum Amplitude Principle, but added some new insight. These structures did not favor groupings of 3 similar sized particles, but a mixture.

The quarks are confined by the high energy density, but it seems some of that confinement could be self imposed. We have seen that a system of three particles is a stable structure, let us explore this more. The three quarks can be modeled as a system of three coupled harmonic oscillators. Using either the equation for MAP of the Superposition principle of wave mechanics, you can find three quarks whose combined amplitudes creates a wave amplitude about 1/3 the size of the electron. The same size as the nucleons. The three quarks are sharing the load of creating a stationary wave that can interact like a standing wave, but has three finite center amplitudes instead of one.

Postulate #4 Quarks have a Fractional Charge because they Share the Charge of a Single Particle due to the nature of Confinement they are created in.

If quarks share the load of maintaining this waveform, could they also share the load of the electrical charge? The nucleons are a quasi-standing wave with three finite centers. As we do not know the origin of charge, we can not say for sure. It does Seem plausible that this is the case and would account for why they do not appear outside the nucleus.

Outside of the hadrons, quarks may still exist, barely, in the Meson cloud, retaining their fractional charge. There they would try to establish composite particles we call the masons. If they escape the nucleus, their amplitude will change, and regain their normal charge, and be detected as electrons or positrons.

Just like with the superposition principle for waves, some to all of the charge could be cancelled out by the other quarks for a net charge of a whole value, 1or 0 net charge. So beside the number of constraints on quark types, we also have charge equilibrium to maintain also.

Quarks acting as coupled harmonic oscillators have another effect. If you try to separate two quarks, the Out waves between them will start pair production in the energy dense region between them, when there is sufficient room and energy for the standing waves to form, and the effects of harmonic coupling drops or stops.

Quark grouping is affected by the density of the region, their constraints as harmonic oscillators in resonance with each other, the Minimum Amplitude Exclusion Principle, the grouping effects seen above, charge equilibrium, and the harmonic amplitude needed for interaction with electrons in the atom. All of these combined effects limit the number and types of quarks that can be found.

So we have one last question to ask. do the quarks create the nucleon, or does the nucleon create the quarks? A nucleon can be created by other particles. Once created, other particles will try to take up residence. Then confinement due to size and energy density becomes the dominant factor.

We now have enough basic information to look at the proton and neutron.

Protons and Neutrons:

Given that quarks are governed by the same rules as the electron, we should be able to apply some of that knowledge to the quarks within the nucleons. The quarks, if they are harmonics of the electron waveform, should have an energy exchange mechanism for virtual particle like the photon. We see this in the gluons. But the gluons of the standard model must carry more information than photons do, because they must adjust the amplitude of the particles also. Remember what Milo's said about the energy exchange mechanism. *"An energy (frequency) exchange between resonances*, (standing waves), *behaves like two coupled oscillators in a circuit, or like two pendulums joined with a spring."*

This is exactly what we see with the quarks as a system of coupled harmonic oscillators. The waves of our field control the amplitude of the quarks, which accounts for changes in amplitude and mass, so the color grouping of the standard model is handled by this mechanism. Because the quarks do not have reflection at the boundary of their individual wave centers, each out wave has greater intensity than seen in the electrons Out wave. The quarks are strongly coupled where as electrons are not. That leaves only one job for the gluons to handle, and only one kind of gluon needed instead of eight.

Quantum field theory predicts a large energy density for the vacuum, the discrepancy between theory and observation is 120 orders of magnitude. By reducing the number of gluons needed from 8 to 1, we have reduced this discrepancy by over half. S.E.D. and our models suggest the Higgs field and boson are not needed in this framework, so this discrepancy can be farther reduced. **[10]**

The 'orbits' of the quarks is not like the orbit of the electron. Confined to a dense sphere with only each other to move around, and fully coupled harmonically, their orbits are very restricted. So our model of the electrons orbit can not be applied here without modification, but the same forces are at work. While on the subject of forces within the quarks, we have one more aspect to consider. The attractive force between

them. This is a van der Waals type force that is seen between two harmonic oscillators. We will explore this in greater detail in the section on nuclear forces. The gluons provide the energy to keep the quarks separate under the effects of this force. As we have seen from our model of the electrons orbit, when there is a change in the distance between the electrons and the nucleus, there will be a change in the number of stationary waves between them. These correspond to the photons and the energy they contain, or in this case, the gluons.

The 'virtual quarks' within the hadrons are virtual only because the existing quarks have the lion's share of the available space and energy at any given moment. When 'virtual' quarks appear, or other particles enter this region, the balance is upset and a particle will be ejected post haste to reestablish equilibrium. How much energy is released when this happens determines where the particle will end up. With enough energy it could escape the nucleus completely, or if the hadron is not in a nucleus to begin with, where it would be observed as an electron or a positron. Less energy and it could be captured by another hadron, starting the process over again. If it barely has the energy to escape, it will end up as part of the Meson cloud that surrounds the hadrons.

The Meson Cloud:

Just outside the hadrons is the meson cloud. The space density equation tells us that the region just outside the hadron will have a higher energy density then farther away. Because there is wave reflection at both sides of the boundary, there will be weak, secondary waves generated in this region. These two factors allow the escaped quarks to maintain a brief existence in this region. There is insufficient room or energy density to form another hadron, but other combinations are possible, the mesons. We have seen that these structures are not as stable as the proton or the neutron. Even the neutron is not stable for long outside the nucleus. Thus our model is in complete agreement with the standard model on this point.

Our model of the electron's orbit shows that there must be interaction between the electrons and the nucleus by means of the photons. The neutral pion decays into two photons. Conversely, two photons can make up a neutral pion. This here is a means for the electrons to interact with the nucleus by means of the meson cloud. It may also answer the question about the theoretical glue balls. The gluons are the photons of the quarks. The neutral pion, like the photon, is its own anti-particle. It has non-zero quark masses, so its makeup is inexact at this time. Could gluons that escape the hadrons be detected as, or like the quarks, form a new particle, the neutral pion? What it decays into would depend on the energy density at the time, so it could decay into gluons inside a hadron in our model. If so, it would make them an effective force carrier between the hadrons, just like with photons and gluons. This can not be answered by our framework at this time, but is an interesting concept to explore.

The Strong Nuclear Force:

The connection between the strong nuclear force and the van der Waals force is seen and calculated, but not explained by any current *intuitive* models. This effect is a universal phenomenon. The van der Waals force has been used to describe the attraction between atoms; it is even seen in the feet of Gecko's. Casmir saw it in the force between two parallel charged plates. The van der Waals force is also seen in the formation of molecular crystals and is the force that holds them. It is seen between ships on the high seas as described by Sipko Boersma in the *American Journal of Physics*, volume 64, No. 5 in May 1996.

"..., as in the case of the Lamb shift, the interpretation of the Casimir force in terms of the vacuum field is largely a matter of taste: underling this interpretation is a particular and arbitrary choice of ordering of field operators...and in particular a normal ordering allows us to attribute the Casimir force entirely to the ***source*** *fields...Why has it taken so long to recognize that the Casmir effect and other vacuum field effects have equivalent derivations in terms of source fields?...****"theoreticians have been discovering a steady stream of close mathematical connections between stochastic problems and dynamical problems." It has taken us a long time to recognize that QED was just another example of this.****"*** p.250-251 **[6]** So as to not get to deep into vacuum or source fields, we will treat it as radiation pressure at this time.

The van der Waals-Casimir forces can be explained from an electrical, classical, or a quantum mechanical

viewpoint. Looking at it as radiation pressure will allow us to bridge some of these as it is a universal phenomenon that holds for all types of waves.

"If a current element $\mathbf{i} = q\mathbf{v}$ *is placed in a traveling electromagnetic wave with an* $\mathbf{E}$ *and a* $\mathbf{B}$ *it will tap a power from the wave* $W = \mathbf{i} \cdot \mathbf{E}$*. At the same time it experiences a Lorentz force* $\mathbf{K} = \mathbf{i} \times \mathbf{B}$*. For the magnitudes of* $\mathbf{E}$ *and* $\mathbf{B}$ *we have* $E = c\,B$*, so the force K in the direction of propagation*

$K = W / c.$

As this is already true for the instantaneous force it will certainly hold true for the average force over a number of periods, The radiation pressure proper." **[9]**

That also means the absorbed power will then be re-emitted as secondary waves in the opposite direction of the attractive force. Exactly like our waves. The energy exchange at the finite center amplitude times this release of energy with the Out wave.

As the two hadrons near each other, the meson clouds begin to merge. With the increase in energy density from this, they start to act like 'real' particles, for reasons already discussed. This breaks the connection between the two hadrons and stops the van der Waals force between them. At the same time, the boundary between the hadron and meson cloud has become less distinct, as the energy densities on each side gets closer. As a result, some mesons can be absorbed by each of the nucleons at this time with ease. The increase in energy from this and the breaking of the van der Waals force moves the two hadrons apart, expelling particles in the process of reestablishing equilibrium. The cycle repeats. This is the repulsive mechanism for when hadrons get too close. Because the hadrons absorb and exchange mesons in this process, the proton and neutron can "swap" places by converting one into the other as in the standard model.

Now extend that model to a line of six hadrons, spaced evenly apart. The van der Waals forces between each of them balance out, if the ends are fixed. This is best done by making our line into a circle. In 3 dimensions we need to space the particles an equal distance from each other in a sphere. We now have the next shell of our model for the nucleus, and the next magic number, 8. Six in this shell and two in the first.

This also shows why the nuclear force has the property of *Saturation*. Each particles van der Waals force can only affect those particles on either side of them in the same shell, and the nearest ones in the shells above and below. Little of their Out wave moves past this region before being absorbed. The strong nuclear force is called that for a reason, where does the intensity of this force come from. The high energy density which is the medium for wave propagation.

Now that the basic shells of our nucleus are in place, lets move on to finish our shell model. We have good agreement with the current shell model, up to a point.

The Compressed Shell Model:

Our framework agrees with the shell model of the nucleus up to the addition of the 4th shell which has only 8 hadrons in it, where as the 3rd shell has 12. This arrangement does not balance the van der Waals forces as efficiently. Also there is no reason to assume that hadrons fill up their orbits like the old electron orbit model does. The hadrons have far less room to work with. Instead a slight compaction of the nucleons within their orbits can balance these forces. The following is a chart that compares this compressed model with the standard shell model.

Magic Numbers		2	8	20	28	50	82	126
Orbits	Shell Model	Compressed Shell Model Orbits by Magic Number						
1st	2	2	2	2	4	2	4	0
2nd	6	0	6	6	6	6	6	6

3rd	12	0	0	12	6	12	12	12
4th	8	0	0	0	12	12	18	18
5th	22	0	0	0	0	18	18	24
6th	32	0	0	0	0	0	24	30
7th	44	0	0	0	0	0	0	36

You will note that the 1st orbit changes from time to time in number, and is unoccupied in the last magic number given. The first orbit is the least stable of the orbits for balancing the van der Waals force, and is used as a fairly stable place holder. The last configuration does not use this orbit as it is more stable without it.

Now this stable structure is an ideal state the nucleus seldom if ever achieves. When it does, it won't last for long. Photons from the electrons, interactions from hadrons getting to close, virtual quarks appearing within the hadrons, all this keeps things active. just as the Uncertainty principle implies, you can never be sure of where an individual particle is at any given time.

Section 3: Gravity

S.W.A.P. and Relativity:

The examples of Einstein's field equations as they apply to a perfect fluid are too many to recount. In the first postulate put forth, energy density was shown to have the properties of a perfect fluid. Energy density exists everywhere. From the rarefied regions of space, to the heart of particles. Elastic and compressible with zero viscosity. It has the attributes of matter, without the drawbacks of matter.

Caroline H. Thompson in her "Psi-wave" theory said *"an aether that my intuition suggested was some kind of fluid."* that *"support the kind of complicated mechanism that Maxwell envisaged with its vortices interleaved with little ball bearings."* p. 1 **[13]**

It is a medium that can pass freely through matter and to which Maxwell's and Einstein's equations can both be applied.

Postulate #5 The Energy Density of Space is the Medium for Gravity Wave Propagation in Relativity.

In light of this paper it seems Milo's Waves are the gravity waves of relativity. Every particle then emits its own small gravity waves. The Out waves, through the action of the superposition principle, gain strength from shear numbers to become the force of gravity we know. Gravity is a van der Waals type force, as are the other forces due to waves we looked at. Only the wave intensity is affected due to energy density. Strong in the nucleus, weak in the vast empty reaches of space, but a force none the less.

Mach's Principle:

The combined Out waves of all particles become the In wave of those particles. As they enter the dense regions, they regain their intensity. This is why Mach's principle works for the general contraction from the van der Waals force in the electron orbit, or the gravitational tension at a given point in space. **[8]** Information is transmitted at the speed of light across space, modified along the way, but it is the particles closest to the receiving particle that has the largest impact on that wave information. The connection between the van der Waals force and gravity is explored in this paper based on SED theory by Cole, Rueda, and Danley. **[12]** Information is exchanged at the speed of light, so any spherical region can be treated as a subsystem of the whole as it contains the shared information of the whole. Mach's principle is a useful tool

that accounts for known and unknown relations in its balance, therefore it should be used when the exact nature of the interplay between forces is not understood, and only until those forces are understood and it can be replaced with a more exact solution.

Quantum entanglement could be explained through the interaction of these waves. Such a study would prove interesting, but outside the scope of this paper.

Postulate # 6 The Gravity Waves of Relativity are the Principle Waveform of the Universe.

The only force we can not directly tie to gravity waves are the EM waves which arise from the interplay of charged gravity waves and particles. The exact method of interactions between EM waves, the energy density and gravity waves still needs to be determined within this framework.

Curved Space:

If the energy density of space is the medium for gravity waves, that means space is not the medium. What does that mean for the concept of curved space? It has long bothered many that the matter/time contractions can be solved in a classical method that excludes the concept of curved space.
De Broglie once said, "When two theories, based on ideas that seem entirely different, account for the same experimental fact with equal elegance, one can always wonder if the opposition between the two points of view is truly real and is not due solely to an inadequacy of our efforts at synthesis." p.44 **[3]**
As we are on the subject of relativity, a thought experiment seems in order.

A long, long time ago, in a universe far far away, there were two planets.

The planet called Euclid, and the planet Non-Euclid. They share a common history and differ only in their view of the universe.

The planet Non-Euclid claimed that space was curved, and the shortest path between two points was a curve called a Geodesic line.
The planet Euclid claimed that only the yardstick used to measure space was curved, and the shortest distance between two points is a straight line.

Both have spacecraft that can travel at the speed of light. They agree to a space race to decide this once and for all. They pick a course for the race. It is through a corridor of densely packed stars and planets.

Both ships can travel forward at the speed of light, but they are not the same design. The Euclid ships are equipped with powerful maneuvering thrusters all around, mounted 90 degrees to the direction of thrust. Their computer system uses relativity to calculate the gravitational pull in any direction on the ship, and the gravity is opposed by maneuvering thrusters so that the ship maintains a straight line through space.

What happens to the ships, and who will win the race?

The Non-Euclid ship, just like a photon, will travel a curved path through space. As they are moving at a constant speed, they do not feel the effects of acceleration. They perceive themselves at rest, moving at the speed of light. At first they will see the Euclid ship as flying an erratic course, first moving towards the center of gravity, then away from it.

The Euclid ship will think their navigation computer has gone haywire as they are thrown sideways, first in one direction, and then the other. They see themselves as flying an erratic course also. The sideway thrust does not affect the forward speed of their ship, so they see themselves as traveling at the speed of light also.

Both ships are in the same frame of reference. They are made of matter, which is just a dense region of energy. So both ships are affected by the force of gravity. The crews of both ships are stuck in the same frame of reference.

There is one crew member however that has a frame of reference outside id the effect of gravity. The

navigational computer. It uses math to step outside the frame of reference to plot a straight course for the race, traveling a chord through the gravitational field rather than a geodesic line. But this requires an input of energy to achieve. In these extreme conditions, traveling at light speed, we can separate the forward thrust from the sideways thrust into their individual scalar values.

The Euclid ship will see the Non-Euclid ship as traveling slightly slower than the speed of light. The Non-Euclid ship will see the Euclid ship as traveling slightly faster than the speed of light. Yet both are in fact traveling at the speed of light. The Euclid ship will win the race.

A geodesic line through space is the most energy efficient path to follow, not the shortest.

This is seen from the start. The electron has the orbit it does because it is efficient to do so, energy lost and gained from waves equal out. To do otherwise requires an input or shedding of energy.

The illusion that space is curved is the result of the contraction of energy density and mass from the effects of gravity.

The warping of space is RELATIVE to our frame of reference. If our frame of reference is a rubber yardstick that bends (light), then we perceive that space is bent also. But if we know how much our yardstick is bent, we can correct for it. Thus we can use a mathematical yardstick independent of "Ridged Bodies" to measure space.

Postulate #5 The Curvature of Space is Relative to the Frame of Reference of the Observer.

This has always been true. Man at one time thought the heavens revolved around us. Math taught us that this was not the case, just an illusion of the senses. Then we discovered a new yardstick to use, light. However our yardstick is bent by gravity. It does not travel in a straight line. So it seems that all of space is curved. But our new yardstick is in fact the old one, for it was sight, caused by photons and light, which first gave us the impression that the heavens were curved and traveled around us. Einstein gave us the math to determine just how bent our yardstick is at any given point, and make corrections to it based on those equations.

As space/time diagrams are rooted in the same frame of reference as we are, they give the illusion that space is curved. Classical methods of calculating matter/time contractions do not suggest this, as they are in a different frame of reference.

Section 4: Cosmology

So what effect will non-curved space have on cosmology? The early universe? Actually not as much as one would think. There are already a number of theories that do not involve curved space. A Static Universe is the conclusion Milo arrived at. Space is not curved, and is infinite in 3 dimensions. A finite static universes based on Milo's work is W.S.M. theory, The Wave Structure of Matter **[11]**. However it is not the only possible conclusion based on this model. Expanding universes are also possible within this framework.

Postulate #6 The Universe was Created by the Same Wave Action as Particles, on a Massive Scale.

Random gravity waves within infinite space would be massive in amplitude, compressing the latent energy density with them. Picture any number of these waves converging on a single location in space from all directions. As they converge, they form a collapsing sphere with an extremely high energy density within it, all of this energy focused on a single point in space. They converge, merge, and continue their journey, now heading away from this point. This expanding ball of energy left in their wake would look like a vast explosion. The starting conditions are similar to the Big Bang model, with the exception that space need not be curved, and we have a well defined boundary. Just as many universe models as we have today are possible.

Conclusions:

1. Electrons models that are spatially extended in some manner, while having a point like aspect and an internal structure, appear to be best suited for a unified field theory. With the right use of ordering in the equations however, this is not a requirement and any model can be used.
2. Energy density can be used as a medium for wave theories.
3. The theory that all 1/2 spin particles are created by the same waveform solves much of the vacuum energy density discrepancy of Q.M. between theory and observation. This would simplify a unified theory, as some suggest a unified theory should be.
4. One waveform needs to account for many forces from the nucleus to gravity and pair production. Or at least give rise to other forces like EM waves through interaction.
5. Space can be treated as curved or infinite in mathematics and get the same results because they are relative to the frame of reference of the method used.

We are a long way from a unified theory. It is hoped this will be of some use in that effort.

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