The New Physics

by

Ray Fleming

Peer Review Edition B

Fleming Enterprises Publications
11303 Blackmoor Dr.
Austin, TX 78759
rayfleming.com

This Fleming Enterprises publication was published, written, edited and illustrated by Ray Fleming.

Copies of this publication may be purchased directly from Fleming Enterprises or a downloadable on-line version is available at rayfleming.com

Printed in the United States of America

That one body may act upon another at a distance through a vacuum, without the mediation of any thing else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man, who has in philosophical matters a competent faculty for thinking, can ever fall into it.

Sir Isaac Newton

Preface

The premise for this monograph is quite simple. We are at the beginning of a new century and the basic fundamental theories that we trust to guide us have changed little in the last seventy years. At the most fundamental levels our ideas and theories have achieved a state of intellectual inertia that we appear unable to overcome. But, if we cannot overcome the most fundamental of problems with our physical theories, then certainly the high level work that continues to go on cannot be taken completely seriously. It is time for us to step back and take another good look at the most fundamental underlying principles of physics if we are going to see an explosion of knowledge and growth in this century to match what we saw in the last.

Acknowledgement
I wish to thank Robert C. Tisdale PhD and Constantin “Dinu” Popa for the many wonderful discussions we shared.

Contents

1

The State of Physics

To begin I feel it is important that we have a perspective of the present state of physics in order to understand where we are, and the work that needs to be done to develop a more cohesive and logical structure for our fundamental theories of the universe. We need to do this because there is a tremendous amount of sentimentality and pride, even to the point of religiosity about our understanding of physics, not to mention the deification of numerous great scientists. Not that it is all bad, or that the people and theories do not deserve our respect, but we need to ask some serious questions, and develop even better theories. To this end I will touch on several major topics, to set the stage.

A. Classical Electricity and Magnetism

This classical theory has been shown to be an excellent model for electromagnetic phenomena at the macroscopic level. There are some deficiencies that are noteworthy. One fundamental complaint is that theory fails to explain how the force is conducted between objects. There is a general statement that there is a field, but what is the field, and what is it about the field that allows it to do work on an object. Certainly there are rather vague ideas about photons conveying the force, but then there is no real theory on how an object knows what the photon is telling it. What for instance is the difference between a photon that tells an object that it is being repelled versus being attracted. There doesn't appear to be any difference in photons as far as we can tell. And yet, electrostatic attraction and repulsion are undeniable physical phenomena.

We can also look at a basic autotransformer with two windings. As a current moves through the primary winding a magnetic field is created within the core. Then if the primary circuit is cut, the magnetic field collapses, and all the energy goes into the secondary windings. Even if the secondary circuit is not complete, the potential will increase until it arcs someplace releasing the energy. It has long been held that the magnetic energy is stored in spinning dipoles in the core material, at some microscopic level that is not well understood. But, what if the core is a vacuum, what then? What form do these supposed dipoles take then?

In these simple gross examples it can be seen that our knowledge of electricity and magnetism is somewhat useful for describing phenomena, but we don't have a clue how it really works at the most fundamental level. We also know that at atomic distances, the functions are no longer smooth, but take big jumps, requiring a theory to deal with this quantization.

B. The Photon

It's a particle, no it's a wave, no it's a particle, well OK, it's both. But how exactly does it accomplish this feat? The photon is nature's favorite way to dispense packets of energy and as such is critical to the overall dynamic of the universe. But in reality we know frighteningly little about what a photon really is and how it behaves the way it does.

C. Quantum Electro Dynamics

Quantum Electro dynamics (QED) was contrived as a means to describe the quantized nature of atomic spectra, and has been added to over the years to become a working method for describing atomic level electricity and magnetism, and particle physics. My first comment goes to the typical reaction of almost anyone as they undertake to understand QED for the first time. It is too complex to be a fundamental theory.

Even those who have developed a working understanding will usually admit it, and while it is not "proof", if 99+% of people's instincts are the same, then they are probably correct, and the theory should be critically reviewed.

What we seem to forget, and what is probably behind the mistrust of the theory, is that it still does not answer the more basic riddle as to why things are quantized in the first place. What is it about the structure of the atom that only allows electrons to be in certain energy states? What physical reality does the wave function represent? Or consider the even more fundamental question, what is the fundamental repulsive force between the proton and electron that keeps the electron from falling into the proton instead of forming a hydrogen atom? No one seems to know.

What we have is only a cookbook that can be used to make some simple calculations. One typical text states "This follows from the fact that *l* can never be larger than *n*-1." This is a typical case of a formulaic rule somehow taking precedent over descriptions of physical phenomena and somehow being mislabeled as facts. Scientists, in the absence of good theories, often stoop to numerology in an attempt to create a working model. That is all the old quantum mechanics was, with the new quantum mechanics being only slightly better with its more generally applicable wave equations. The wave equations give us answers that are in good agreement with observation once they have been properly massaged. But we are not engineers, at least I am not, and an equation that gives a correct answer may be useful for building things, but unless it also answers many of the deeper how and why questions a true scientist should find it to be inadequate.

D. The Weak Electromagnetic Force

What is this really? We know that there is an elegant solution, given the constraints, melding the electromagnetic and weak electromagnetic theories into the electro-weak theory. But, the

idea that there is a small amount of error that must be accounted for separately from electro-magnetic theory, does not justify a fundamental force theory at all. The electro-weak force should never have been separate in the first place, as it has always been nothing more than a failure of classical EM and QED to describe what is really going on. It is most likely nothing more than another case of the quantum mechanical solutions being fudged to match observation. We need to take a fresh look at the weak force and gain better insight into its origins.

E. The Nuclear Force

OK, now the quarks that make up the protons and the neutrons exchange gluons that hold them togeth..., hold everything. Here we are with gluons that sort of operate the way the photons are supposed to with electricity and magnetism, some kind of psychic mind meld for quarks. But we still don't understand the fundamental principle underlying why two protons, each with a positive charge, overcome their electromagnetic repulsion and stick together, provided of course that there is a neutron or two are around to help out.

What about the binding energy versus mass problem? The fundamental descriptions of the proton and neutron give us the impression that these are spheres of a given size and a given mass that is intrinsic to the particle. Yet when we look at the atomic masses of various isotopes we see that the atomic mass is not equal to the sum of the free masses of the constituent particles. We say that some of the mass becomes the binding energy of the nucleus. But if these particles are these hard and fast spheres then how is the mass changed? How is it that these sacrosanct bodies glue themselves together and exchange mass for binding energy? The theories are lacking at the most fundamental levels, even if they do allow us to make some useful calculations.

F. Gravity

This is the last of the biggies, the holy of holies, where two of the greatest gods of physics stand shoulder-to-shoulder defying anyone to attack their principles. And yet, as with quantum mechanics, who among us felt that general relativity was too complex to be the fundamental truth? Once again complex may be the wrong word, since every many-bodied problem is inherently complex to solve. So maybe the difficulty is that it is not intuitively obvious or easily understood. The classical theory of course works quite well on the scale of the solar system with a few pesky exceptions that general relativity is supposed to have solved such as the precession of the perihelion of Mercury problem.

But, what is going on here? Astronomers have been searching for decades for the 90% of mass that appears to be missing. Without that mass the present formulations of gravity and the universe as a whole won't work. And all the while the astronomers have to keep searching at the physicist's insistence that *their* theories are right. No one seems to want to speak aloud that a theory that is 90% wrong is well, wrong. I know I never got full credit for getting problem 10% right on a quiz. Given the circumstances though, we might give partial credit in this case, but a serious review is in order.

We can start by trying to figure out why a spiral galaxy is structured the way it is. No one denies that it is a fundamental example of forces in the universe, and yet, neither of the prevailing gravitational theories comes close to offering a reasonable explanation for the spiral formations. The bottom line is that no theory of gravitation should be taken seriously if it cannot account for the structure of a spiral galaxy.

G. Summary

I will admit to being a little harsh and overly simplistic, but I could go on and on with numerous other examples. The point is that the state of physics is not all grand and wonderful. We

still have those persons, like annoying little child tugging at our trousers saying, "but why" to every answer we can think to give, and they deserve an answer. And while the truth is that there are always deeper questions and new layers of depth to our knowledge, like an onion with infinite layers. Unfortunately we have not made much progress over the past 70 years at trying to get to the next layer of the onion. Not that there have not been many wonderful accomplishments built upon the existing models, but physics seems to have stagnated in its own hero worship rather than moving forward toward deeper understanding.

With this introduction, I hope I have conveyed some little taste of where my mind was with regard to physics as I allowed myself to ponder the problems in an attempt to find some cohesive theory to tie it all together and achieve a more fundamental understanding of the universe.

2

The Rules

As with any endeavor it is good to set the guidelines. Because our knowledge of he universe is as flawed as it is, we must be able to start with a clean sheet of paper, and use only those things that we know to be true from experiment. As well, we must be able to distinguish the experimental results from the theoretical bias of the experimenter. These rules are a combination of fundamental philosophy about science and the universe and truths based on past experience.

1. **Every theory ever known is wrong.** Over the course of a few or even hundreds of years, every theory will be shown to be incomplete, oversimplified, partly wrong, or completely wrong, no matter what. So, every theory is worthy of being questioned. The best we can hope for is oversimplification, particularly at the beginning. So that is what I will strive for.

2. **Start with an intuitive model.** A mathematical model is important, but it is easy to hide overly complicated or even erroneous ideas in mathematical equations. It is equally easy to reject and refuse to consider a solely mathematical model, by not taking time to understand it. If an idea is simple enough to be fundamental, it is simple enough to be described in a simple intuitive manner and in plain language. The mathematical model and precise physics language comes later.

3. **Everything moves because it is pushed.** And, even if it is at rest it is being pushed in order to stay at rest. We must always have a physical model for a force. If

no competent person should fall into the trap of believing in force at a distance theories, then why are with satisfied with models that fail to account for a physical mechanism for every force. Particle and celestial bodies are not clairvoyant. A body moves because it is pushed and something is pushing it. A theory that does not account for a mechanism behind a force is, at best, incomplete.

4. **Avoid using names.** Through the years we have developed such a reverence for individual accomplishments that it clouds our judgment about whether their ideas should be reexamined. Someone with new ideas faces an inquisition of sorts where they are at best ignored and at worst attacked as heretics, so we will attempt to minimize those reactions until the intuitive model is solidified.

5. **Stick with what is known.** So many theories start with having something new to help explain a phenomenon, whether it’s a graviton, or a coordinate system, or a quark, or neutrino. No one ever found a more fundamental solution to a problem by adding stuff to existing theories. In the absence of physical evidence we must avoid making up new things to help solve our intellectual challenges, for they only introduce entirely new sets of problems that are usually only weakly supported by the physical evidence if they are supported at all.

The rules can be difficult to get used to, but they are intended to help us strip away our prejudices so that when we have distilled a problem down to one and only one possible solution, we can conclude that it must be correct regardless of how odd it may seem.

Now we embark on an exploration of our world, I am not promising to answer every question, or consider every possibility, or peel away every layer of the onion of knowledge. But I will attempt to distill the problems down to the simplest level, so that only the simplest solutions will do. These solutions should by their simple nature also have the broadest possible applicability, and serve as a foundation for additional work. These are the seeds of a few ideas that I hope will grow and mutate into theories that will give us the tools we need to make the 21st century a century of great discovery.

3

Electricity and Magnetism

How does electricity and magnetism work? As pointed out previously, the biggest problem with the basic theory on a large scale is not with it producing wrong results, but the lack of an underlying mechanism to understand the interactions.

To begin, we need to look at a charged particle, say an electron in space. If an electron is near matter, its field will cause other matter near it to become polarized. That is, the electrons and protons separate in nearby space with the positive dipole preferentially facing toward the local free electron, as simply illustrated in Figure 3-1. So, a free charge can change the polarity of local matter.

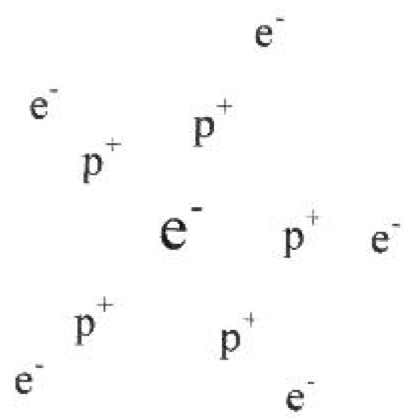


Figure 3-1 A free electron surrounded by hydrogen atoms that are polarized in response to its electric charge.

But what happens if nearby space is a vacuum? Or better yet start with the question, what is in a vacuum? As to the second question, the one thing that we do know that exists in a vacuum is vacuum fluctuations. These so called virtual particle pairs consisting of a particle and its antiparticle that flash in and out of existence in the time allowed under the uncertainty principle. So while we think of a vacuum as being nothing, it is in reality a soup of virtual particle pairs. And, yes, while the idea originated out of quantum mechanical theory there is experimental evidence tied directly to this phenomenon. One piece of evidence is a close range force that causes objects to be attracted to each other and another is known by small shifts in electron orbital energies.

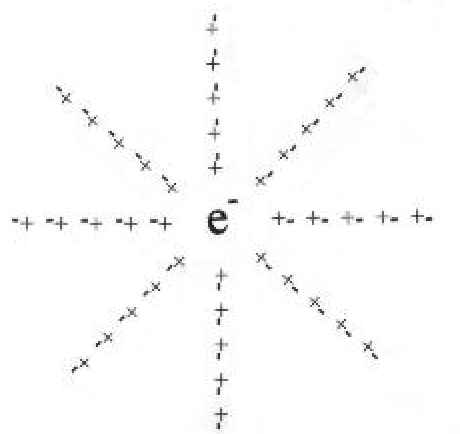


Figure 3-2 A free electron surrounded by virtual particle pairs that are polarized in response to its electric charge.

From here on I will use the term "virtual" from time to time when referring to these vacuum fluctuations, but keep in mind that they and their influence on the universe is very real.

Why is this important to electricity and magnetism? It is important because these particle pairs are dipoles, and as such will be influenced by the local field in precisely the same way that free particle dipoles are. As illustrated in Figure 3-2, a free electron will have a sea of particle pairs around it that are at least partially aligned relative to the influence of the electron's charge.

This alignment is not due to a force at a distance but is due to a contact interaction where the virtual particle pairs are in contact with the free particles, and adjacent virtual particle pairs. The question of what constitutes a contact interaction at the particle level and the precise dynamics of such interactions are questions that will have to be dealt with at a later time.

Positively charged particles will partially polarize the vacuum fluctuations in the opposite orientation from negatively charged particles. Remember that I use the word partial in an intentional way, because the number of particle pairs that exist instantaneously is very large, and a single unit charge will only influence a small percentage of them.

So what happens now when two particles of opposite charge, say an electron and a proton are near each other in space. In this case we have the effect illustrated in Figure 3-3 where particle pairs form a virtual bridge between the particles.

e- +- +- +- +- +- +- +- +- +- +- +- p^+

Figure 2-3 A free electron and proton with a row of polarized virtual particle pairs lined up between them.

Then if we look at two like charged particles, we have the situation shown in Figure 3-4.

e^- +- +- +- +- +- -+ -+ -+ -+ -+ e^-

Figure 3-4 Two free electrons with a row of polarized virtual particle pairs lined up between them with like charges in opposition at the midway point.

But wait a minute. In this case we end up with two like virtual charges butted up against each other, which should of course repel each other. Would not the natural course of things be for the vacuum fluctuations to try to reach a stable equilibrium state? We expect that it should and does. The virtual pairs will move in an attempt to achieve an equilibrium condition. To accomplish this, the like charges deflect away from each other leaving a hole in space as shown in Figure 3-5. Then a new virtual pair comes in between them, then another, and another, and another.

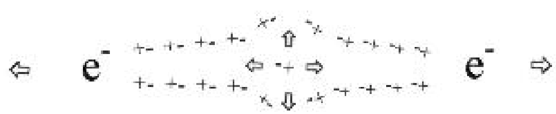


Figure 3-5 Two free electrons with virtual particle pairs between them showing the deflection in the center and a new pair coming into existence pushing the electrons apart.

As each new particle pair arrives on the scene it is forced to align with nearby polarized particle pairs and subsequently deflects to avoid like charges. This creates an increase in pressure in the space between the free particles. The virtual

particle pairs push against adjacent pairs, which in turn push against those in line toward the particles. This pushes the particles themselves apart, and is the essence of electrostatic repulsion.

What happens to the virtual particles are not in the direct line between the charges? They will also have new pairs show up between them to push them apart along an axis parallel to the charges. But since they are not on axis, the lines of virtual dipoles get pushed along a curve oriented away from central point. The virtual pairs trace out the well known repulsive electrostatic field lines as shown in Figure 3-6. But they aren't field lines at all, but rather, virtual particle pairs acting as simple dipoles instantaneously lined up end to end.

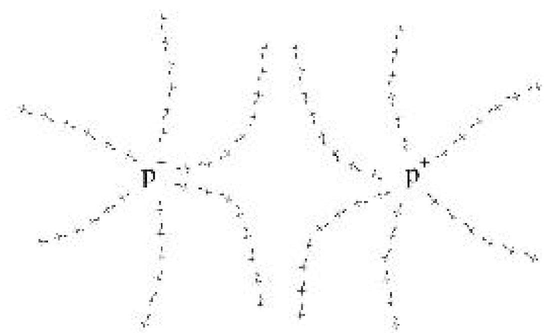


Figure 3-6 Two free protons with polarized virtual particle pairs oriented between them forming the well-known electrostatic repulsion lines.

So now we return to the electrostatic attraction model. In this case the virtual particle pairs line up end to end. And what happens as each pair disappears? As each pair contracts toward annihilation it appears to pull on the chain of particle pairs. Then when it has gone, the space available for the next pair is smaller so pairs and/or longer wavelengths get excluded.

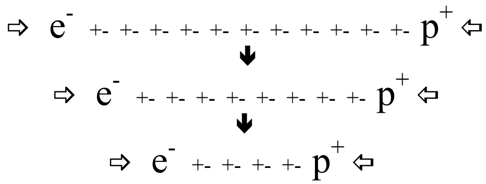


Figure 3-7 A free electron and proton being pushed together as the available space for virtual particle pairs between them disappears.

We need to remember that there is a general pressure being exerted on the particles from the outside, in particular a component of this pressure can be thought of as being on the line between the particles. You may ask, what pressure, where did that come from? From the principle of inertia we know that an object will stay in motion unless acted upon, and it has long been thought that something is in fact exerting a tangible force simply to maintain the position. We will return to inertia later, but suffice it to say that we should think of electrostatic attraction, or any other force for that matter, as a dynamic pressure situation. The electrostatic attractive force is not really due to the virtual dipoles between the charges actually pulling them together. But, the alignment of some of the virtual particle pairs between the oppositely charged particles leads to a reduction in the pressure pushing them apart relative to the pressure pushing them together.

As with repulsion, when we look at the off axis pairs we see that as pairs are excluded, the strands get pulled toward the axis. What we see then are stands of virtual pairs that follow the well know field line diagram of electrostatic attraction, as seen in Figure 3-8.

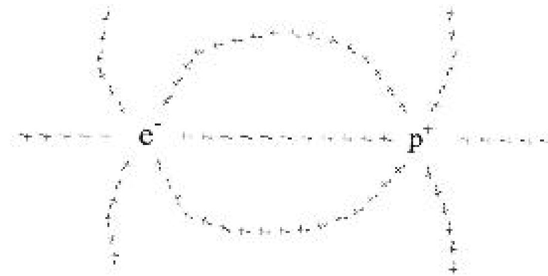


Figure 3-8 A free electron and proton with virtual particle pairs between them showing the lines of electrostatic attraction.

Next we will examine magnetism. In order to understand the origins of the magnetic field we need to see what influence a moving charge has on the vacuum fluctuations. To start with we will consider an electron moving through free space. As with the static case we see re-orientation of the virtual particle pairs with a percentage of positive charges oriented toward the electron. The charge is in motion relative to some of the particle pairs, so as the electron moves, the virtual dipoles will rotate to maintain their orientation relative to the charge.

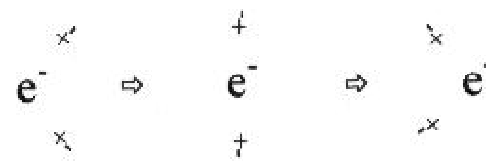


Figure 3-9 A free electron in three separate positions. Two virtual particle pairs rotate in response to the electron motion.

To do this they rotate about their center point. Figure 3-9 displays this change in orientation as the electron moves along a line.

Next, we need to look at a series of charges in motion instead of looking at a single charge. Of course a series of charges in motion constitutes an electrical current. The virtual particle pairs rotate in response to a charge, and continue rotating for the next charge, and so on. This leads to virtual pairs rotating relative to the current. Each pair though exists for only a brief moment, and may not complete 180-degree rotation. But its rotation affects other adjacent particles, causing them to rotate, thus conserving angular momentum. Then a new pair comes into existence in the empty location and is influenced by the momentum of the surrounding pairs. Figure 3-10 shows an illustration of spinning virtual particle pairs.

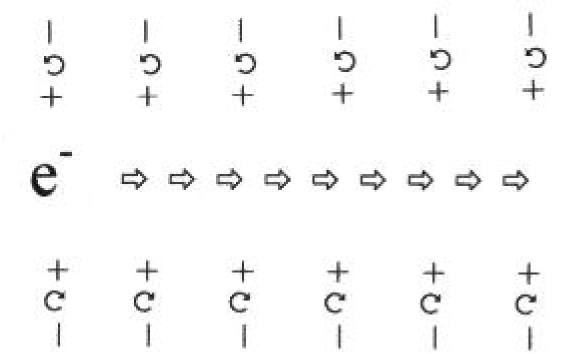


Figure 3-10 Electrons in motion along a line induce rotation in surrounding virtual particle pairs.

The reverse effect is also true in that a sea of spinning particle pairs can induce a current in a conductor. We only need to remember that the angular momentum of the spinning virtual particle pairs must be conserved. This can be accomplished in a couple of ways. The spin of one pair can induce spinning in other nearby pairs, which can induce a replacement pair to spin. Or, if there is a nearby conductor, the spin can induce charge movement in the conductor converting the angular momentum into linear momentum within the conductor.

To derive the standard magnetic, or B, field concept we only need to refer to the right hand rule. If you hold your hand with your fingers curled inward and your thumb point up, and then align your fingers so they point in the direction of particle rotation, your thumb will point in the direction of the B field, Figure 3-11. With this simple translational technique it is possible to see how virtual particle pair motion and classical magnetic theory relate to one another.

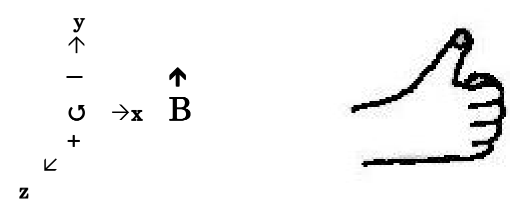


Figure 3-11 The right hand rule to determine the direction of the magnetic, or B, field shown here pointing along the y-axis.

The electrostatic, or E, field is even simpler since the alignment of the field is in a line with the polarized charges going from negative toward positive, Figure 3-12.

+– +– +– +– +– +– +– +–

← **E**

Figure 2-12 The electrostatic, or E, field points in the direction of the positive virtual particles.

From there we can relate the virtual particle force model of electricity and magnetism to the classical model, and ultimately derive all the classical equations. By understanding the mechanism we now have a deeper insight into the workings of the universe and gain a more fundamental understanding of how all the various classical EM devices actually work.

We would also expect that there would be no magnetic monopoles, since the magnetic force is due to virtual particle pairs that are always dipoles.

4

The Photon

With all the science that abounds regarding the photon there is a real lack of knowledge of its physical makeup, and how it obtains its characteristics. Except, there is one experimental observation that crops up repeatedly. A photon appears to be, at least briefly, during any interaction, the center of an electron-positron pair with a separation distance of half the photon wavelength. At the risk of being quaint we will follow the cliché that if it looks like a duck, and quacks like a duck, then it's a duck. Or, in this case, proceed with the notion that a photon truly, or at least partly, is an electron-positron pair.

We need to approach this in a logical manner. First we need to accept that photons are waves and have a wavelength and frequency associated with it. As such, it will have a minimum and maximum point and twice per wavelength it crosses the zero point, as simply illustrated in figure 4-1.

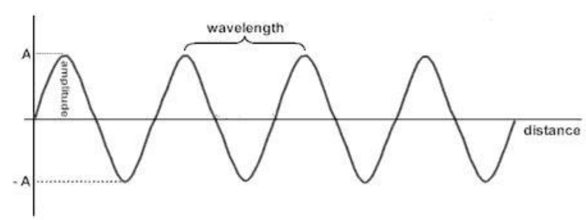


Figure 4-1 A photon represented as a sinusoidal wave.

We can imagine that the minimum or maximum are the points where the virtual electron-positron pair is at its maximum point of separation, and the zero point is where the pair has annihilated. We would then have particle pairs that comes in and out of existence twice per wavelength, and we can visualize them in a flip-flopping motion, rotating end on end, first one way then the other. They have one positive-negative orientation in the first half wave and the opposite orientation in the second half wave. We then see a maximum amplitude on one half wave and a minimum amplitude on the second half wave that are directly correlated to the charge orientation of the pair, as seen in figure 4-2.

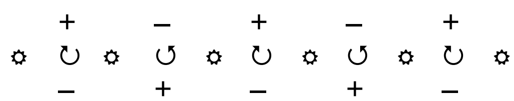


Figure 4-2 The photon represented by a series of electron-positron pairs with each successive pair rotating in the opposite direction between annihilation events.

If we follow the particles motion, the positive charge moves along the sinusoidal waveform in the positive direction. Interestingly, the negative charge follows another sinusoidal waveform that is 180 degrees out of phase and traveling in the opposite time direction. This explains how a photon is its own antiparticle since it can be viewed as being both matter and antimatter simultaneously, traveling in opposite directions as illustrated in figure 4-3.

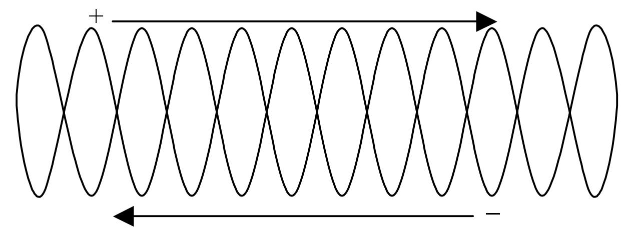


Figure 4-3 The photon represented as a positive charge wave moving forward and a negative charge wave moving in the opposite direction.

This model matches the field model as well. The standard photon description calls for a photon to have an oscillating E field along one plane and a B field oscillating perpendicular to it. In this new model the E field is determined by the orientation of the oppositely charged particles first in one direction and then the other.

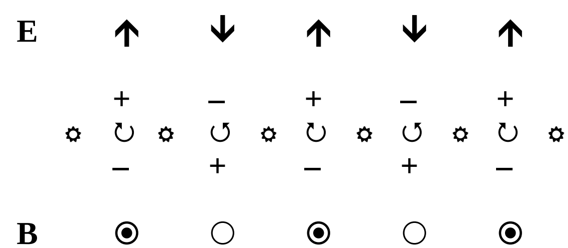


Figure 4-4 The E field points in the direction of the positively charged particle and alternates up and down. The B field points along the axis of rotation and is alternately point into and out of the page.

The magnetic, or B, field is directed outward along the axis of the dipole rotation, so it is perpendicular to the E field, and during each half wave the central electron positron pair rotates in the opposite direction. This is illustrated in figure 4-4.

But, how does the next particle pair in line know what it is supposed to do or even that there is a line of virtual pairs making up a photon in the first place? To answer this we first must consider what effect the central photonic pair has on the surrounding virtual pairs. We would expect that the rotation of a single pair would induce rotation on adjacent pairs, and the pairs adjacent to them, and so on toward infinity. Then, as with the magnetic force, the rotation of the field of virtual particles can in turn induce rotation on a pair that is created in space at the point of annihilation.

But why would a new pair be created with exactly the right energy, right rotation, at that place, at that exact moment in time? It cannot be purely chance or coincidence. Once again, we look at the magnetic force example. In that case once a field of rotating virtual dipoles is established by the motion of current, if the current stops, the virtual pair rotation stops, and finds something, usually other virtual particle pairs or a nearby wire or other conductor to accept the energy and dissipate it in some fashion.

The virtual particle pairs near our photon do the same thing. When one central photonic pair is annihilated the amount of energy stored in the adjacent rotating virtual particle pairs is at a maximum. Without something driving their rotation they will need to find a way to release the energy, and what they do is induce the creation of a new central photonic pair of exactly the proper energy, and at the proper space-time coordinates, rotating in the opposite rotational direction from the last pair. How this precisely occurs is a deeper question that needs to be examined, but suffice it to say for now that the principle of conservation of energy requires that it be true.

In this manner, we can have energy distributed across a wave front, and yet have a central focal point that the energy can move in and out of and achieve the natural duality that has been so well established for a photon. This interplay between virtual particles is evident all along the photons wave front as seen in figure 4-5.

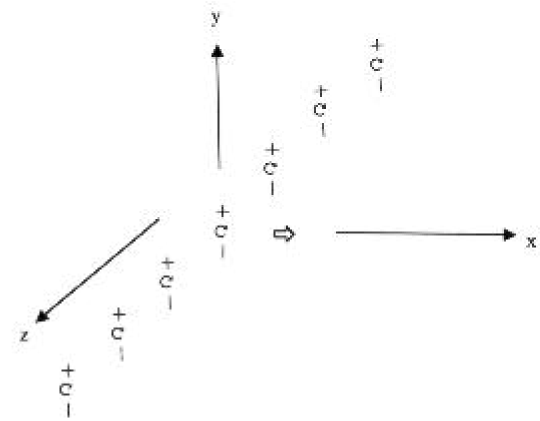


Figure 4-5 A photon moving in the x direction with virtual pairs rotating in response to the central pair along the z-axis.

While the pairs along the wave front are all shown the same way, that is not the case. If it were, the total energy in the photon would be infinite, so the amount of energy declines with distance from the central pair and the character of the particle pairs changes in some way to compensate.

We can also consider how this model relates to light polarization. If the vibration is along one axis, then the photon is polarized along that axis. If the axis of vibration changes over time in a corkscrew fashion then the photon is circularly polarized. We can also see that the rotation of the nearby particles will extend outward from the central pair, and when they hit some object, the relative orientation between these particle pairs and the object will have an effect on what happens to the photon, whether it is scattered or transmitted as seen in figure 4-6 a and b.

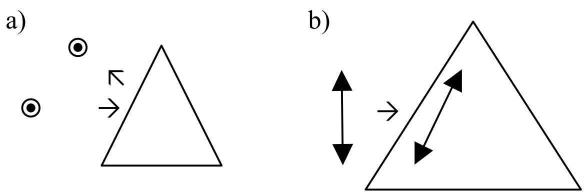


Figure 4-6 a) A photon polarized with its axis of rotation into the page has a wave front that is parallel with the surface and is more easily reflected. **b)** A photon polarized with its axis of rotation up and down and at an angle relative to a surface will be less likely to be reflected and will undergo refraction.

When the surrounding matter moderates the photon's velocity or otherwise changes the interactions between the virtual particles that are part of the wave front, it leads to all the well-established optical properties. While figure 4-6 only mentions the virtual particles along the axis of rotation, there are always pairs that are influenced by the photon propagating radially outward from it perpendicular to its direction of motion. The virtual pairs that strike the surface first will slow down, or speed up as the case may be, while the other part of the wave continues onward. This speed differential causes the wave front to change direction, a phenomenon we call refraction.

Of potentially more importance is how this photon structure relates to diffraction. From diffraction experiments we know that the wave front has structure. So, the virtual particles along

the wave front form a structure related to the wavelength. We also know from the dual slit experiment that a photon can be split between two slits on either side of the central photonic pair. Since the photon can rematerialize on the other side, we then know that the energy can be channeled though other points along the wave front as long as they match up with peaks in the wave structure. We also know from this experiment that the photon reappears as if it matched the speed of light along the straight-line path, when in fact the energy flowed through two distant slits. So, if you consider the distance to and from the slit in addition to the straight-line motion of the photon, we must conclude that the velocity along the path through the slits is faster than the speed of light. This tells us that the rotation of the adjacent virtual particles propagates at a rate that is much faster than the speed of light. This property is important and we shall return to it later.

One other point for future discussion relates to the rest mass of the electron and positron. Pair production of these two particles requires 0.511 MeV of energy, and since there is a vast array of photons with energies substantially lower, we must consider that we are not truly discussing the electron and positron at all. Or, in order to not contemplate new particles at this time, they may not be in the same state as when they exist as free particles.

In order to avoid confusion between free electrons and positrons or other particles pairs and the continuum of not really virtual particle pairs, I will refer to these particle pairs as partons from this point onward. Parton is a word that has been used by others for these pairs, and is in no way meant to imply that these virtual particle pairs are anything new.

When we look at the meaning of this theory from the broader perspective, one of the most significant points is that the photon does not appear to be an elementary particle. But rather, a photon looks like an elementary form of energy transport composed of partons.

5

Atomic Structure and Quantum Mechanics

Since quantum mechanics was initially conceived to deal with the complex quantized structure of the atom, it is important to look at the manner in which we can conceive of this structure in an intuitive way that does not rely on empirical formulations but rather physical forces. To that end we will look at some of the atoms of the periodic table and see how electron structures evolve from a force perspective. In each case the situation is far more dynamic then considered here, but we can use our intuitive understanding of force interactions to find the reasons for the energy states and use that as a starting point.

Rather than attempt to tackle quantum mechanics all at once, I will adopt the standard approach of beginning with the hydrogen atom. A hydrogen atom is of course composed of a proton and electron in what can be loosely described as being in orbit around each other.

A. The Hydrogen Atom

To begin with let us go back to the electron and proton in free space at a distance that is substantially larger than the effective radius of a hydrogen atom. At a large distance the interaction between them must be as described in the classical electromagnetic theory. And, just as discussed in Chapter 3 some partons align with their positive and negative orientation oriented in response to the position of the electron and proton.

This alignment is then responsible for a reduction in the ability of the partons between the electron and proton to press outward against the two particles. The proton and electron are then pushed together by the external pressure from the parton jitter. As the two particles approach each other, there are fewer partons between them. And, as the distance is reduced the electrostatic forces increase. The electrostatic force will affect a rapidly increasing percentage of a rapidly decreasing number of partons. In other words, the force gets stronger.

The particles will continue to approach each other until they get so close that some mechanism pushes outward with a force equal to the inward pressure. We can say this because we know that the electron does not fall into the proton in the normal scheme of things. It is this outward pressure that keeps the electron from being pushed into the proton that is the fundamental source of the quantization effect. It has a rapid onset at certain small distances. We do not have a force that pushes the electron into some tangential motion, so an orbital wave equation is inadequate.

If we look at our system, and only consider those things that there is evidence for, we are lead to the conclusion that this quantization of space at relatively small distances must be a property that is brought about by partons. There is no evidence that the electron and proton have this property in and of themselves along with some magical ability to express the characteristic over a distance. And, there is nothing else that is known to exist in that space.

There are three possible approaches to deal with this quantization. The first, and most traditional, is the one that says that the two particles trade photons. But we know that when a particle emits a photon, it will move in the direction opposite to the photons momentum. And, when a particle absorbs a photon, it will also move in response to the photons momentum. We can easily see how exchanging photons could push two particles apart. The electrostatic attraction pushes them back together, and the particles would again emit

photons. In this model, however, the photon energy must come from somewhere, and the only solution is that it would have to be converted from the particle's mass. So if the photon-trading scheme were true the particles would lose mass and eventually dwindle to nothing. You might say, what about the electrons momentum, could the photons come from that? But, if that were true, the electron would spiral into the proton, so that won't work either. Plus, we still don't have an explanation for how the electron goes from falling into the proton to having some tangential momentum.

A second simplistic approach we might consider is that the partons are of a fixed size, so that when one was removed a quantum jump would take place. But, there is a continuum of parton energies. It is impossible that there could be a simple numerical correlation.

The third approach is based on an idea that there is a continuum of wavelengths of aligned virtual particles between the electron and proton. Then as the electron and proton approach each other, wavelengths that are longer than the distance between them are excluded. And, as more and more wavelengths are excluded something happens to increase the outward force. Figure 5-1 illustrates our problem.

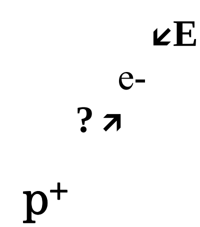


Figure 5-1 The hydrogen atom has an electron in orbit around a proton. The electrostatic force

> pushes them together, but we do not know what pushes them apart.

This type of force is in keeping with known cases of forces exerted by virtual particles, so we will keep that it mind as our best bet, while we wait and see what that new force may be.

If we take the easy way out, as is done with QED, and forget that we don't understand how the electron is repelled from the proton, but assume that it magically develops some tangential momentum. We can then study the forces associated with an electron in orbit around a proton. We will do so in the next chapter.

B. The Helium Atom

The helium atom has two electrons and a nucleus. For the purposes of this discussion we will think of as a compact +2 charged spheroid, because its radius is small in relation to the atomic radius. As with the hydrogen atom, electrons converge on the nucleus until they reach a point where the internal and external pressures reach a kind of equilibrium. We would expect that since each electron sees two protons, that they will be more strongly attracted to the nucleus than the hydrogen case, so the energy it takes to ionize the atom is higher than with hydrogen.

At this point, what we know is that we have a positively charged nucleus, two negatively charged electrons, and vacuum in between. As with any positively and negatively charged bodies we would expect some percentage of the partons to be polarized between them. We would also expect that between the two electrons there will be a central zone where like charges will have to be adjacent, leading to repulsion.

But if we think about it, when the nucleus is centered between them, the repulsion between the electrons will be at a minimum. And similarly, when the electrons move so that there is line of site between them as it relates to field lines, the electrons will be repelled from each other, forcing them back in the shadow of the nucleus. Since the electrons are always in motion they will wobble back and forth about the nucleus. This arrangement is shown in figure 5-2

As an aside we should note that this is simple explanation for why there are two and only two electrons in the inner (k shell) orbit of every atom above hydrogen. For no other reason than this lowest possible energy state can only be achieved with two electrons on opposite sides of the nucleus. Once a third is introduced there will always be a line-of-sight repulsion between at least two of the three pair combinations, and they will be repelled from one another.

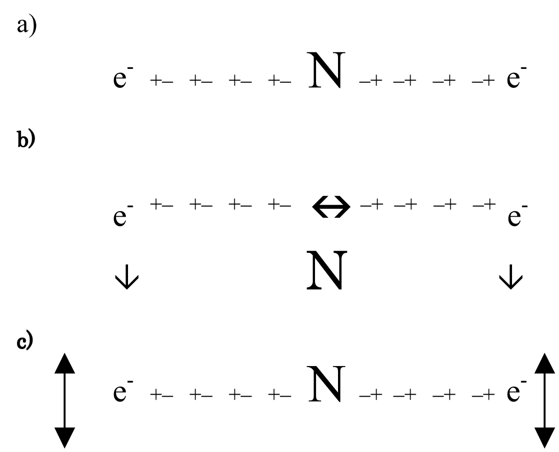


Figure 5-2 a) The helium nucleus directly between the electrons shielding them from each other. **b)** When the electrons come out from behind the nucleus they are repelled from each other. **c)** This leads to the electrons oscillating back and forth, and to the standard dumbbell like visual representation.

If we look at the above model we notice also that the electrons are in motion relative to the nucleus. Due to this motion the aligned virtual particle pairs will rotate slightly during their brief existence to stay aligned. In this manner a local magnetic field will be generated, if only briefly. This is illustrated in figure 5-3.

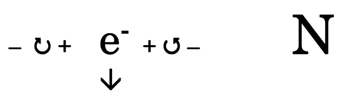


Figure 5-3 As an electron moves around the nucleus it causes the nearby virtual particle pairs to rotate.

But what happens when the electrons are exposed to each other and experience a sudden reversal in direction? The magnetic energy must go somewhere. Since we know no photons are created to dissipate energy, the momentum must be borne by other virtual particles, the electron, or both. The answer is most likely both. We will look into this more in the next chapter but we can see that the magnetic force must play a role in the momentum change.

From this simplified analysis of the helium atom we would expect the electrons would be on opposite sides of the nucleus, generally move in opposite directions of rotation, and to reverse direction whenever they are in electrostatic line-of-sight of each other.

C. Lithium

With three electrons one could predict an equilateral triangular structure. But in this case, as stated previously, the lowest energy state is when the inner two electrons are on opposing sides of the nucleus. The remaining electron is then repelled by both of the other two forcing it out to a much higher orbit. This is another clue that there is something odd in the theory of the atom, since electrostatic repulsion on its own would probably not lead to such a structure. The normal electrostatic repulsion force being inversely proportional to the distance squared does not vary quickly enough to cause the quantization effect and would most likely lead to the equilateral triangle shape if it were the only force at work.

But continuing on, one could ask if the first two electrons are in a straight line, wouldn't the third have the choice of a circle around the nucleus, but in fact there will seldom be a straight line, but rather an elongated triangular formation, meaning that the third electron will seek a position equidistant from the two inner electrons, but further away from the nucleus as shown in figure 5-4. Then it will move around in response to their motion.

Figure 5-4 A lithium atom with two electrons close to the nucleus on opposite sides with the third at a distance.

D. Beryllium

With four electrons we would expect a tetrahedral structure if the positioning was equal, but we still achieve the lowest energy state with the inner two electrons close to the nucleus and in opposing positions. The second two will also be aligned in opposing positions about the nucleus, but will align themselves on an axis that is perpendicular to the inner two electrons so they are at the furthest possible distance. We should note that the first two electrons of each shell, the s state, have a special status of attaining the lowest energy position. This is the case because of the oppositional alignment relative to the nucleus, and the first two electrons of each successive shell will be aligned more or less perpendicular to the last pair, as shown in figure 5-5.

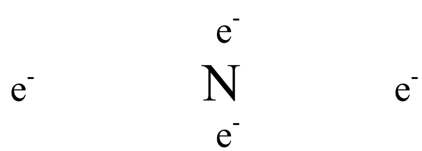


Figure 5-5 The beryllium atom with two pairs of electrons in opposition about the nucleus with the first two in a much closer position.

E. Boron

Following this scheme, electrons number five would lie along the remaining axis in an oppositional arrangement (Figure 5-6). We can call it the Z-axis if we have the first and second two in the X and Y-axis respectively.

The dynamic is a little more complex with some electrons being alternately in electrostatic line-of-sight with either two or three second shell electrons, still yielding two distinct energy levels. The electrostatic and magnetic jitter described

in the previous chapter is always present, and leads to the cloud representation we are so familiar with.

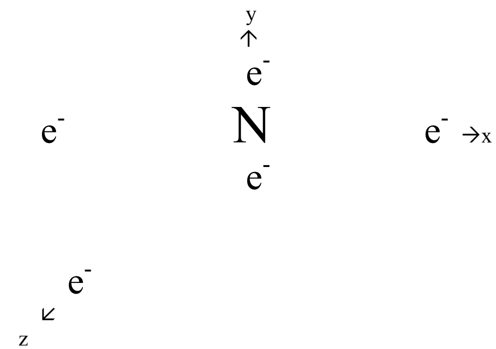


Figure 5-6 In the boron atom the fifth electron naturally falls along the remaining major axis (z) at a similar distance to the last two.

F. Carbon to Neon

At first glance we might think that the number six electron would take a position opposite of the number five spot, but here is where we start seeing a change in the dynamic arrangement. At this stage the lowest energy state occurs when the electrons in the shell are the farthest from each other, so they arrange themselves not with concern to polarity about the nucleus but geometric distance relative to the nearest electrons. This is not all together unexpected if we consider the electrostatic repulsive force, but tells us something of the other forces at play as well. With the three major axes taken the next electrons would obviously lie at the ends of the two axes that are roughly 45 degrees away from them, and ninety degrees from each other.

And so it is that carbon and nitrogen will have one electron in each of these states, and oxygen, fluorine, and neon will fill out the pairs. You may recognize these as the azimuthal quantum number p. The axial alignment for boron would then equate to the magnetic quantum number m=0, with the remaining two axes being 1 and –1 whatever that was supposed to designate.

G. Sodium, Magnesium & The Rest

Electrons eleven and twelve will seek positions in the holes of the previous shells that equate to the positions of the two inner K-shell electrons. These are commonly known as the 2s position electrons.

But why? Why are there not four more electrons in the second shell? We could certainly see them lying along the two other intermediate axes. And why are there not more than four?

Our intuitive reaction is that there must be some special distance where the electron spacing is stable. This distance is what defines both the shell radius and the maximum number of electrons in a shell. But what is it? We do expect electrostatic repulsion to be included in the force equation, but it does not produce such as sharply defined effect. It only changes at a $1/R^2$ rate, and we know the electrons are confined to much tighter positional tolerances from the narrowness of the atomic spectral lines.

It is related to the same problem we started with when we attempted to explain the hydrogen atom. Some kind of repulsive phenomenon that has a sudden onset is required to explain atomic structure. As with the hydrogen atom we need to examine the possibility of a wavelength exclusion phenomenon that induces a sudden change in the intensity of the outward force on the particles.

This atomic structure thought experiment could be extended through the periodic table with more electrons per shell at increasingly higher energies. Given that there must be a

certain minimum distance between electrons, there are more electrons in higher orbits simply because the surface area of the larger sphere is greater. Once a shell is filled to the point that there are no new positions that have the same degree of separation, the next electron will be forced out to a higher orbit. We will stop with Magnesium, since it is difficult to study the structure of higher atomic number elements without three-dimensional models.

In each case, we would like to think that the electron structure that is so well known is not just something we can model with a set integer rules and exclusion principles, but something we can understand by analyzing parton interactions and the forces that come from them. We expect that the reason the line spectra are quantized is because the force equilibrium solutions naturally occur in steps dependant on the number of and distance to other nearby electrons in electrostatic line-of-sight, in addition to some yet to be defined repulsive force that has a very steep rate of change over certain small distances.

We have uncovered a major problem with quantum theory in that it fails to give us a good physical description of the repulsive force between a proton, and an electron, or between electrons. This is definitely something we need to know if we are going to go about our business as physicists.

6

Wave Quantum Mechanics

While the previous analysis puts a face on the physical mechanics behind the old quantum mechanical numerology, a major question remains, which once pushed our predecessors toward developing a different approach. The problem they sought to solve, or at least successfully model, was an explanation for the fact that normal changes in motion of electrons in orbit around an atom do not yield photon emission. In the more general case any change of moment of a particle is accompanied by the emission of a photon, Figure 6-1.

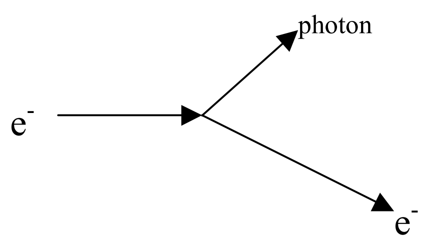


Figure 6-1 An electron changing direction and emitting a photon.

We also know that when an electron changes position from one orbit to the next it also emits a photon that equates to the energy change, figure 6-2.

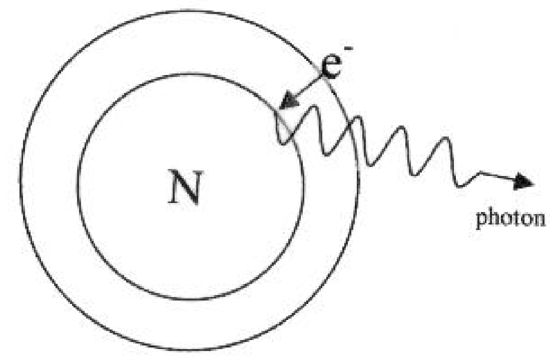


Figure 6-2 Photon emission after and electron changes orbits.

When a particle in free space changes direction, at least one photon or other particle must be involved to carry the momentum equivalent to the change in momentum of the particle. Electrons in an atom are constantly in motion relative to the nucleus, and yet, we do not see a stream of photons, as we might expect, to balance the changes in momentum. Of course, if an atom did radiate away its energy in this manner we expect that it would collapse in on itself, or change in some other similarly destructive manner. This is something else that does not occur. But, that leaves us with the puzzle about how momentum is conserved as the electrons jiggle around in their orbits.

The scientists of the day had within the previous generation come to terms with the photons seeming particle-wave dual nature, so there was a natural transition toward looking at the electron as a particle-wave phenomenon. With this idea in hand, a theory was formulated that described electrons as waves with a given probability that a particle would be at a given position, as one might expect from the uncertainty principle. The electron waves have a periodic wave nature. So, an electron shell can exist only when a certain integral number of wavelengths can encircle the nucleus in a regular in-phase pattern. Fractional wavelengths cannot occur. Thus this model yields a quantized structure. As for the thorny momentum problem, they conceived that all the energy was bound within the wave structure, regardless of where the electrons may appear to be at any given moment.

Unfortunately the wave equation does not explicitly address the physical form of the wave and how and why the energy and momentum is conserved within it. It also does not address the repulsive force needed to create the force balance in hydrogen and other atoms in the first place. It simply contains the unstated assumption that there is a balance and goes on its merry way.

But, to be honest, this was a rather ingenious approach for its time, and given the amount of evidence showing the utility of the theory, no matter how incomplete or contrived some solutions may be, we would have to believe that any alternate solution must yield similar answers for many cases. As with the photon, the important thing is to put a tangible physical reality in place of the ephemeral wave-particle duality interpretation. To this end we once again turn to what we know exists in the midst of the electrons and the nucleus, the partons.

To start with let us consider a single electron in the free space of a vacuum with nothing else around. We know that when an electron or other charge is in motion, some of the nearby partons will orient themselves with respect to the charge. We also know that these pairs will rotate to reflect the charge movement as shown in Figure 6-3.

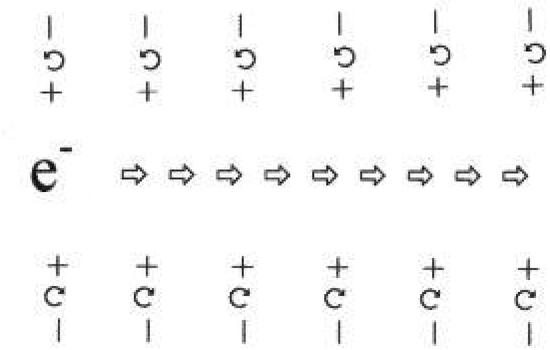


Figure 6-3 An electron in motion inducing virtual particle pair rotation.

But what happens to that rotational momentum when the particle pairs cease to exist? It has to go somewhere, or be counteracted in some way. We can only conceive of two possibilities involving the two things that are present, either the electron itself or other partons. The moving charge induces virtual parton rotation radially in all directions perpendicular to the direction of motion. The only way that the energy in the virtual particle can be transmitted back to the electron is if the electron stopped moving. But, since it can continue to move, partons must act in such a way as to conserve momentum. To do that, successive partons must rotate in the opposite direction as shown in Figure 6-4.

There will be an entourage of partons accompanying the moving charge expanded outward radially from the axis of motion. The energy propagates along the line of motion from one pair to the next.

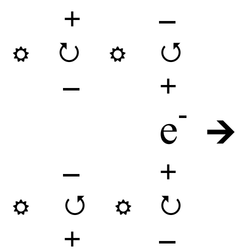


Figure 6-4 As an electron moves through space the adjacent partons rotate in response, but the next pair to appear has the opposite rotation.

If we consider then what would happen if the electron somehow stops in space, we will have some idea about how fundamental interactions work. At the instant the electron stops, some of the partons vanish, but the momentum cannot stop, and like the magnetic field of an inductor, when the current is turned off, the energy must go someplace. But with nothing around but more partons, all that can happen is that the next pairs that crop up along the original axis of motion have to have a reverse rotation so that there is no net rotational momentum. Then when those pairs extinguish, the next rotate back the previous way, and so on, as the pairs flip flop back and forth. Guess what? We have a photon that comes into existence at the moment the electron stops as illustrated in figure 6-5.

We can expect that a parton would come into existence along the central axis as the focal point to the wave front. The photon must also contain enough additional momentum to compensate for the momentum of the electron. So the energy within the central photonic parton will make up the difference, and will have the proper energy and wavelength.

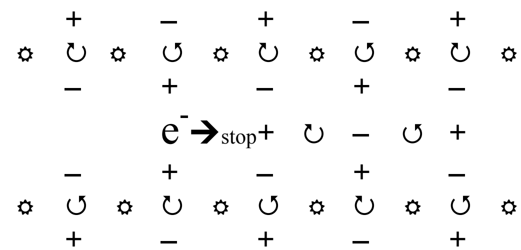


Figure 6-5 If an electron stops moving the wave continues with a photon at the center.

While we generally think of the photon being emitted from a source and impinging on the electron, we can consider the above interaction from the standpoint of the photon moving either way.

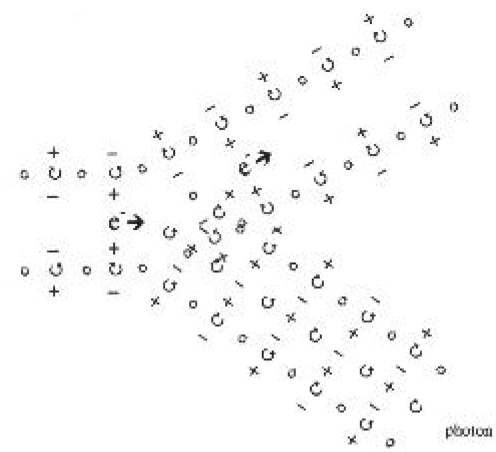


Figure 6-6 When an electron changes direction the partons accompanying it have their momentum split between the electron and a photon.

If we the consider the case where the electron changes direction retaining some momentum, the component of the momentum in the surrounding rotating particle pairs that did not follow the electron would lead to the formation of a photon. This is the more typical view we have of an electron changing direction in space as seen in figure 6-6.

With this model we have shown that an electron in motion produces a parton wave front much like that of a photon. We also know why and how the photon is either created, or destroyed, depending on your perspective. Also under the rules of classical physics we would expect an electron to radiate a photon when it changes directions in a similar manner.

Now, how does an electron change direction without leaving a photon in its wake? In an atom we have one or more additional particles, either in the nucleus or other electrons in orbit. These particles participate in the parton interactions. If we consider a single electron in motion around a nucleus we will see some polarized partons between them, and they will rotate between the two free particles in response to their relative motion. They will rotate in the same direction as the orbit. The virtual particle pairs outside the electron orbit will rotate in the opposite direction. What we have then is a rotating parton that has no coherent linear wave front that could be readily converted into a photon, so it must do something else.

What happens when a parton outside the radius extinguishes? Since the rotational momentum is not radiated away as a photon, the equal but opposite energy must be transferred to another virtual pair and/or somehow to one of the particles. Let's start by getting a better visualization. Assume we are viewing the situation from the top looking down along the axis. If we have an electron moving in a clockwise orbit, we would see virtual pairs inside the orbit also rotating clockwise

and those outside rotating counterclockwise, as shown in figure 6-7.

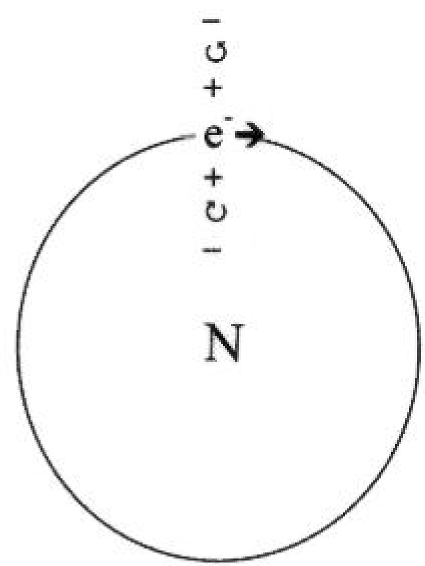


Figure 6-7 An electron in orbit around a nucleus inducing rotation in nearby patons.

If we follow the pattern we have seen so far, we would expect that the next parton that replaces the one being extinguished to the outside would have the reverse angular momentum, or counter clockwise rotation. And the parton before that would rotate clockwise. Then if we follow the electron around we will see a pattern of alternating or flip-flopping partons forming a circle. The waves must meet up in phase when we come back around in order for the wave formation to be stable. Now, since the sympathetic rotation propagates radially, not just one direction, we end up with a spherical wave-like shell, figure 6-8. So what we have is an electron riding the crest of a spherical wave, which is a good match for the quantum wave theory. The nature of a spherical wave also allows for a readily understood mechanism for energy storage and transitions at the atomic level.

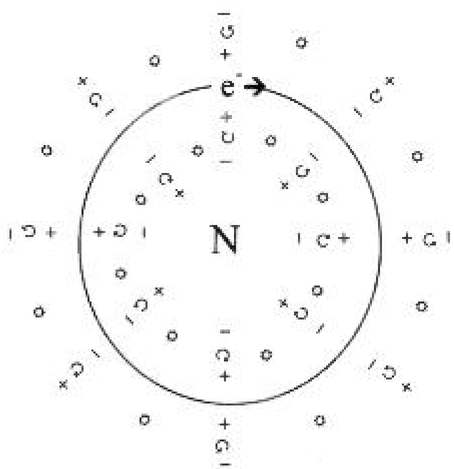


Figure 6-8 An electron in orbit around a nucleus forming a spherical wave of rotating partons both inside and outside its orbit. We would also expect charges that are not shown along the orbital path, much like a circular photon with an electron in the middle.

We also need to look at what happens within the entire sphere. We would expect that parton rotation near the electron orbit would lead to rotation in other partons extending outward and of course inward. We might think that the wavelength immediately inside the electron orbit must be shorter than those immediately outside the orbit, as shown in figure 6-8, if they are going to match up in phase over the entire 360 degree

circle. So what we would have in that case is a phenomenon that should be specified by arc length, instead of a fixed wavelength. But if that were the case, then the frequency would have to be the same regardless of the distance from the nucleus. But if we consider the $\lambda\nu=c$ relationship of light and the uncertainty principle, the partons on the inside would have shorter wavelength, higher energy partons existing longer then they are allowed by the uncertainty principle. And, partons the outside would have particle pairs with longer wavelengths at the same frequency meaning that they are faster than the speed of light. Neither of these is acceptable, so we must think of it differently, and come up with a better representation than figure 6-8.

Immediately outside the shell, we have a virtual sea of partons that are not in phase, and are in fact made of all available frequencies, like the rest of the vacuum. Inside the shell we should really expect the same thing, except that it has a much higher percentage of aligned partons because of the field strength. But since the electron is not infinitely small, there is some width to the shell, and we would expect the shell to be wider than the electron, so that there are partons on both sides being forced into rotation. Yet if all the partons involved in the shell structure have exactly the same frequency and wavelength, they would not all be in phase around the shell circumference.

That means that the electron must rotate. The partons inside the electron orbit must have a shorter wavelength and higher frequency, while the electrons outside the electron orbit must have a longer wavelength and lower frequency. In our earlier visualization of a clockwise rotating electron, the electron itself will have to rotate counter clockwise on the same axis, so that the inner partons have a higher frequency and the outer partons have a lower frequency than they would have if there were no rotation This is shown in figure 6-9 where the wavelengths now match.

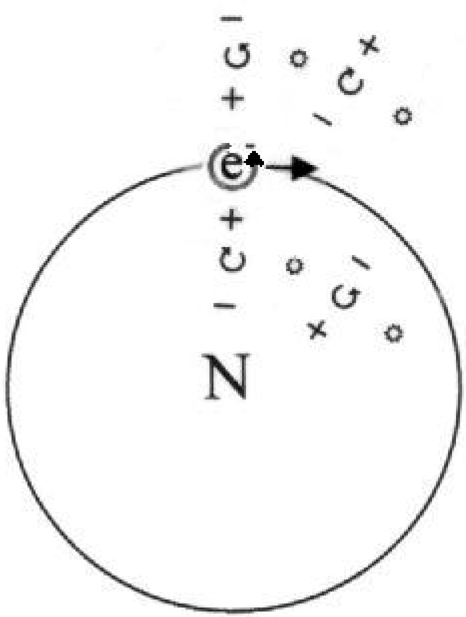


Figure 6-9 The electron rotates counter clockwise so that the outer partons spin faster, and the inner ones slower so that their rotation speed, and hence wavelength, and frequency is matched.

The spin, or angular momentum of the electron, will of course be unique for a given orbital solution, so it will appear quantized as well. This is an important reason for why there are so few allowable orbital solutions. This also gives us some idea of the thickness of the shell, as the influence of the electron spin declines rapidly beyond a distance a few times greater than the electron's effective diameter.

One critical piece of information we can garner from this scenario is that the electron is not acting like a point source of charge at close range. If it were a point source, its spin would not have any affect on the surrounding particles. Since we know that the nearby partons must respond to electron spin, the charge must be localized to the surface of the electron. This information will be important when we discuss the composition of the electron in the next chapter.

If we look closely at figure 6-9 we will recognize something else that we need to take into account, the magnetic force. The partons inside the orbit rotate in a direction to produce a magnetic field directed towards the reader. This will produce an outward force on the electron. The partons outside the orbit rotate the other way, and they produce an inward force. Since the particles on the inside are in closer proximity to two charges, their rotation will lead to a stronger force in the outward direction. The net magnetic force from the rotation points outward and to some degree must balance the electrostatic attractive force.

We could congratulate ourselves and say that we have a theory that is equivalent to QED, by we still have not answered the question of why an electron that heads straight toward a proton is repelled and somehow slips into an orbit.

Returning to the atom, our experimental evidence says that two electrons never have precisely the same energy state and spin state in orbit around one nucleus. Based on the above set of ideas, in order for two electrons to share the same shell, it would be necessary for the two electrons to be in phase with the partons that make up the shell at all times. The only possible way to conceive of that would be for them to be in perfect opposition about the nucleus moving on the same axis of rotation. We do not see this, and hardly expect such a situation to be stable if we consider the real dynamics of an atom. The integrity of the shell would be destroyed as soon as the atom came under the influence of anything else.

Could a second electron have the opposite spin state, but still share the same shell? Then it could move in the opposite direction from the first as long as it was in phase with the shell harmonics. But once they come into line-of-sight of each other they would be repelled and have to change directions, which means that they have to flip their spin axis as well. Would we expect that the transition of the repulsive force could be that sudden, and somehow contain the energy and thus not emit a photon? Once again, it is unlikely that such a situation would be stable, particularly once some outside influence disrupts the balance.

It is much easier to believe that every electron inhabits only one spherical wave, and changes of momentum do not have to be perfectly coordinated between two electrons. The thought of perfectly coordinated electrons seems absurd. Anyway we are helped out here in that we know that the energy states are slightly different, since we know that the atomic spectral lines have two similar but distinct lines for a given shell energy. If the energy state is slightly different, the second electron will form its own shell to traverse in.

Of course the standard reason for there being two energy states is that the protons and neutrons of the nucleus each have an intrinsic spin state, as has be shown in experiments of free particles. So the nucleus typically has a non-zero net spin state and even when there are even numbers of particles in the nucleus it still has a non-zero magnetic moment. The relationship between the spin orientations of the nucleus relative to the two oppositely spinning electrons creates a small difference in energy sufficient for the two electrons and their two separate spherical waves to co-exist.

The nucleus' spin cause partons to rotate in the opposite direction. This produces a small magnetic field. An electron rotating in the same direction as the nucleus will be influenced by the magnetic field, and forced inward into a slightly lower orbit. The electron orbiting in the opposite direction will be forced slightly outward and will take up an orbit farther out.

We have seen that spherical wave formations of partons allow for the encapsulated movement of electrons around the nucleus. We have seen that the theory falls out of our basic understanding of electro-magnetic principles as it applies to both free particles and partons. Of course, we still need to determine the nature of the atomic repulsive force that is needed to explain the distance relationships, and the fact that electrons do not fall into protons very often.

7

Elementary Particles

Elementary particle physics is a more recent invention. Particle theory began the discovery of the electron and proton at the turn of the last century, but the neutron and positron were not added to the list until thirties. Muons and pions were found in the forties. The antiproton was not confirmed until the fifties, with the vast remainder of the particle zoo coming later. Eventually there were hundreds, and each was categorized by mass, charge, spin, and over time a myriad of other characteristics need to make sense of the QED formulations.

In our desire to come up with something a little more fundamental looking, quark theory was developed as a means of paring this down to fewer particles that could be combined to form the hundreds of others, and new selection rules were added, such as strangeness and charm, in the process. But, what we have ended up with is a lot of selection rules we use to make the puzzle pieces fit, with little or no fundamental understanding of what these properties represent in terms of a real physical reality.

A. Electron-Positron, Proton-Antiproton

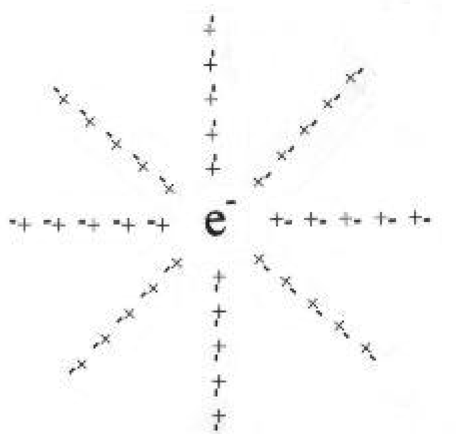
When searching for particles that we might consider to be truly fundamental, we should first consider the constituents of the simplest atoms, hydrogen and anti-hydrogen. The electron, positron, proton, and antiproton are the only particles with mass that do not decay, and can only be destroyed when they are annihilated by an opposite matter state equivalent. So, these particles are the most likely to be fundamental.

In the absence of any data on the internal structure of a particle, we might visualize it as a free-floating sphere that possesses the characteristics we assign to it in some arbitrarily fixed way. When we think of mass, we think of the particle filling some volume of space and having a uniform density. For charge, we may think that there is some subunit of charge distributed throughout the particle in some manner, although the charge/mass ratio varies from particle to particle. When it comes to spin, or angular momentum, one would intuitively feel that a sphere could rotate at any rate or orientation, or not at all, yet it spins at a fixed rate. As for the rest, we have a grab bag of rules that sometimes apply and sometimes don't depending on the type of interaction and very little idea of what any of it is supposed to mean in relation to particle structure.

We do know that particles possess angular momentum in a form that we call spin. We know that free particles have been shown to exhibit two different momentum states, so it is not simply a function of some inter-particle interaction but an innate property. We must conclude that a particle is more than a simple self-contained sphere, and based on the spherical wave phenomenon associated with electron orbital shells, we expect that charge exists at the particles surface. They are not a simple point source, and cannot be treated in such a simplistic manner. But, some particles behave in such a way that we might conclude that they are fundamentally dimensionless, even though in other instances we can measure what appears to be a real diameter.

Why don't we start by assuming that it is a dimensionless entity in free space, that has some properties that are the cause of the things we know as mass, charge and spin. If we look at an electron and positron we should see our dimensionless center surrounded by oriented virtual particle pairs as shown in Figure 7-1.

a)



b)

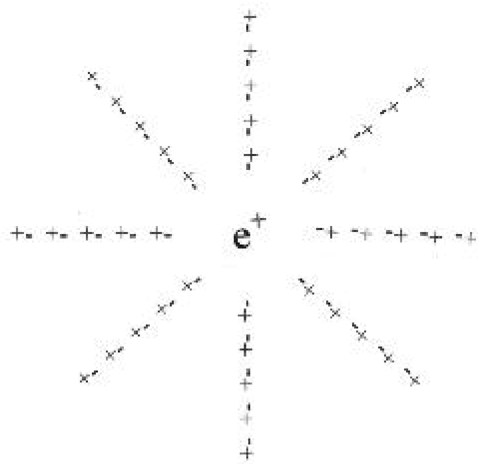
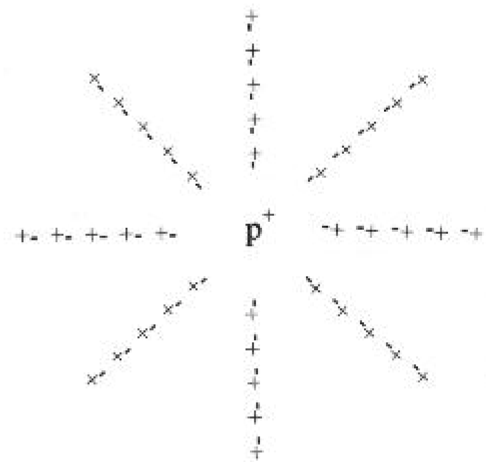


Figure 7-1 a) An electron with partons oriented around it. **b)** A positron with partons oriented around it.

Not surprisingly this looks like our original view from electrostatics, but at a smaller scale.

The figure showing linearly propagating partons does not appear to give us any special insight into the nature of the electron and positron, so why don't we look at the proton and antiproton (Figure 7-2)

a)



b)

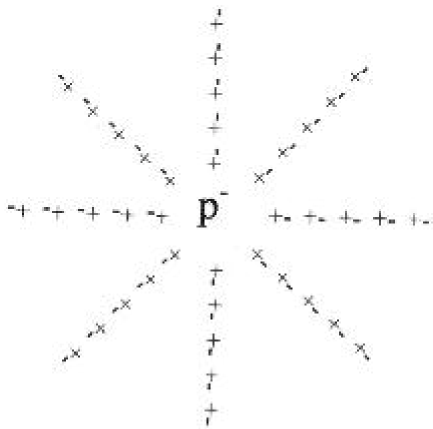


Figure 6-2 a) A proton with partons oriented around it. **b)** An antiproton with partons oriented around it.

Immediately note that the proton looks the same as a positron and an electron looks the same as an antiproton. So why the big difference in masses? The only clue we have is the one principle difference. If we consider one type of parton that has a matter-antimatter relationship mirroring that of the electron-positron pair, (electron-like partons, or e-partons), then we have a condition where an electron that is surrounded by e-partons will have the ant-matter side of the parton pair adjacent to it. Positrons would have the matter side or electron-like half next to it. On the other hand, protons and antiprotons have an adjacent e-parton half of the same matter sense next to it. Could it be that protons must be composed of proton-like partons (p-partons). That way they could have anti-matter next to matter giving it a stable matter-charge configuration. This could lead to the size difference due to some fundamental attribute that the proton has that the electron does not? After all protons are bigger, so proton-like partons might be bigger too, for whatever reason. If the

matter-antimatter orientation is a fundamental preference, could there be some matter-matter repulsion phenomenon responsible for the greater size of the proton? Or would matter-charge and electric-charge act together and magnify each other's force strength? It could also be possible that the proton and antiproton are simply two additional stable solutions, and the matter antimatter question is irrelevant. We can leave this question open for a moment.

Getting back to the particles charge, if we have a central charge of unknown origin and a sphere of partons around it, we would have charges near any surface chosen a given diameter away. Given that partons in free space have a randomized distribution of frequency, we could not expect that the charges on a spherical surface would all be the same, but instead an equally random distribution, figure 7-3.

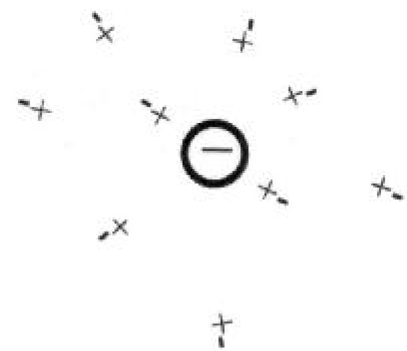


Figure 7-3 A negative point charge surrounded by oriented but randomly distributed partons.

This would leave us with effectively only a point charge in the center, even if the charges were ordered in some fashion so that there was a spherical surface of negatively charged partons at the electron's effective diameter. If we look at the way the charges sum up over the entire sphere, we would still effectively have only a point charge at the center from a classical perspective of electromagnetics, figure 7-4.

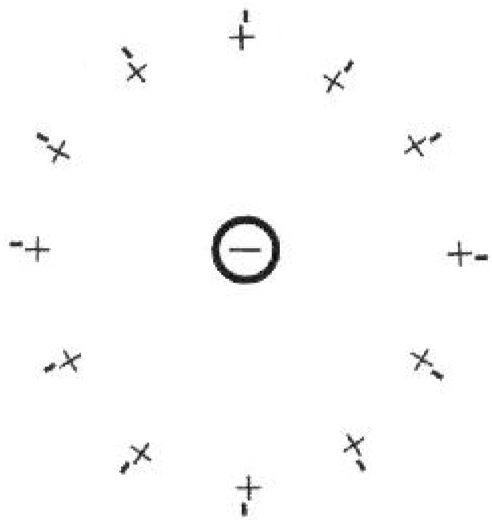


Figure 7-4 A negative point charge surrounded by an equidistant shell of identical partons.

What if there was some way that the charged partons near the effective diameter could partially shield the interior charges? What if there is a spherical wave at the effective diameter of the electron? If the wavelength of the partons in the wave were small enough, they could block longer wavelength partons inside from interacting with the outside, and block the force and charge properties as well. This is similar to a simple mesh

screen that can block microwave wavelengths. Any structure that is effectively a mesh screen can block wavelengths that are longer than the openings. In particular, those wavelengths between the particles effective diameter and the spherical wave's intrinsic wavelength can be shielded as shown in figure 7-5.

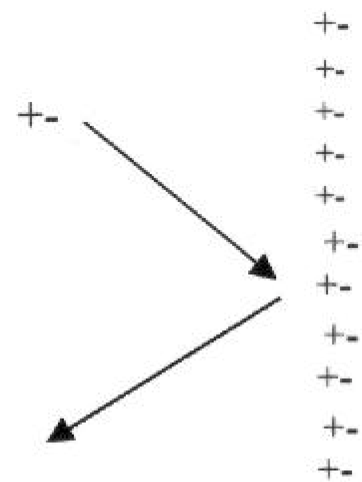


Figure 7-5 A parton with a slightly longer wavelength than a parton wall cannot penetrate it.

If we think about our standard model of electro-magnetism we realize that we see electrostatic charge distribution as a continuum. In order for this continuum concept to be true at short distances, the physical entity that transmits the force must be infinitely small. And, as we know from our consideration of electricity and magnetism, the only possible carrier of the force are the partons, which are not infinitely small, but come in a variety of wavelengths. The belief in the electro-magnetic force as a continuum is at the root of our conceptualization that we can integrate over the volume of the sphere and assume the charge is at the center, while in reality, once we reach the point that wavelength exclusion becomes significant, this concept no longer applies.

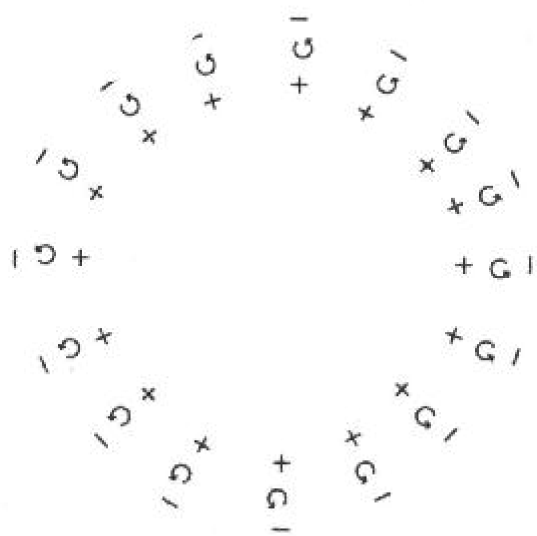


Figure 7-6 A two dimensional representation of an electron showing a ringed formation of partons.

The electrostatic field is after all due to parton pair interactions, and if those interactions are blocked, there is no field, or more factually it is reduced by some percentage related to those wavelengths that are excluded from the interactions.

We can further consider characteristics of this spherical wave. First we know that the charge attributed to a particle would by necessity be the charge of the partons along the outer perimeter of the wave. This means that a parton would rotate a half rotation with, in the case of an electron, the outer parton having negative charge. The partons would be coupled with others in a wavelike structure and the wavelength must be such that the there is spherical symmetry. We end up with an electron being a parton formation as illustrated in figure 7-6.

If that were all, there could be an infinite number of solutions, since for any diameter, numerous wavelengths could lead to an in phase wave. So, there must be at least one more constraint to restrict the number of solutions to one, or a handful at most.

When we consider the arrangement of partons though, we note that we now have like charged partons aligned toward the center of the particle. There will of course be a repulsive force created by partons within the spherical wave. The size of the particle is then determined by the energy balance between this repulsive force and the inward pressure from the free partons outside. This would also give us some idea as to why the electron charge is of a specific magnitude, given that it is always the same size with the same charge differential.

As for spin, it must be related to the direction of rotation of the particle pairs, as they must behave as a unit. We would expect that they must rotate a half rotation during their life so that they start and end their life with a stable charge oriented relationship. We can also see from the circular representation that the electron can rotate in one direction or the other yielding two opposite spin states.

Another critical question is, where is the mass, if a particle is mostly vacuum? To answer question we need to look back at the parton shielding effect. It was proposed in the early 1960's that gravity was a result of the pressure the universal field of partons exerts on matter. One problem with this theory is that if the frequency range of the partons is infinite, the energy of free space would be infinite and the force would be infinite. So, the theory evolved with a high-energy cutoff limitation, which has never been satisfactorily explained.

But we do know that a spherical wave will appear transparent to wavelengths that are shorter than its intrinsic wavelength. At the same time it will shield interactions of longer wavelengths, up to wavelengths on the order of the diameter of the particle. In this way, the particle exerts less pressure on the surrounding partons, and blocks the transmission of those wavelengths, and the forces that are associated with them.

When there are two particles a certain distance apart in free space, there is more pressure from every direction except the one in a line toward the other particle, so the two particles are pushed together. The mass of a particle is a function of the volume of space contained within the sphere and the effective high and low cutoff frequencies of the spherical wave. We should also note that previous work developing gravitational theories of this type has led to the conclusion that most of the force is due to energies near the high energy, short wavelength, cutoff frequency, which is what we would expect.

The matter-antimatter state of the particle is still a question that needs to be looked at. When we see an electron, we not only see negative charge, but we see it as matter. Yet the partons that make up the electron are an equal part matter and antimatter. The most likely answer is that much in the way that the spherical shell shields the electric characteristic, it also shields the matter charge characteristic. So, we see only see the matter. This is very important, as we need to realize that matter charge, much like electric charge, can exist as a point charges and as dipoles, and should have properties analogous to electro-magnetics.

Amazingly enough though, by starting with a dimensionless particle in the center, we have ended up with no particle in the center at all, but rather a spherical shell of partons that is the free particles true identity. The most important characteristics of particle physics have been taken into account and attributed to this structure, at least for the electron and positron.

If we turn to the proton and antiproton, we see that in order for the correct charge and matter sense to be exhibited by them that they must in fact be made of proton-like partons. In other words the proton must have positive electric-charged matter-charged partons at the outer surface of its spherical parton shell. Which means that the inner surface has negatively charged antimatter charged partons facing inward towards each other.

That leaves us with only one possible cause of the proton mass being much greater than the electron mass, at least among those attributes we have considered and without inventing something entirely new. The cause is the internal outward working forces are much greater for a proton than for an electron. If we look at table 7-1 we can see the charge and matter combinations and how repulsive strength relates to these combinations.

Table 7-1

Charge Type	***Matter***	***Antimatter***
Positive Electric	Highly Repelling	Slightly Repelling
Negative Electric	Slightly Repelling	Highly Repelling

The proton, antiproton, and proton-like partons all fall in the highly repelling category, while the electron, positron, and electron-like partons fall in the slightly repelling category.

Why is this so? We can consider for now that matter is the positive version of matter-charge and antimatter is the negative version of matter-charge. Since in general positive and negative charges are attractive, while like charges repel, we should then be willing to accept that two positive charges are repelled even if one charge is electric and the other is matter. Since e-partons have mixed electric and matter-charge polarity they are push outward more weakly than the stronger p-partons.

As to the question of the origination of the fundamental attractive and repulsive forces; electric, matter, or a combination, that is a question that is open in the standard model and I do not have a proposed solution to present here.

If we concede for the moment that this is the way it is, we can explore other ways of looking at the details. Since the p-partons have more repulsion between particles for the same distance, they will contain much more energy. So it follows that p-partons will tend to have shorter wavelengths and higher energies than e-partons. It is this difference that will turn out to be critical to our understanding of force dynamics in general.

If we look at the region of space inside the spherical wave, we expect that it will contain a mixture of e-partons and p-partons of a variety of wavelengths up to the diameter of the particle. Very short wavelengths, shorter than the spherical shell wavelength, will not have much of an effect on anything. Because of the energy disparity though, we will have a condition where there will be an unequal percentage of e-partons to p-partons, and the percentage will vary with the wavelength range as determined by the particle size. The larger proton should then contain a lot of e-partons, and because of the matter-matter juxtaposition between the negative antimatter side of the p-partons in the shell and the positive antimatter side of the e-partons inside the sphere,

there will be a lot of outward pressure. Of course we should consider the converse argument that the size is due to outward pressure from within for the same reasons.

The electron on the other hand is smaller. We expect that the smaller diameter means that more e-partons are excluded until the point the p-partons begin to exert the matter-matter repulsive force that determines the spherical waves equilibrium point. So, the electron diameter is supported by the repulsive effect between the positive antimatter side of e-partons of the spherical wave and the negative antimatter side of the p-partons inside.

Fortunately this doesn't create a problem for atoms and anti-atoms since the force relationship between the protons or antiprotons in the nucleus and the electrons or positrons in orbit, is symmetric, as seen in figure 7-7.

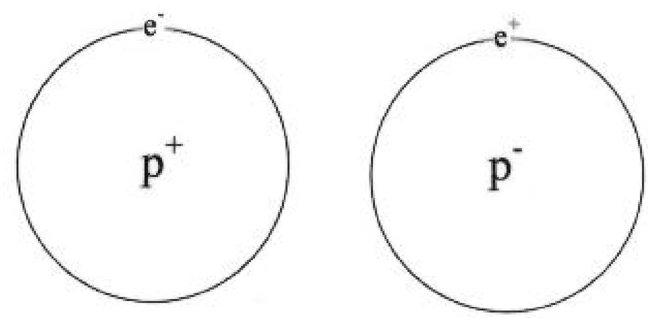


Figure 7-7 Hydrogen and anti-hydrogen are shown to illustrate that the matter-antimatter relationships are the same in both, even when we consider the matter force theory.

When we consider what this means to electricity and magnetism, we realize that the effect of matter charge in space will be as important as the effect of electric charge. Since the partons that are responsible for the force always have both characteristics, on a large scale they will always exert forces that are proportional to both of the forces. We do not notice that we are truly considering the summation of two forces. We would not be able to separate the two under normal conditions because of the randomized distribution of partons in free space, and the fact that we almost always experiment with matter alone. Our electromagnetic equations assume the summation of these two effects, and we don't even notice, at least not at the macroscopic level. It does however give us something to ponder when we take up consideration of nuclear forces and their relationship to electromagnetic forces. The highly repelling group takes part in strong interactions. High levels of repulsion mean high levels of binding energy, once the repulsive forces are overcome.

Since this idea is so different from the standard model, it is important that we study it further, by evaluating forces on a more basic level, and considering what alternative architectures may be appealing.

How should a fundamental force propagate in space? If we look at the present theories of electricity and magnetism and gravity, we see two forces that are known to fall off in strength in proportion to the inverse of the square of the distance ($1/R^2$) between bodies. If we consider a spherical shell at any distance from the body exerting the force, the sum of the energy over the sphere will be a certain value. Then if we look at the energy associated with a shell, at a different radius from the body, the total energy is the same. So, a shell at any distance from the body will have the same total energy. But, if we look at the force on a second body that has a smaller area, the force on it is then proportional to the percentage of the spherical area that it intercepts. This percentage varies with the square of the radius. So in fact, our statement that the force declines in this manner is truly a statement that the energy is conserved, since the sum is the same at all distances.

That means that a short range or long-range force that might vary in something other than a $1/R^2$ fashion relative to the radius violates the theory of conservation of energy. For example, a short range force, like the weak and nuclear forces, that falls off more rapidly than $1/R^2$ will mean that, either the energy at greater distances is absorbed by the vacuum, or the energy at nearer distances is created from the vacuum. The way the standard model tries to get around the violation of conservation is to say that the energy is contained within a particle and the particle moves from one body to another and tells it what to do.

The problem with this theory is that for the interaction particle to exist, it must borrow energy from the vacuum and return it. Such an interaction could be allowed if it happened fast enough to be within the uncertainty principles' time-energy limitations, but these particles generally live longer than allowed. And, a antimatter analog particle is not created at the same time violating a whole slew of conservation principles. You might say that these theories are on borrowed time, or if you prefer, energy.

The more intuitively satisfactory way of looking at fundamental forces is to say that all fundamental forces follow the $1/R^2$ rule, and any other force must be a superposition of two or more fundamental forces.

If we look at other alternative explanations for the difference in repulsive forces inside an electron and proton, we could try to use the interactive particle approach, again maybe there is a lighter weaker one for the leptons and a heavier stronger one for the baryons. But, we end up with the same conservation violations and uncertainty principle violations that we have with similar short-range theories. Anything else we might try is entirely new, requiring a new type of force, and a new type of particle characteristic beyond the established electric and matter charge states. A theory like that would introduce a new level of complication that is not a satisfactory treatment of the facts, particularly in view of our desire to extract the simplest and most elegant explanation for everything.

The matter repulsion effect does account for the forces and even more importantly provides an intuitively simple and acceptable force mechanism. And, while we have several other things to explore before we understand how this force has been able to remain inconspicuous, we will see that it accounts for all the phenomena we see without leading to something new that is beyond explanation, or violates known experimental evidence.

B. The Neutron

The neutron is the next most prevalent particle in common matter. Neutrons are fairly stable, but according to current theory, decay into a proton, an electron, a photon, and a neutrino. Before getting into the heart of our neutron analysis, I need to say that I find the notion that an elementary particle can decay, ridiculous. If it can be split into components and be built from components it is the components that we must consider as fundamental. Having said that, it is time to figure out what it really is we are describing.

Since most of the energy of a neutron can be accounted for by the proton and electron, we should consider what happens as a free electron approaches a free proton. To begin with we have an identical case to the hydrogen atom up until the point that there is a balance between the inward and outward parton pressure. At this point we recognize that the electron must have additional momentum to carry it deeper toward the proton. This energy will be the same as the energy released during neutron decay. If the electron has this much momentum, then it can continue toward the proton.

Once the repulsion effect is overcome, the electron waveform can pass through the proton waveform without additional difficulty. Since the electron is quite a lot smaller than the proton, we know that the wavelength of the electron’s parton shell will be quite a bit smaller than the wavelength of the proton’s parton shell. So the electron can pass through the proton. At this point the phenomena that may be more properly called electro-matter repulsion will affect the orientation of the partons in both the electron and proton so that we observe a net neutral charge from outside the particle.

Because we know the neutron is matter we know that the partons must still be matter oriented. And, since we know it is charge neutral, and we know that the electron wavelength is small enough that the similarly small partons can transmit the charge force to space external to the protons shell. This means that the proton must also have positive charge oriented outward. We also know that the internal repulsion must still exist to keep the electron from collapsing entirely. So we will have some equilibrium process, but the electron and proton are fundamentally unchanged. Once this equilibrium is achieved, we have a neutron.

Since both the electron and proton retain their intrinsic spin properties, there is no need to introduce the neutrino concept solely for the purpose of conserving angular momentum. The momentum has instead been transferred to the interior partons that are shielded from external view.

C. Muons and Taons

These are the other two main characters in the lepton group. Both of them decay into an electron and some energy. Our first inclination should be that these particles are similar to an electron. We do know that these particles are much more massive than the electron, although the muon is much less than the proton.

Since these are leptons and do not participate in strong interactions, they must be composed of electron-like partons. Could it be that their extra mass is attributed to a higher cutoff frequency? That would mean that the shell is composed of shorter wavelength partons. But, that would also lead to proportionately greater repulsion that would force it to be larger in diameter too. So, in any case the structure of these leptons must be quite a bit larger than the electron. At a fundamental level we can consider the muon to be a higher energy solution to the dynamic force model of the electron. And, the taon is a level above that. They will both still have the same fundamental structure as shown in figure 7-8.

a) **b)**

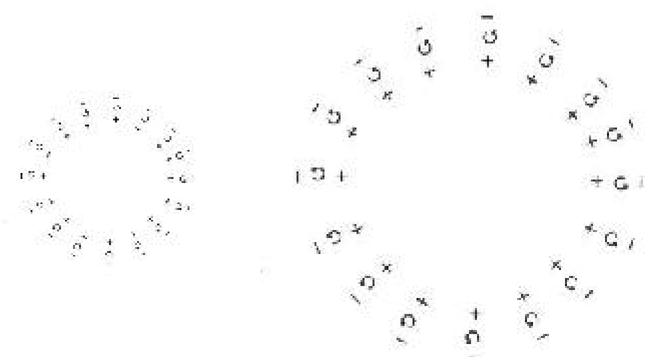


Figure 7-8 an electron a) shown in comparison to a muon **b)** illustrating that they are similar structures of different size.

An alternative solution that we might consider is that a muon is a two-tiered shell particle and the taon is a three-tiered shell particle, with each shell being a spherical parton wave much like the electrons. Such an idea is shown in figure 7-9.

But while the two tiered structure works well for the neutron, we know that it decays into two major particles. So, we are not surprised that the neutron could be composed of two particles, and have the tiered structure. The taon on the other hand decays to a muon, and the muon decays to an electron, and under present theory, neutrinos are the only other particles involved. But if we end up with only a single spherical wave then we must start with only one, so the larger single shell theory is more likely to be correct.

Alternatively, some may like the idea that a neutrino rests inside the muon and forces it to become larger.

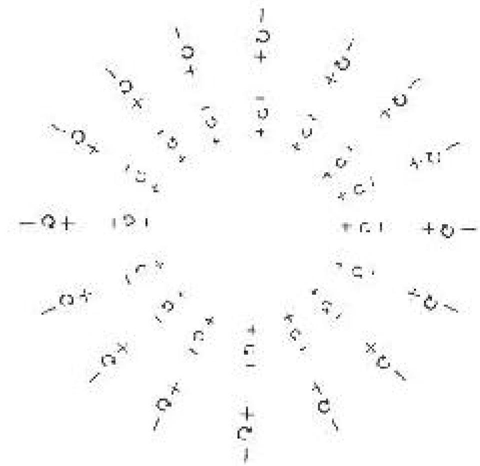


Figure 7-9 An illustration of a hypothetical two-tier shell configuration for a muon.

Since we have a sequence of three particles of different energies that are comprised of e-partons, we would expect that there would be more at even higher energies where there are higher energy solutions to the same problem. Unfortunately we may have to wait for higher energy accelerators to be developed to search for them.

D. Neutrinos

Here we should briefly consider the three tiers of neutrinos. As we recall from quantum theory, the neutrinos are leptons that were invented to account for the spin conservation theory of quantum mechanics. It was decided for some arbitrary reason that spin was not a property of motion related to some internal process in the particle, but rather an unexplained intrinsic property, hence the need for an additional particle to conserve the momentum. While the neutrino's role in QED has been expanded a great deal, we should consider that if the angular momentum can be conserved in ways that do not require them, we should defer to the simplest theory, the one with the fewest particles.

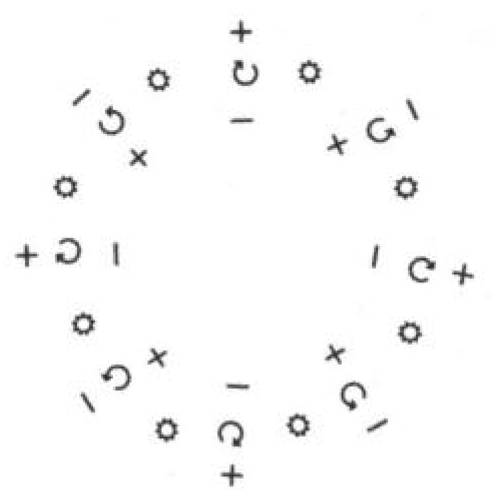


Figure 7-10 An illustration of a configuration of a neutrino.

If we do however consider neutrino structure in the same way we look at the electron we would expect that alternate charges of e-partons would appear at the surface as illustrated in figure 7-10.

The problem with such a concept is that within the structure of the theory so far, there is no way for such a particle to be massless. It would also be matter neutral, which would be something new and different. The interior is also matter and charge neutral, so how could there be an internal repulsive force to keep it in equilibrium? If the particle existed it would probably be an extremely small particle with an extremely small mass. Is it a neutrino? Maybe it is. Whatever it is, it is, an interesting structure, a sort of ball photon, so we should consider it as we explore the known particles.

In particle theory the neutrino is equated with the process of separating two spherical waves, as with a neutron, or a change in the size of a wave structure as with the muon, and might possibly not be a particle at all. We do expect that the energy differential will require the involvement of one or more photons in the interactions, but not necessarily a neutrino.

E. The Rest of the Particle Zoo

If we extend our theory to the other particles, we expect them to be explained in terms of being various sizes of structures, and/or various combinations of spherical waves. They may be higher order quasi-stable solutions, or multiple tiers of electron-like or proton-like partons, or various combinations of them.

Some of the particles, as we saw with the photon, are a cylindrical formation, so we expect some combinations like that. One particular example is the mesons, which appear to be too small to be a spherical p-parton formation, since they are smaller than the proton. They will require that we come up with a different structure of p-partons to account for their strong interaction component.

The baryons, which aside from the proton, decay into two or more particles, are most likely composed of multiple spherical wave shells that are directly related to their decay products.

Still other particles, the W and Z particles for example, may turn out to be equivalent to the force attributed to the virtual p-parton and e-parton induced forces between two other particles.

Some particles, the quarks for example, may be nothing more that the superimposed or adjacent wave structures of other particles as seen in various combinations. This result is not at all surprising in the end, since if any possible wave superimposition can exist and is at low enough energy for us to have seen it, there is a good probability that we have seen it. The things we have learned while putting together the quark model should actually allow us to rather quickly unravel the parton shell combinations required to create all the particles in the zoo. An in depth analysis of 200+ particles is unfortunately beyond the scope of this monograph.

F. The Elementary Particles

So now we have the information we need to answer the question, what particles are elementary? The answer is, the partons!

But, now the inquisitive little child has returned to look up at us and ask, “what are partons made of?” For my part I visualize them as some kind of Siamesed double bubble that expands and contracts, twisting one way as it expands and the other as it contracts as shown in figure 7-11. The electron-like and proton-like variations are orthogonal states of the same basic phenomenon, with of course the asymmetry already noted.

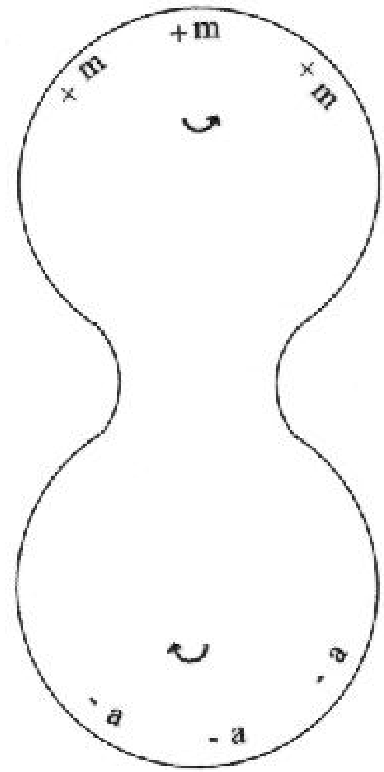


Figure 7-11 A proton like or p-parton with positive matter charge on one end and negative antimatter charge on the other. The twist is also illustrated.

The twisting motion is worthy of some additional thought. We expect that each half of the parton will have some angular momentum since their particle analogue does. In order for the parton to be spin neutral though, the two halves must spin in opposite directions. And, in order for there to be zero net angular momentum in normal vacuum space, it must counter rotate during its collapse to balance the prior forward rotation. But this means that there are two different directions of rotation that are possible. I will define them based on the spin direction of the matter side of the parton during expansion, and simply call the rotation clockwise or counterclockwise.

If we then consider that a particle such as an electron would likely be made of partons that rotate the same direction, then we will have a simple explanation of the two particle spin states. It also gives us an additional dimension to worry about above and beyond the two dimensions in the illustrations. If we visualize the synchronization of the rotation of the partons with a proton or electron we have a better idea of how they form a sphere. A parton could not simply rotate in a linear motion, but must have a circular motion.

As to the question what are the partons made of? Are they higher frequency partons? Are they sub-partons? The philosopher in me wonders if there are an infinite number of infinitely smaller sub-parton layers. In the end, I can only conclude that we have reached the next layer of the onion of knowledge and I will grudgingly leave it for another day, another generation, or possibly another century.

8

The Photon Revisited

While the fundamental description of the photon from chapter two was not significantly affected by the later discussions, we should now think of the photon as not only having an E field and B field associated, but also a matter field (M) and matter moment (B_m) associated with it as well. If we use the convention that matter is the positive charge attribute, and antimatter the negative of it, a photon with an electron-like parton at the center will have an M field that points in the opposite direction from the E field, and a B_m field that points in the opposite direction from the B field.

A. The P-Photon

We also have something new to consider, a proton-like photon. Under our model there appears to be nothing to preclude the existence of a photon composed of p-partons instead of e-partons, and if there is nothing to preclude something's existence then it likely does exist. This photon will have similar structure to the electron-like photon as illustrated in figure 8-1.

+m –a +m –a +m
☼ ↻ ☼ ↺ ☼ ↻ ☼ ↺ ☼ ↻ ☼
–a +m –a +m –a

Figure 8-1 The p-photon represented by a series of p-partons.

A p-photon will have the polarization and rotational force components of fields pointing in the same direction. Given that relationship, we expect that a p-photon is substantially more energetic than an e-photon, and may be the dominant species of photon for energies in the MeV range and higher. From another perspective, these will likely be wavelengths on the order of the proton size and smaller. Since the matter orientation and matter-moment are opposite from an e-photon, it will be much more energetic.

We should also consider what p-photons might be within the scope of present particle physics. Could some cosmic rays be p-photons? Could p-photons be part of the composition of mesons or the neutral pion? It should be interesting to compare these particles at a fundamental level, although as I said previously I will not attempt it at this stage.

B. Red Shift

What about red shift? How does a photon that starts in one place know that it needs to be a different energy someplace else? It is often described as a Doppler effect, or by potential theory, but in keeping with our rules we must ascribe a real force to it and a real medium.

When a photon from a distance galaxy gets to use it appears red shifted, lower in energy, because the galaxy is moving away from us at a speed that is significant compared to the speed of light. When the photon looses energy, that energy must go someplace. Since it is not in the photon and it is not in the body that the photon hits, the only place we know for it to go is for it to be stored by the partons. It must be in the form of rotational energy. So when our intergalactic photon strikes Earth, part of its energy becomes part of the matter moment energy that surrounds Earth in space. This phenomenon is no different in principle to the way photons and charged particles interact.

B. Photon Pressure

It is important to mention photon pressure. As most of us are aware, when photons strike a body and are scattered, their momentum is transferred to the body, causing it to be accelerated. A common novelty item has several small flat panels painted black on one side and white on the other that are attached to a spindle that can rotate on a central axis. When it is exposed to light, the white side of the panel moves away from the light making the assembly rotate. This is due to the fact the light hitting the black side is absorbed and the light's momentum is transferred to the flag. On the white side the light's momentum is not only lost, but it is reflected and so gains momentum in the opposite direction. The energy difference can be as much as a factor of two for perfect absorbers and reflectors. The amount of momentum in visible light photons is small, but at higher energies, or shorter wavelengths it could be a very important effect.

We need to remember that the momentum transfer can occur any time that the photon is absorbed or reflected, versus being transmitted. Long wavelengths such as microwaves interact with large bodies. Shorter wavelengths, from infrared to ultraviolet, interact with matter depending on relative energy levels or spacing of various types of electron bonds, and electron shell transitions. X-ray wavelengths interact based on inner shell electron spacing.

If we look at increasingly smaller levels of scale we will expect that even higher, greater than MeV range energy photons, with wavelengths on the scale of the particle diameters will interact with them, and be scattered by them. At the very high end, as much as 20 orders of magnitude higher, we would expect photons on the scale of the cutoff frequency of the electron and proton to also interact with them.

Do such high-energy photons exist in significant quantities? Is there a mechanism that can routinely produce photons in this energy range? If so, they would have tremendous penetration depth in ordinary matter, so much so that most ordinary detectors would not have the stopping power to detect them. Many of them should be energetic enough to cause pair production, which would ultimately lead to a larger number of lower energy e-photons being produced through a series of interactions. But if they did exist in a significant quantity they could have a substantial impact on the dynamics of the universe.

9

The Atom Revisited

If we consider the implications of electro-matter attraction-repulsion as it relates to atoms, we have to recognize that there can be a difference in the force depending on whether electron like partons, or proton like partons, or a mix of the two is responsible for the electro-matter forces. Why is this relationship important? Because it gives us a hint about the source of the missing repulsive force between the proton and electron in hydrogen and other atoms, a major unanswered problem with current quantum mechanical theory.

As discussed previously when we considered the hydrogen atom, we expect that longer wavelength e-partons will be excluded at an increasing rate as an electron approaches the nucleus. We can conclude based on all we have considered previously, that the e-partons, which have positive charge and negative matter on one side and positive matter and negative charge on the other, produce a small outward force. The p-partons, on the other hand, have positive matter and electric charge opposed to negative matter and electric charge, and so have much greater resistance to pressure. Because of this difference the p-partons will push against the electron and proton more.

We can expect that like their namesake's, e-partons are less energetic on average than p-partons, so they have different energy distributions. There are few low energy p-partons and there are few high energy e-partons. So, as the electron approaches the proton, the ratio of the partons changes. Low energy long wavelength e-partons are excluded until only p-partons remain. The force is then dominated by p-partons, with there greater ability to resist pressure. Eventually the outward pressure due to the p-partons equals the inward directed external pressure, and the converging process halts. This is illustrated in figure 9-1.

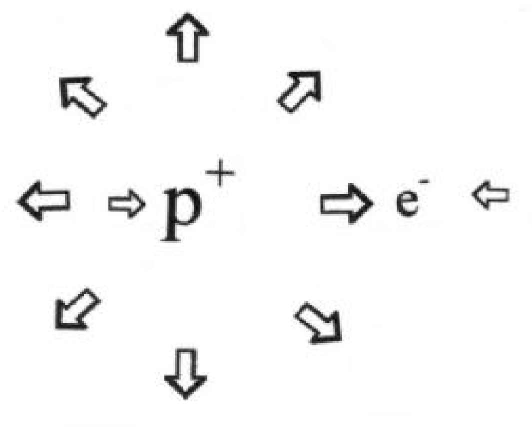


Figure 9-1 A hydrogen atom with the proton and electron being forced apart by p-parton repulsion represented by the large arrows. While they are also forced together by external parton pressure, represented by the small arrows.

A similar effect occurs between two electrons in orbit around a nucleus. The e-partons between the electrons and the nucleus are unable to resist the inward pressure. The p-partons between the electron and nucleus exert greater pressure, as described above, yielding a repelling force. On the other hand, between the two electrons, the e-partons will have a repelling effect as we expect when two like electric charges are nearby. But, as we determined previously it takes a much stronger and more rapid change in outward pressure than a simple electrostatic force that varies in relation to $1/R^2$ to create the narrow energy states of the electron shells. This rapid change

in force dynamics occurs when electrons are close enough that the p-parton repulsion dominates the interaction. It is this rapid transition between there being enough space for e-partons or not that determines the minimum spacing limitations that defines the electron orbital structure.

Once we add this repulsive force effect to our understanding of basic electrostatic and magnetic forces we can finally describe the atom in terms of a true balance of forces. And we can do it without requiring that the electrons move tangentially by some inexplicable means.

10

The Strong Nuclear Force

In order for there to be an equilibrium between forces in the nucleus, there must be an interaction that holds the particles together, and that force is what we will attempt to describe in this chapter. As a consequence of our explorations we now have the tools to describe the strong nuclear force, and how it relates to electro-matter dynamics. The fundamental reason for the existence of the strong interaction is the strong repulsion we see with proton-like parton based particles, and proton-like parton virtual pair interactions.

We should first look at the simplest example of the strong force, the deuteron nucleus. The deuteron has a proton and a neutron in the nucleus. We can start by considering these two particles at a large distance. As we move a neutron toward a proton we see no repulsion due to electrostatic charge. It is only when the two are so close together that virtual electron-like partons are excluded to a large degree that we begin to see the force of the virtual p-partons acting to hold the two apart. We suspect that matter repulsion cannot be very strong, so it does not take too much energy for the particles to get close enough that they become loosely bound together. The pressure from the surrounding free partons holds them together and the p-partons hold them slightly apart. The effect we know as the strong force is not really needed to sustain this state. The deuteron nucleus is illustrated in figure 10-1.

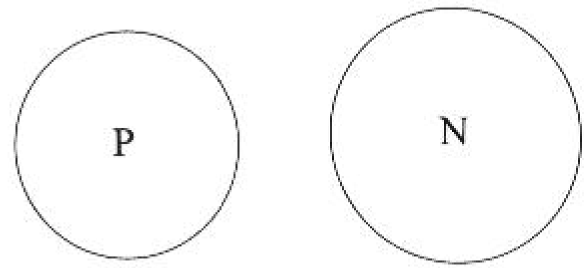


Figure 10-1 The deuteron nucleus with the proton and neutron in a loosely bound state.

Next we will consider the helium nucleus. Whether it is He^3 or He^4, we have to show how they overcome the charge repulsion of the two protons. It is important that we note that He^2 does not exist, so even though the strong force is strong, one or more neutrons are needed to make the two protons stay together. We would expect in the case of He^3 that the neutron would be between the two protons, shielding them from each other. This is illustrated in figure 10-2 (a). Since the particle diameters are similar there will still be a good deal of charge repulsion around the sides of the neutron, so something has to bind them together. The same is true for He^4. Even though it should be in somewhat of a diamond-like formation in the ideal state. The He^4 nucleus is illustrated in figure 10-2 (b).

While these geometric representations of the nucleus are interesting and we could easily continue building larger and larger nuclei, they do not answer the question of how an attractive force is capable of binding the protons and neutrons together so that they can withstand the electro-matter repulsion between them.

a)

b)

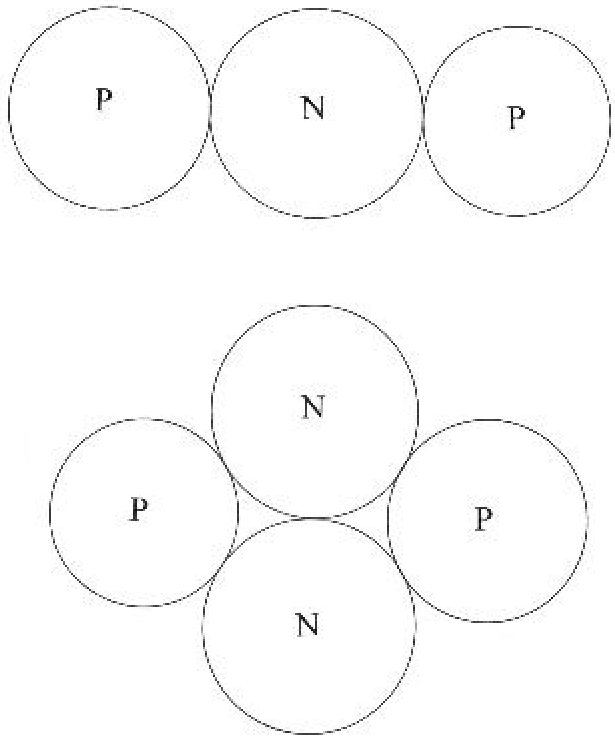


Figure 10-2 a) A simple illustration of a He^3 nucleus. **b)** A simple illustration of a He^4 nucleus.

How do these particles bind with each other, or more precisely how do the spherical parton shells that make up the structure of the particles interact? One important clue is in the fact that total mass of nuclei is not equal to the sum of the free masses of the constituent particles. It is, in fact, always a little less. This mass discrepancy has long been thought to equate to the binding energy, or at least a part of it. We now know, though,

that mass is related to the volume of the particle, and the wavelength of the partons within the shell. The wavelength determines the effective cutoff frequency for the parton pressure force. The mass differential must then be due to a change in either the total volume of the particles, or the wavelengths of its spherical shell. Since the wavelength is due to a unique force solution, it is not going to change, so, there must to be a change in volume. But, since the wavelength of the particle's spherical wave must remain fixed, and the sphere must be a fixed integral number of wavelengths, the volume of the particle is not going to change either. How do you change the total volume without changing the component volumes?

The change in volume must be due to an overlap of the particle volumes. The spherical waves overlap along their surface in the contact region between two particles. We also know that the amount of mass displaced is small, which is why we expect the binding interaction to occur at the particle's surfaces.

As discussed previously, the protons' wavelike shell is composed of proton-like partons. The positive electric and matter charges are oriented outward. The neutrons' outer shell is the same since it too is a proton wave formation on its outer edge. As two of these spherical waves come together, the parton pairs will align themselves so that the parton dipoles interlock forming a very strong electro-matter bond. As the two particles rotate against each other, the parton pairs fill the gaps in the other particle's shell, much like two gears meshing together. It is the interlocked dipoles of the partons on the surface of the particles, and the strong electro-matter bonds formed this way, that is the root cause of the strong nuclear force. This interaction is illustrated in figure 10-3.

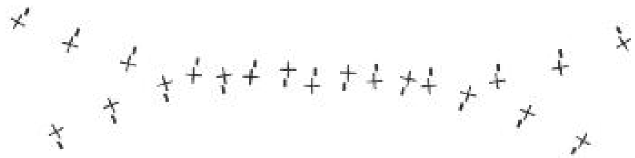


Figure 10-3 A portion of the shells of a neutron and a proton illustrating the electron-matter charge alignment and volume overlap.

As with a quantum mechanical analysis of atomic structure, the structures and interactions of the nuclei are equally, or possibly even more complex. The mathematical troubles of dealing with the many-bodied problem prevent us from treating them in a completely general way. So, such an analysis is beyond the scope of our simple thought experiments. We can see, however, that the strong nuclear force is simply an extension of the electro-matter force theory.

11

The Weak Force

The weak force is obscure to all but a few physicists, so I will only mention it briefly and leave a more detailed accounting to others. We can make a few observations. The weak force is another short-range force that exhibits an energy falloff with distance much greater than the $1/R^2$ relationship, so we should not consider it a fundamental force. What we do expect is, that like other particle interactions at short distances, this force is due to the changing frequency distribution of e-partons and p-partons in space.

As two free particles become closer, the longer wavelength e-partons are excluded, leaving a higher percentage of shorter wavelength p-partons in the space between the two free particles. This introduces a change in the balance between the two vastly different matter-charge and electric-charge repulsion affects produced by the different electro-matter orientation of these two partons. This wavelength exclusion phenomenon creates a transition zone where classic electricity and magnetism equations are no longer valid, and matter-charge and electric-charge effects must be considered independently. Physicists created the weak force theory in order to explain a subset of errors brought about by their lack of understanding of this near space transition region.

So, as we suspected in the beginning, the weak force idea owes its existence to the erroneous nature of current electromagnetic and quantum theory. It is odd that QED theorists have traditionally added new numerological rules to deal with differences between physical reality and theory. But, somehow the weak force theory managed to escape the jaws of QED, and become an independent force theory, at least for a while.

Ultimately a detailed analysis of each application of the weak force theory will show that it is completely unnecessary in light of the electro-matter theory.

12

Gravity

Gravity is one force theory that physicists tend to feel the most confidence in, and yet neither the classical or relativistic models can account for something as fundamental as the structure of a spiral galaxy. Even worse, all the astronomical measurements agree that the universe has one tenth the mass it needs, in order for the theories to be true. Then we add in that current astronomical measurements also indicate that the rate of expansion of the universe is increasing, meaning that a large-scale repulsive force is an absolutely necessary part of any gravitational theory. Considering these three things, any person with a reasonable capacity for thought would have to conclude that the current theories are untenable, and in need of major revisions, or even replaced in their entirety.

Fortunately, the situation is not so dire. We do not have to be foundering around without direction as we face the inadequacy of current theory. For we have at our disposal based on the examinations in the prior chapters all the necessary components for a reasonable theory of gravitation.

A. The Parton Pressure Force

There is one recognized theory of gravitation that does include a physical mechanism for gravity. As we would expect from our prior discourse it is the one based on a virtual particle pair pressure phenomenon. As the partons jitter in space they exert a force on adjacent partons, and this force is transmitted throughout space through interactions with other partons. As we have discussed, the energy density of the vacuum is much greater than the energy density of mass, so the regions of mass can more factually be thought of as a hole in the pressure field.

We can visualize a massive particle as a bubble in the parton sea, except that unlike a bubble in water, which is compressed and is in pressure equilibrium with its surroundings, the spherical wave that is the particle cannot be "compressed". And so, mass is a region of space where the surrounding pressure gets lost, and cannot be transmitted in its entirety. This pressure shielding effect is what we historically call gravity. It is illustrated in figure 12-1.

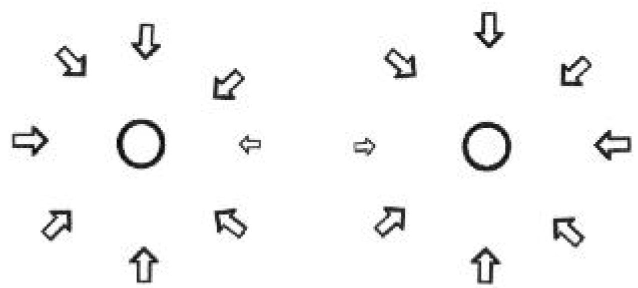


Figure 12-1 Two matter bodies with the pressure between them reduced due to them shielding each other from parton pressure.

We can visualize the gravity shielding effect as a shadow, and any body that falls within the shadow of another will have less pressure against it. Then, since there is less pressure pushing the bodies apart, they are pushed together.

The major shortcoming to this theory is that there is no mechanism for understanding the cutoff frequency. Partons exist over a continuum of frequencies. If all possible frequencies up to infinitely high frequency and high energy partons participated in the pressure force interaction, the pressure force would be infinitely strong. While there is most likely a distribution curve of parton energies such that very high-energy partons occur less frequently, such a distribution could not account for the parton pressure force being finite. There must be some upper limit or cut-off frequency.

In theory, partons interact simply based on which wavelengths are influenced by a given body. A body made of silica for example will be transparent to wavelengths that are longer than the external body diameter, but transparent to wavelengths smaller than the crystal lattice spacing like x-rays. A silicon atom will be partially opaque to wavelengths between the atom's effective outer diameter, and the diameter of the innermost electron orbit. It will be opaque once again to wavelengths on the order of the size of the nucleus down to some energy where the protons become transparent.

It is this last that is what we call the cutoff frequency. An electron is smaller than a proton and has a higher frequency cutoff, but also has less volume and thus is not as important as the proton in the overall scheme of things. The cutoff frequency estimates in the published theories are an average over all the physical structures in space

The particle model we derived earlier addresses this proton transparency question. The cutoff frequencies are a property of the proton's and electron's spherical wave structure, in particular their wavelength and diameter. But whether or not the basic particle structure is a spherical wave, the particles simply must be transparent to the shorter wavelengths, not that unlike normal matter being transparent to x-rays. Reasonable treatments of the parton pressure theory have concluded that most of the gravitational force comes from the most energetic partons with wavelengths within the first few orders of magnitude of the cutoff frequency. Dealing with the cutoff frequency in this manner allows us to overcome the fundamental problem of a absence of a physical mechanism in the classical and relativistic gravity models.

B. The Matter Repulsion Force

Almost all galaxies are moving away from each other. Shouldn't we first consider whether a force is pushing them apart? Recent evidence confirms that the rate of universal expansion is actually accelerating. So, the presence of a long-range repulsive force is undeniable. Even as we look at the structure of a spiral galaxy, shouldn't we consider that the light and dark parts of the arms are more than just a pretty image, but are direct evidence of a transition between an attractive and a repulsive force? There is incontrovertible experimental evidence that there is a force in the universe that works in opposition to gravity. What is it?

We already know what it is. It is the matter repulsion force. If we again consider the nature of the partons, whether they have an electron-like or a proton-like matter-charge relationship, they have zero net electric and matter charge. Matter is a charge-like phenomenon itself, even if we have not historically thought of it that way. And, it has similar force interactions to electric charge where likes repel and opposites attract. In the large-scale open vacuum of space we expect there will be a normal distribution of the two parton types, such that we would not see independent charge forces, but rather, the normal macroscopic electro-matter effects we are used to seeing. We also know based on experience and measurements, that local matter will achieve electric charge equilibrium, so that it appears electrically neutral from a distance.

But could it appear to be matter neutral? Of course it would not. In a region of space near a massive body, the partons are oriented with their antimatter component closer to the matter. Since we have two opposite matter-charge oriented partons this can be accomplished while retaining complete charge neutrality. In other words an equal number of e-partons and p-partons will be oriented due to matter such that there is no

electric field, only a matter-charge field. We are then left with matter-oriented partons around a matter body, as shown in figure 12-2.

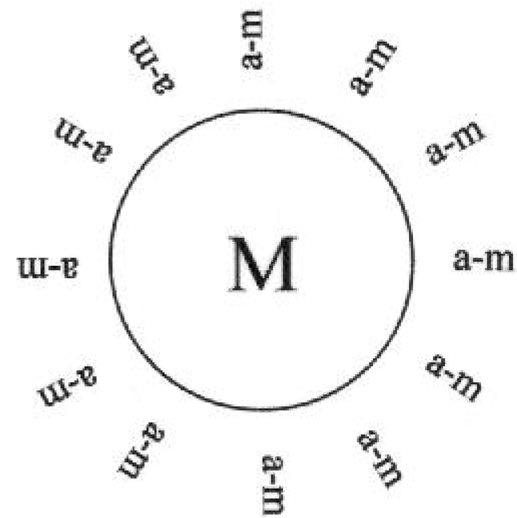


Figure 12-2 A body of matter surrounded by matter oriented partons.

In exactly the same way that a massive body can be electrically charged it also can have matter-charge that can propagate outwardly through the vacuum of space. The matter-charge interaction will be similar to electrostatic repulsion given that they are intrinsically similar. As such we would expect to see partons matter oriented in a repulsive mode with respect to two galaxies as shown in figure 12-3.

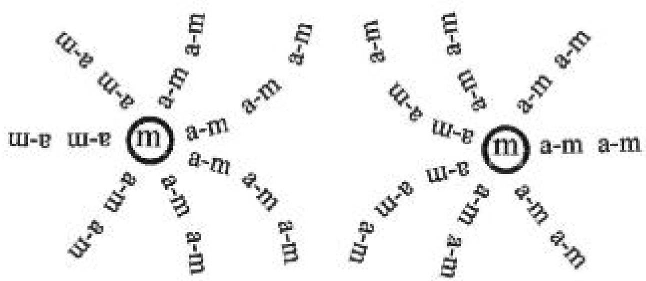


Figure 12-3 Two bodies of matter will be surrounded by matter-oriented partons in nearby space that orient themselves in a repulsive configuration.

Since the gravitational constant is an empirical constant, there is no fundamental reason that it might not be the sum of two fundamental forces. So, the sum of the matter repulsion force and the pressure force can and does equate to the several hundred year old classical theory of gravity. These two components separately are most likely an order of magnitude or more stronger than the sum that we call gravity. Within the scale of the solar system, the parton pressure force effectively neutralizes the matter repulsion force. Because the classical solution works so well on a small scale, we never stopped to think that gravity might be due to two opposing forces.

One point of interest is what is the relative strength of the matter force versus the electric force. We may expect that the matter force is somewhat the weaker of the two or we would have had to account for the matter force in ant-matter particle experiments. We should calculate at least a first approximation of the matter force strength before going too far with this comparison. We will most likely find that it has something to do with the relative population density versus energy distribution curves for each of the two partons and how that

relates to the number of partons involved in each force. We will also find that we have ascribed mass, some quantum number, charge, and/or moment to particles in order to adjust for the matter force.

We now have a simple force that is capable of explaining the large-scale force affects in the universe. We still need to account for the fact that the matter repulsion force is stronger than the parton pressure force at greater distance, so we will return to that question later.

C. The Matter Moment Force

The question of how gravity interacts with a body in an elliptical orbit has long been puzzling to scientists. To deal with the change in energy state as a body moves from its closest position (perihelion) to its farthest position (aphelion) scientist invented concepts such as potential gravitational energy, theories of force carrying particles such as photons or gravitons, and eventually a curved space-time model that seeks to avoid the problem through mathematical manipulation. Since no model of gravity is complete without an explanation of the force dynamics of a simple elliptical orbit, we shall address it here in the most straightforward way possible while incorporating a physical medium behind the force interaction.

To understand the force dynamics of the orbit, we need to first look at the effect an electrically neutral body of matter in motion has on the nearby partons. We know that even if a body is charge neutral it cannot be matter neutral. A matter body will influence partons to orient with their antimatter side nearer to the body. If the body is in motion relative to the surrounding partons they will rotate in response to the motion of a nearby body, as illustrated in figure 12-4.

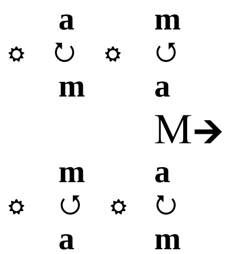


Figure 12-4 A body of matter moving through space causes nearby partons to spin, which leads to other partons spinning in response to their motion in such a way that momentum is conserved.

This rotation induces a matter-moment about the body. Those partons are rotating matter-antimatter dipoles, and they participate in a matter-moment force that can be treated in the same manner as the electrical charge induced magnetic force. And, as easily as a moving body induces a matter-moment, the matter-moment exerts a force on the moving body. The force orientation can be described as shown in figure 12-5.

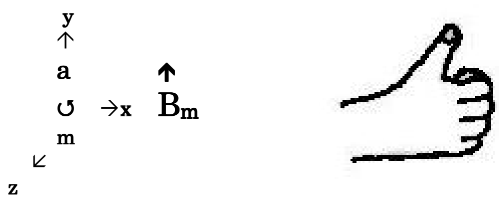


Figure 12-5 The right hand rule to determine the direction of the matter-moment, or B_m, field shown here pointing along the y-axis.

If we now consider a two-body problem with two bodies in orbit around each other, we find that the partons in the space

between the bodies rotate in the direction of the orbit, yielding a matter moment force pushing the two bodies apart. The partons on the outside of the orbital boundary rotate in the opposite direction, yielding a force that pushes the two bodies together. Since the partons inside the orbit are in closer proximity to both of the bodies, the matter-moment is stronger inside. So, the net matter-moment force pushes the two bodies apart.

If we consider a large central body such as the Sun orbited by a smaller body like the planet Mercury in an elliptical orbit, when the planet is at its perihelion it is also at it's greatest velocity. At the perihelion the matter-moment field will be at its maximum and it will force the planet outward away from the Sun. But when the matter-moment energy is transferred to the planet, the matter-moment field decreases in magnitude, and the planet slows. Eventually when the planet is at its aphelion, the parton pressure force takes over, pushing the planet closer to the Sun, recharging the matter-moment field. This process is repeated indefinitely.

We don't have to rely on phony potential forces, and we don't have to pretend that we know how a photon would carry information on gravity. This matter-moment force model gives us a real physical mechanism for the energy exchange we see in bodies in orbit within our solar system.

D. The Precession of The Perihelion of Mercury

If we only consider the three force effects above in an isolated two body system, we would have a situation where the planet would perfectly trace out the same ellipse each time it orbited, with each tracing being directly on top of the prior one.

Astronomers have known for centuries that the perihelion of Mercury is never in precisely the same position after an orbit around the sun. This is mostly due to the gravitational forces exerted by other planets and bodies in the solar system. But, by the mid 1800's after very precise measurements and calculations were done based on the classical gravitational model, it was well accepted as fact that there was a 43 seconds of arc per century discrepancy between theory and measurement.

Something new had to be added to the model that corrected this discrepancy. Ultimately, a new model called general relativity emerged and was accepted partly based on its solution of the precession of the perihelion of mercury problem. Since that time, for any theory of gravitation to be seriously considered, it to must address this problem, so we shall address it here.

If we look down on Mercury's orbit shown in the traditional counterclockwise direction, the precession advances the orbit, so the perihelion also moves in a clockwise direction. This is indicative of a small additional force pushing the bodies together, so that they are held together just a fraction longer than they would without this force.

So what haven't we considered yet? How about the matter-moment due to the rotation of the Sun? In our diagram, the Sun also rotates in a counterclockwise direction. This rotation induces partons to rotate in the clockwise direction. This is opposite form the rotation caused by the orbit. The matter-moment force exerted by these partons pushes Mercury inward toward the Sun. The distance from the Sun to Mercury is large relative to the Sun's diameter, so the precession force is much smaller than the matter-moment force due to the orbit.

Mercury does not rotate with respect to the Sun so the matter-moment from Mercury's rotation is not important. In this respect Mercury is like Earth's Moon. What is interesting is if it did rotate, the matter-moment field would be converted into a force pushing the two bodies together. This would cause the rotation to slow, and over time, eventually stop. This is

another common phenomenon that is not readily explained by present gravitational theories, except for the unsatisfying tidal force model. It is very easy to understand once the matter forces are considered.

The fact that makes the matter-moment solution for the precession of the perihelion problem, more acceptable than the general relativity solution, is that while general relativity was not at all useful in addressing the structure of a spiral galaxy, matter-moment does. The central disk of a galaxy rotates, inducing a matter-moment that pushes stars inward. The stars that are closer to the disk are subjected to a greater inward force. This inward force makes the stars appear to precess in their orbits. We could also think of it in terms of stars with faster orbits being closer to the core, which causes them to be in a leading positing relative to the outermost stars. This is the reason for the spiral shape. Under the classical and relativistic models there is not nearly enough mass for a spiral galaxy to be held together, but then it does not take into account the matter-moment force, which accounts for the error.

Our matter-moment model of gravity solves the precession of the perihelion problem. And, better than that, it solves a couple of important and tricky problems that have never been solved in a fundamentally simple manner. No model of gravity is acceptable if it cannot account for the structure of a galaxy, and we are already part way there.

E. The Earth's Magnetic Field

We will take a brief detour and consider the earth's magnetic field, since it is a timely point in our analysis. Present theories of the origin of the field have been no better than vague ideas about rotation induced magnetic fields and dipole moments largely in the iron of the earth's core. As we considered earlier, we do a much better job explaining the permeability of a vacuum by attributing it to parton rotation.

We also expect that an electrically neutral body must cause parton rotation when it moves through nearby space. So a rotating body will produce a matter moment inside as well as around itself. But how could a matter-moment induce a magnetic field when it should be electrically neutral? The key part of the question is the "should be". In the real world, where everything is not perfect it is perfectly reasonable to think that the matter-moment is not perfectly neutralized, and that there can be some residual magnetic component. This magnetic component could vary over time and even change polarity as conditions within and around the body change. And yes the high permeability of the iron core can magnify it and make it much larger than say the Sun, which is composed mostly of hydrogen. We should expect that the instabilities in the field over time are due to changes in the earth's molten core.

How do those instabilities come about? If we go to some point inside the Earth we can consider a sphere beneath us and a spherical shell above us. If we say that the inner sphere is rotating counter-clockwise it will cause partons around us to rotate in a clockwise direction. The outer shell will induce partons near us to rotate in the counterclockwise direction. At some position not too far below the earth's surface, when the masses of the inner sphere and outer shell are equivalent with regard to inducing parton motion, there will be no net matter moment. Above and below that point the matter moment will be in different directions. This creates a region of instability where rock is molten and churns, and forces the solid rock near the surface to move around. Irregularities in the earth's structure lead to a small net magnetic moment induced by all the iron rich rock moving about.

This argument can of course be extended to the sun and other bodies as an explanation for the origin of the magnetic fields, and planetary layering, questions that have baffled scientists for centuries.

F. The Decline in Pressure Force at Long Range

Returning to the problem of the light and dark regions of a spiral galaxy, the intergalactic red shift, and the accelerating expansion of the universe, we must now determine how the matter repulsive force comes to dominate the large-scale interactions.

We can return to visualizing the parton pressure force as being caused by the gravitational shadow of one body across another. But we also must consider that most of the pressure force is exerted by wavelengths slightly lower in frequency than the cutoff frequency. That means that most of the pressure force must occur at the surface of protons and neutrons, and to a much lesser extent electrons. Now we can visualize the shadow of a distant body as it falls on a proton, and imagine how the pressure force interacts at the proton level.

As we consider stars that are farther and farther away from our proton we notice that the shadow region will become increasingly narrow as the solid angle intercepted by the star diminishes. We know that simply because there is a cutoff frequency, there are partons whose wavelengths are so short that they no longer interact with protons, and thus don't participate in the parton pressure gravitational force. Since the proton has an effective diameter, we can also convert cutoff frequency into terms of solid angle and determine a minimum solid angle, or cutoff angle, at which the proton becomes transparent to the pressure force. If a star is so far away that the solid angle it intercepts as viewed from a proton is smaller than the cutoff angle, the parton pressure force ceases to have any effect.

We can visualize a proton as a sort of mesh screen ball that roughly equates to the spherical wave structure. It is transparent to frequencies above the cut-off frequency because those high frequencies have small wavelengths that are smaller than the openings in the proton shell. So, if the shadow of the distant star is smaller than a hole on the proton's surface, the partons that carry the pressure force will go right through it without exerting any force.

But we might ask, what happens to the lower frequency partons that normally cause the pressure force? The answer is, that as the shadow becomes narrower as we get closer to a proton, the longer wavelength partons that are longer than the shadow is wide become disrupted by the partons outside the shadow. Those wavelengths then become part of the normal parton background, and have no net pressure effect one way or the other.

When the star is closer, and intercepts a greater solid angle than the opening in the proton shell, it does push against it. This is what we see in local space. The transition from full gravity to none should be fairly rapid and occur relatively quickly as distances increase.

On the other hand matter repulsion is due to the polarization of partons in space. The orientation of a parton is due to the orientation of the partons next to it, and so on. Long chains of polarized parton dipoles can stretch across the universe and the solid angle between two bodies will have no affect on the force strength. It is a simple $1/R^2$ force to an indefinite distance.

Once the pressure force falls to zero, the matter repulsion force dominates the longer-range interactions. With galaxies we must consider the size of the central disc since there is so much overlap between stars that it can be treated as a solid object when calculating the cutoff angle. Galaxies made of matter that appear smaller than the cutoff angle will move apart from one another, and the rate of expansion of the universe will accelerate.

G. Galaxies

We now have all the information we need to solve the puzzle of the galaxy. As we discussed already the matter-moment induced by the central disk of the galaxy imparts a strong inward force. This force is strong enough overcome the normal matter-moment force due to the orbit of the star, thus pulling the star into a much lower orbit than it would be otherwise. As nearer stars are pulled inward they advance in their orbit relative to stars further out leading to spiral formation.

On the other hand, as stars are drawn inward, star density in the outer two thirds of the galaxies diameter decreases. At some point the mean distance to nearby stars becomes small enough that the matter force pushes stars apart. But that means that those stars are being pushed towards other stars that are still close enough for the pressure force to be effective. Over time, stars collect in bands with dark areas in between. The stars that are furthest away from the center of the galaxy form the thinnest bands. There will be a limit to how far away a star may be and still be held within the galaxy.

H. Gravitational Bending of Light

One other key component of the theory of general relativity that allowed it to supercede the classical theory in the minds of most scientists was that it included a theory that explained the bending of light as it passes close to the Sun. Light is deflected approximately 1.75 seconds of arc due to the gravitational force of the Sun. The classical theory has no explanation for the interaction of a photon with a nearby massive body since photons do not have rest mass. The general relativity theory incorporates a curved space theory. The light beam follows a path of gravitational equipotential, which is not necessarily a straight line.

We may wonder how a photon could interact with "gravity" in the first place. Would it respond to the parton pressure force?

The photon is certainly well within the gravitational shadow of the sun, so it could be pushed on from one side. That force, however, is generally due to partons that are many orders of magnitude higher in frequency than the frequency of light photons we are considering. If the photon responded to parton pressure from like wavelengths it would almost certainly be bent away form the sun due to photon pressure, so that can't be it.

We know that a photon doesn't have mass in the traditional sense, but does it have virtual mass? When the virtual electron-positron pair at the center of the photon flashes into existence it briefly has volume and structure similar to an electron. So it should block partons from transmitting the pressure force at the instant it exists. We can equate this to mass, and if we take the average over time it will be non-zero. We can think of it much in the same way that we think of an alternating current having voltage. Since a photon with 0.511 MeV of energy can turn into a free electron and positron, we must conclude that the parton itself has similar structure to an electron and therefore will have some volume and cutoff frequency associated with it. We would expect a visible light photon to have a very small virtual mass associated with it, but that should be sufficient to account for light bending around a star.

What is interesting is that a photon is matter neutral, so it will not be repelled or attracted to a star due to the matter polarization force. That means that the bending of light force could be due to parton pressure completely independently of the matter force or any other force. If so we can calculate the independent force strengths from it. We can see that our failure to attribute the bending of light to the proper cause is due to our failure to recognize that gravity is the sum of two forces. Any attempt to apply the classical gravitational model to the photon based on a virtual mass theory would have failed because the net force is too small to account for the angle.

Before we run off and say we have it all figured out we must consider the matter-moment force. The photon oscillates in first one direction and then the other so it produces oscillating magnetic and matter fields that point in opposite directions. We know that since the photon is moving relative to the star a matter-moment will be induced, and will interact with the photon. It has been know for well over a century that magnetic fields interact with photon and change the state of polarization, so we expect that a matter moment will also affect the polarization state. It will cause a linearly polarized photon to become circularly polarized. The matter field due to the star may also affect the polarization state of the photons.

A change in polarization state does not change the direction of the light. And, if either the matter or Bm force bent the light, the amount of change would be related to the polarization state of the light. This would cause the light to be spread out depending on angle of polarization. We do not see this, so it cannot be the answer.

We know from experience with optically transparent materials, that light refracts when it enters a material with a different refractive index. We don't see light refract due to solely being near the surface of an object. In order for a significant amount of the light energy to be within the sun, the photon must be essentially in contact with it. And the effect would vary rapidly with distance. This is not the phenomenon we are considering, so bending of light is not going to be due to some kind of partial refraction.

That leaves us with one answer. Photons have virtual mass due to the average effective volume and cutoff frequency due to the central parton. It is therefore directly influence by the parton pressure force. It is not affected by matter repulsion because it is matter neutral, and so it is a different magnitude than we would expect from the classical gravitational equations.

Of course it helps that we know that the space probe Ulysses measured an increase in gravity the farther it was from the sun, and the difference was too great to be caused by protons and other particles. The only other thing we know that occupies that region of space and declines with distance from the sun is light, so the virtual mass theory solves that puzzle too.

I. The Missing Mass Problem

Both the classical and relativistic models suffer from the missing mass problem. Our new model of the universe is so vastly different that the missing mass question is no longer relevant. The additional inward force within a galaxy is accounted for with the matter moment due to the rotation of the central disc. We no longer try to believe that galaxies moving apart from each other are somehow even within range of some attractive force. They move away from each other because they are pushed apart.

Equally important, we have given up describing the red shift as being residual velocity due to some long ago event. In other words, our theory does not support a big bang theory; at least not in it's traditional form. The big bang theory introduced all kinds of troubling problems to our model of the universe, many of which are now gone including the missing mass problem.

J. Conclusion

We have found that gravity can be described as a combination of several of the fundamental forces involving matter. There is the parton pressure force component, which is the closest thing to our traditional idea of gravity. There is a matter repulsion force that is responsible for intergalactic red shift

and the expansion of the universe. On a smaller scale such as our solar system the sum of the parton pressure and matter repulsion forces equates to classical theory of gravitation.

We no longer have to rely on potential gravity theories, since we now know that the energy dynamics of a planet in orbit are due to the matter-moment forces. And those same forces account for the precession we see in the planets of our solar system as well as the stars in a galaxy. By understanding the complex interplay between these forces we now have a chance to develop an accurate and physically meaningful view of the universe.

13

Relativity

Since relativity theory is an important component of a general gravitational theory we must consider how to view partons in free space relative to one or more rest frames. If we were to put ourselves in the position of a virtual particle pair flashing into existence, it is unlikely we would view the surrounding space as curved, but in fact only respond to what nearby particles, virtual and real, are doing. That is the way I prefer to view things, rather than from a potential surface viewpoint.

Up to now most of us have probably preferred to think of these virtual particles as having no motion of their focal point relative to the object we are considering. If that were the case, all the old arguments against æther theories could be used once again. So, in order to be consistent with relativistic theories, it must be the case that the foci of partons can be moving in any direction and at any possible velocity relative to an object or rest frame. The sea of partons must have no preferred direction or velocity. The forces as viewed from any rest frame will then be as expected by relativistic theory.

That means that the body is always in motion relative to some of the partons, so it is always interacting with them and inducing rotation. If we view this body from another rest frame that is moving a different velocity, the rotation of the partons around it will be different from our perspective. If we are approaching the body, rotating partons will appear to rotate faster. If we are moving away from the body, rotating partons will appear to rotate slower.

As our relative velocity approaches the speed of light, more and more of the partons in space will appear to rotate increasingly faster. If we could move at the speed of light they all would appear to rotate at their maximum rotation.

Why is the velocity of a body of matter limited by the speed of light? It is simply do the fact that the angular moment of the partons around it must be conserved, and the life span of the partons is tied to the speed of light. The fastest that a parton can move is when it rotates one full wavelength during its existence along the direction of motion. Then the parton must be replaced by another parton, which carries the momentum. For the process to occur faster the next parton in the series would have to come into existence before the previous one self annihilated. In order for a body to move faster than light it will have to be decoupled from the surrounding partons, but that would mean somehow eliminating matter-charge attraction.

Next we need to consider relativistic mass. What is it really? What happens at relativistic speeds, to make us want to say it has more mass? If we consider an electron, does the electron mass increase? Does the volume of the sphere change along with its wavelength and the electro-matter repulsion properties that sustain the equilibrium? Certainly we would expect that a wave front would appear compressed or expanded when viewed from the perspective of a different frame of reference, but what of a spherical wave? Could it appear to have one wavelength in its rest frame and a different wavelength from another frame of reference and still be in a unique equilibrium state?

While the electron may appear flattened somewhat from the perspective of someone moving at the speed of light, the inner force dynamics remain unchanged along with the spherical wave's wavelength, and the total effective volume of the electron. We must think of a particle as having a given size and wavelength from every perspective in order for the equilibrium solution to be viable.

With that being the case where does the mass come from? If we consider it from the standpoint that force equals mass times acceleration, the “mass” includes the mass equivalent of the energy stored in the moment of the partons. If it is not within the shell of the particles, it can only be the energy of the parton wave front.

What about relativistic gravitational mass? I am referring to an additional force of gravity caused by the additional “mass” due to a body’s velocity. In the classical theory of gravity there was no consideration of such a thing as relativistic gravitational mass. That idea was not developed until the theory of general relativity. We have two basic choices. One is that relativistic mass has no effect on gravitational forces. The other is that it does. We need to examine each force that makes up gravity in order to decide.

The parton pressure force works on the principle blocking the force that might otherwise impinge on a distant body. In order for relativistic mass to block a great amount of force one of three things must happen; the size of the particles must increase, the effective cutoff frequency must increase, or the partons outside the body must disrupt the transmission of the pressure. We have already concluded that the first two are unlikely, since that would compromise the integrity of the particle. We said previously that as a body approaches the speed of light, more and more partons near it would rotate in response to its motion. If the partons are rotating and carrying some of the body’s momentum energy, they cannot be transmitting the pressure force. So we do have within the scope of our model a means for relativistic mass to participate in gravity.

As for matter repulsion, the parton blanket around the moving body is matter neutral, and will not participate in that interaction. The partons will have a matter moment, but since they will be oriented in a circle around the body at every angle, their net matter-moment will be zero. The partons associated with a body moving near the speed of light will be neutral to the two matter forces. The only contribution to those forces will be due to the particles within the body.

By using the simple idea of parton rotation with respect to the motion of a body is space we have been able to develop the concept of relativity.

14

Inertia

No discussion of gravitation, or forces in general would be complete without some statement about inertia. The property of a body to stay at rest unless acted on is a fundamental principle of great importance that needs to be incorporated into any useful theory.

The problem with inertia is that the classic and standard models never had a physical model to account for it. There is a rather vague, untested, and unverified principle, that inertia is due to some relationship with other bodies in the universe, but it fails to propose an underlying physical mechanism.

It has been proposed by several scientists that inertia is a property of the sea of virtual particles, although maybe not using that specific wording. It is the pressure of these particles exerted from all directions that sustains an objects relative motion in space. Since this theory is in keeping with the rest of this monograph, and is the only reasonable model that contains a physical mechanism, we will use it as a starting point.

There is however one thing to consider. If inertia was solely a pressure phenomenon in the virtual particle vacuum, then we still don't have a good understanding of why an object in motion stays in motion. We can say that since the vacuum has no preferred coordinate frame, it cannot be described in a way that incorporates drag opposing a particle in motion.

It is possible, however, to make a stronger argument. If we look back to a matter body moving through space as illustrated in figure 12-4, and consider the parton wave front that

propagates in response to the movement of matter, we see that we have a sustained wave that carries an important percentage of the total momentum of the body. From relativity we know that this wave exists even from the perspective of the body at rest.

The parton wave front and the body that produces it are locked in motion together and one cannot change without the other changing. If the body is to come to a stop, then the parton wave has to stop as well, or at least be decoupled from the matter body. We would expect that this decoupling could occur by turning the parton wave into a photon, or by it becoming part of the momentum of another body that it collides with.

In any case we see that the parton wave phenomenon is the physical mechanism behind inertia, and is in keeping with the theories we have considered.

15

Antimatter and the Universe

One of the remaining big questions is why do we not see antimatter in local space? We expect that matter and antimatter came into existence in equal proportions through some cosmic event. This could occur much in the same way that a matter and antimatter particle pair can be created when there is enough energy present, but on a much grander scale. We also know that if galaxies where made of matter and antimatter there would be a lot more collision events where we see very bright objects undergoing intense matter-antimatter annihilation. We do not see a significant number of such events, so we have to think that any given galaxy is entirely made of one or the other.

From a distance, with only photon emissions as our guide, we have no way to tell if a galaxy is composed of matter or antimatter. But, we also do not see much evidence of matter and antimatter galaxies colliding, at least not in nearby space-time. If we did have antimatter galaxies in equal proportion to matter galaxies and somewhat randomly distributed, we would expect that they would be slightly more attracted to the matter galaxies. That should lead to a significant number of collisions between matter and antimatter galaxies that are not occurring.

The attractive matter force though could help explain this discrepancy in another way. We may consider that matter and antimatter clusters would be pushed together destroying each other until there was only some fraction of one or the other left. This would have happened a long time ago, and we would only see evidence of it at the farthest distances of space-time. The residue of these collisions would be a lot of photons.

For some matter around today though, either the antimatter must have been eliminated leaving an excess of matter, or the antimatter must have been separated from the matter in space-time, and somehow forced apart enough, by some means that we are not currently aware of, so that collisions do not occur in local space-time.

The approach that I am fond of is that the matter antimatter separation is one of time rather than space. It has long been a convention that all particle events can be considered as being the antimatter corollary in the opposite time direction. So why, if there was some event that produce matter and anti-matter in empty space, would that event not propagate in both time directions? Or to look at it from the other way, to think that such an event would only propagate in one time direction seems preposterous. If the event does propagate in both time directions, why could there not be an excess of matter headed in one time direction and an excess of antimatter headed in the other? Matter and energy can still be conserved and there would be no need to worry about missing antimatter at our place in space-time at all.

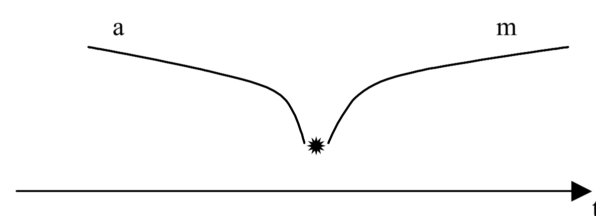


Figure 15-1 The universe expanding in both time directions.

Since evidence confirms that the rate of expansion of the universe is accelerating, we can only conclude that the universe will expand infinitely. It is an open system.

We have also concluded that we are not stuck with the traditional Big Bang theory, since we do not need to account for intergalactic red shift as residual momentum. It is due to a real force. The free particles could still have been generated in a single event that filled the universe with particles, but it would be slightly different then what we imagine now.

We do need an explanation for the existence of free particles. It could be either a single event or multiple events that occurred in the distance past. Or, it could be a continuous on-going process, whereby particles are produced in a random fashion in space. Each of these ideas has pluses and minuses, and there is no definitive evidence to allow us to state with absolute confidence that one or another is correct.

If there is a region of space with no free particles and it is perturbed in such a way that parton waves are produced. Those waves will constructively interfere at some points and form peaks of energy. And, if those peaks are large enough, pair production can occur.

But we do not see newly borne galaxies forming in between older galaxies, but rather the phenomena we associate with new galaxies are all at the limits of space-time as we see them. So, we must conclude that the universe does not manufacture extra matter everywhere at once. Some other special conditions must be required.

Interestingly enough, my work began with the desire to explain the origin of the universe, but I realized I could not proceed without a more coherent and realistic description of the fundamental forces and particles. Unfortunately, while the model that I have come up with has given me a lot more

insight with regard to the basic questions I began with, I am still far from a solution.

We are left with the same key questions that demand intellectually and experimentally defensible answers:

What event or events produced the free particles?

How did we come to have little or no antimatter in local space-time?

As with many other critical questions, I will resign myself to dealing with them another day, or leaving them for someone else, who with either the benefit of better experimental evidence, or a better intuitive grasp of the obvious, can reach a defensible conclusion.

16

The Proposal

The working title for this monograph was “A Modest proposal for Physics”, until the theories showed themselves to be an even better model for the universe than I expected at this early a stage, and a friend chided me that no one would believe in such a thing as a modest physicist.

In any event, the proposal is that a virtual particle model, which might also be called a zero point energy (ZPE) model, appears to be the only approach that will lead us to a unified force theory. So, I invite other physicists to work more seriously on this model. The original point to the text was to persuade you the reader of the numerous advantages to a ZPE model, both with some theories that follow rather directly from experiments and prior theoretical work, and some highly speculative hypothetical ideas that present intriguing possibilities.

As an aside, I avoided the term zero point energy or field (ZPF) for a reason, since the term has been intertwined with the popular science culture and the belief that some people have in free energy and the like, and is therefore held in ill repute by much of the established scientific community. This is unfortunate since ZPE models are very attractive, and are often necessary. We as scientists should have an open mind about possible new and unexpected phenomena. A century ago the idea of fusion as a means of releasing bound energy would have been received with skepticism, but given that there are known techniques for releasing bound energy, there is a real possibility that we will find others. Of course the proponents of such ideas either need to have very convincing arguments, or irrefutable experimental evidence, or both. In any event, by

avoiding the ZPE term, I hoped that some readers might read further before being overcome by some theoretical prejudice.

I similar avoided referring to the zero point energy as æther since that is another bad word in the physic dialect. The thing to remember about æther is that last centuries theories intrinsically tied the æther model to a coordinate reference frame. We know that there can be no fundamental coordinate rest frame and while it is difficult to free ourselves from it, we must, if we are to understand the universe. Fortunately we have a precedent in general relativity, since it requires us to abandon the idea of a fundamental coordinate frame of reference. If we can do that, and accept general relativity, we can certainly accept ZPE in a coordinate-less manner. Not to do so would be hypocritical.

I have also chosen to limit my use the word field, since the field concept was borne out of our ignorance of the fundamental nature of force transmission, as were potentials. I feel that we can only understand the true nature of forces if we restrict ourselves to dealing with the forces themselves and the balances between them.

Getting back to the force model, we can summarize a few things:

There is one fundamental force:
    The electro-matter force

The electro-matter force has three components
1. The pressure component
2. The polarization component (electro-matter charge)
3. The rotational component (electro-matter magnetism)

There are two fundamental particles
1. The electron-like parton (e-parton)
2. The proton-like parton (p-parton)

There are two fundamental energy packets

1. The photon, specifically the electron-like photon
2. The proton-like photon (p-photon)

The electro-matter and gravitational force can still be treated with the classical equations on classically sized problems, but they will require a compound formulation that deals with the pressure, and matter-charge and electric-charge components separately for many other problems.

I have read numerous accounts of physicists speculating that when we do find a unified field theory and have determined the true fundamental nature of the universe that they would expect there to be two, or maybe three, fundamental particles or forces. The models I have proposed, and that I propose we expend some effort developing, are a reflection of that goal, and hopefully you will agree, offer us some hope that once the appropriate mathematical models have been rigorously developed and peer reviewed, that we will achieve a more complete understanding of the universe.

17

The Mathematical Model

Now that we have a rough intuitive model in place, it is time to look at the form of the mathematical models, and review some of the fundamental theories of the past, and those relevant to the future. I will also abandon the rule about using names at this point, since hopefully those still reading at this stage, are open minded enough to consider the possibilities, regardless of their reverence for our predecessors. It will also be useful for those who wish to review prior works.

I am not a physics historian, so I will concentrate on those things that I am aware of, and that have direct bearing on our discussion. As we all know, a truly original thought is a very rare thing, so I hope to add credits where deserved in the future. Also, my mathematical skills have suffered through years of lack of exercise, so please consider the following mathematical analysis with that in mind.

A. Zero Point Energy

We discussed earlier that the virtual particle pair concept is related to Heisenberg's Uncertainty Principle, which allows a small amount of energy to exist for a small amount of time without violating the conservation of energy principle. The idea actually originated with Max Plank in 1911, so it has been around a long time.

Virtual particle pairs have been generally conceived to be any one of the hundreds of particles along with their antimatter opposites. We have seen from experiments that a particle pair can be produced when a photon has enough energy to equal the rest mass of the two particles, and we have also seen that a matter-antimatter pair can annihilate each other and leave a photon. In keeping with the theories in this text we would expect that a pair be created when the photon actually hits a parton that has sufficient energy to become a particle pair. In the case of the virtual particle pair the energy is borrowed, for the lack of a better term, from the vacuum and returned to it.

Zero point energy models have seen a difficult existence. Whenever a scientist postulates that some event is due to ZPE effects, it is usually followed up rather quickly with a rebuttal that offers an alternative. That is one problem with mathematical models they are always falsifiable. We do have two theories that have withstood attempts to find alternative explanations and they are generally cited as experimental proof of the existence of ZPE.

The first I will mention is the Lamb Shift. Lamb and his associates cataloged a great number of atomic spectral lines and compared them with the predicted line energies as derived from Schrodinger's Equation. Lamb found several discrepancies, or shifts, in line energies that have been attributed to ZPE interactions. Why it is that, in the face of the necessity to fudge the QED result with a ZPE formulation, no one succeeded in championing the idea that the ZPE approach is more fundamental, is beyond my comprehension.

The other theory that has a great deal of relevance to our discourse is the Casimir Effect. In 1948 Casimir theorized that the ZPE would produce a Van der Waals type force. The theory was developed based on the concept that virtual photon pairs were responsible. The theoretical description of the photon presented here is quite different, but a parton-based effect is equivalent for a broad class of problems.

In the simplest illustration of this effect, we consider two conductive plates. When the plates are positioned close enough together, on the order of a micron or less, the plates are pushed together. As the plates move closer together, more

and more longer wavelength partons are excluded from the region between the plates, eventually reducing the parton pressure to a significant degree. The parton pressure pressing inward on the plates from outside remains unchanged, and the unbalance of the forces causes the plates to move together.

The Casimir force is quite weak at relatively large distances such as a micron, and it is a difficult positioning and measurement exercise. But, experiments have been done and are in good agreement with the theory. The formula for the attractive force per centimeter square for two plates distance D apart is as follows:

Equation 17-1

$$U = -\frac{\pi^2 \hbar c}{720 D^3}$$

The general equation is of the form:

Equation 17-2

$$U_\gamma^\infty = \Sigma \tfrac{1}{2}\hbar\omega_k e^{-\gamma\omega_k}$$

The Casimir Effect is very important to the arguments set forth in this monograph since it illustrates both the parton pressure and wavelength exclusion phenomena. We would naturally expect that with distances on the order of nanometers, picometers or less, that the effect would become increasingly significant and stronger, particularly when we consider the transition between parton types.

B. The Photon

I want to make a brief departure and revisit the photon, since it is so important to energy transmission. We know that the energy of a photon equals the frequency times Plank's constant ($E = h\nu$). We also know that the uncertainty principle, which allows for the existence of virtual particles, dictates that the difference in energy multiplied by the difference in time is less than or equal to h divided by 4π. ($\Delta E \, \Delta t \leq h/4\pi$)

We also expect under this theory that each central photonic pair exists for only half of the wave frequency, $t = 1 / 2\nu$. So the maximum energy E of the photonic pair is $E = h\nu/2\pi$. Those familiar with much physics will recognize $h/2\pi$ as h-bar designated by the symbol ħ, a constant that appears with even greater frequency than h.

But where is the rest of the photons energy, the other $(1 - 1/2\pi)$ worth of it that is not entrained in the central pair? The answer is; the energy that must be carried by the other virtual particle pairs along the wave front. The common nature of h-bar also means that this 2π relationship between the energy at one central point compared to that of the entire circular field is something fundamental. Of course when we hear 2π we think about the circumference of a circle. We would expect that the wave front expands outward radially from the central photonic pair filling a circular space at any instant, making the area proportional to the square of the radius. But we also know that the energy is not uniform over this area, but falls off in proportion to the square of the distance. So given the situation, 2π makes perfect sense.

We also expect that there will be a similar constant relationship involving the energy distribution in a spherical wave structure, and there is. It is approximately 1/137 and is called the fine structure constant. This constant merits much additional study, but I will unfortunately have to leave it for some future date.

C. Gravity – The Parton Pressure Effect

Newton was the discoverer of the first law of gravitation and published it in 1686. It is still the most useful form for solving classical gravitational problems. It takes the simple form below, with G as the gravitational constant:

Equation 17-3

$$F_g = G \frac{m_1 m_2}{r^2}$$

The theory was not significantly amended, or more accurately generalized, until Einstein developed the General Theory of Relativity in order to deal with some problems in the classical theory, particularly the advance of the perihelion problem. In its simplest form shown below, G is the gravitational force and T is a stress-energy tensor.

Equation 17-4

$$G = 8\pi T$$

This is a nice compact looking form, but determining the Tensor for non-classical problems is an exercise that only practiced physicists can perform, so I will not attempt to elaborate on it further.

The next turn of events that is of particular interest to us came about in 1967 when Sahkarov proposed a theory that the gravitational force was due to the ZPE. He theorized that the elasticity of space was responsible for the force, and came up with the first equations for it, the first order of which is equivalent to general relativity. The ZPE is described mathematically as ½hν, which we set equal to ½ħck, so we can use k as a frequency dependant variable in the equations that follow.

He also dealt with the cut off frequency problem. A normal treatment of the ZPE that considers all frequencies from zero to infinity will lead to an infinite force. In most quantum models this infinite ZPE force is normalized out, you might say that it is ignored through some mathematical slight of hand. Sahkarov gets around the problem somewhat by creating a cut off frequency and assigning it a value on the order of the reciprocal Plank length, which is approximately 1.6 x 10^{-33} cm. This length is very short indeed, and represents energies in the 10^{28} eV range. By looking only at the first order gravitational term, we can derive a value for Newton's gravitational constant, G, as shown in equation 17-5.

Equation 17-5

$$G = \frac{c^3}{16\pi B\hbar \int k \, dk}$$

The coefficient B comes from Sakharov's derivation and is a dimensionless number on the order of 1. The wavelengths that take part in the gravitational interaction are the critical determining factor for G. So, based on the model we have theorized, the wavelengths of the parton shell of the fundamental particles will be close to the cutoff wavelength.

While physicists are indoctrinated in the view that forces do not require physical media, the truth is that we almost all agree with Newton's quote in the introduction to this text, and desire an explanation that has a physical medium. Consequently, Sakharov's theory has gotten a lot of attention, although no single treatment of it has been so well accepted as to become the accepted model for gravitation. This is due largely to the fact that his theory did not solve any new problems not already

explained by Einstein's theory. Aside from the physical medium problem there has been nothing to compel scientists to accept it. Of course, Newton would feel those who do not find it compelling are lacking "a competent faculty for thinking."

Of particular interest to us is some of the work by Puthoff. He has reaffirmed the ZPE gravity model based on parton pressure, and in fact his papers are where I got the term parton. Additionally he derived the force using a stochastic electrodynamic (SED) approach, which is a classical alternative to QED that was established by Boyer and others. SED is more in keeping with our model of the universe. Puthoff has also worked on a similar derivation of inertia along with Haisch and Rueda.

The important question then is how do we sum the pressure due to the e-partons and p-partons to determine the combined gravitational force? If, as we have theorized, their electro-matter orientation yields different force strengths, then we will expect that the pressure on space due to the two partons will be different. In fact we would expect the pressure due to p-partons would be significantly greater. We will also expect that the wavelength ranges, or at least the population densities at given frequencies will be different between the two.

But, how do we sum them? Is it a simple sum as it is with gases where the partial pressures due to different molecules may be added up in a simple fashion? Or, does the electro-matter interaction lead to a more complex relationship? I will take the position that the electro-matter relationships are accounted for in the polarization and rotation terms that we will consider in a moment, and that the force that we attribute to being purely due to pressure can be summed up in a simple fashion. This leaves us with a simple relationship as shown in equation 17-6. The e and p subscripts define the e-parton and p-parton component relationships.

Equation 17-6

$$G = \frac{c^3}{16\pi\hbar[B_e\int k_e\, dk_e + B_p\int k_p\, dk_p]}$$

And the Newtonian equivalent force equation takes the form of equation 17-7, keeping in mind that the ultimate magnitude of G will be quite different from what it was supposed to be in Newton's day.

Equation 17-7

$$F_g = \frac{m_1 m_2 c^3}{r^2 16\pi\hbar[B_e\int k_e\, dk_e + B_p\int k_p\, dk_p]}$$

With this work in hand we already have a strong fundamental basis, including a mathematical model, for our gravitational force. We still need to look at the frequency issues as it relates to the particles, as well as the effective distance of the force. We also need to look at higher order terms in the Sahkarov theory that are in addition to the classical terms, and need careful consideration. But, for the most part the theory is in place and waiting for mainstream acceptance much as it has been for over 30 years.

D. Vanishing Gravity at a Distance

Because we know we have accelerating expansion of the universe, intergalactic gravitational red shift, and light and dark bands in galaxies, we have to conclude that at some point on the order of a tenth the size of a galaxy, the parton pressure force we commonly call "gravity" falls to zero, and the repulsive force takes over.

Within the scope of a parton pressure theory of gravity the classical mass of the elementary particles must be related to their volume and the range of wavelengths that they block. This wavelength range is between the diameter of the particle and the wavelength at which the particle becomes transparent (transparency wavelength).

We know experimentally that a proton has a diameter on the order of 10^{-15} m. The electron is known experimentally to be less than 10^{-18} m, how much less, we do not know. I will arbitrarily assume that it is 10^{-19} for the purpose of my calculations. The ratio of the volumes of these particles is the ratio of the diameters cubed, and is on order of 10^{12} as calculated in equation 17-8

Equation 17-8

$$(10^{-15} / 10^{-19})^3 = 10^{12}$$

Since the "mass" of a proton is only ~2000x the electron there is a difference of $5\text{x}10^8$ (from equation 17-9) that must be attributed to the difference in their transparency.

Equation 17-9

$$10^{12} / 2000 = 5\text{x}10^8$$

We can assume that the transparency wavelength for the electron is at the Planck Frequency and is 10^{-35} m. Since virtually all the parton pressure energy is due to the shortest and most energetic wavelengths, the proton must have a shorter transparency wavelength as seen in equation 17-10.

Equation 17-10

$$10^{-35}\text{ m}/5\text{x}10^8 = 5\text{x}10^{-27}\text{m.}$$

Since most of the mass in the universe is in the form of protons, or neutrons, which are essentially the same thing within the scope of this argument, we must consider most of "gravity" is due to partons pushing on protons. No other common thing, beside electrons, is affected by these short wavelengths.

The size of the gravitational shadow cast by a distant star onto a proton is relevant. If the size of the shadow at the proton's surface is smaller than the transparency wavelength, there will be no parton pressure force exerted against it. Partons that are longer than the shadow is wide will be neutralized by normal random ZPE events.

We can define the transparency angle (10^{-11} from equation 17-11) by the ratio of the transparency wavelength and the proton radius.

Equation 17-11

$$5x10^{-27}\ m/5x10^{-16}\ m = 10^{-11}$$

If we use our Sun with a diameter of 1.4 million km as an example star, we can determine how far away it would need to be in light years. One light year is $9.5x10^{15}$ m, and the distance that the sun stops exerting "gravity" on a distant object is 14,700 light years (equation 17-12).

Equation 17-12

$$(1.4x10^{9}\ m/10^{-11})/9.5x\ 10^{15}\ m = 14{,}700\ LY$$

The Milky Way Galaxy is 147,000 light years in diameter, so the 14,700 value matches up very well with the width of the dark spiral bands within the galaxy. The bands are formed

because some stars are pushed apart while others are pushed together depending on their distance and initial distribution.

E. Electro-Matter Theory

The well-known classical model for electricity and magnetism as established by Maxwell is, even in light of a ZPE foundation for the force, still valid for a broad class of problems. This should come as no surprise.

We do need to realize that these equations were determined for a region of space-time that only contains matter, and so they describe the polarization and rotational forces of the partons between matter bodies. Maxwell's equations for a vacuum in their integral form follow in equations 17-13(a-d).

Equation 17-13

a) $$\int \mathbf{E}\cdot d\mathbf{A} = \frac{Q_t}{\epsilon_o}$$ (Gauss's Law)

b) $$\int \mathbf{B}\cdot d\mathbf{A} = 0$$ (No Magnetic Charge)

c) $$\oint \mathbf{E}\cdot d\boldsymbol{l} = -\frac{d\Phi}{dt}$$ (Faraday's Law)

d) $$\oint \mathbf{B}\cdot d\boldsymbol{l} = \mu_o\left(I + \epsilon_o \frac{d\Psi}{dt}\right)$$ (Ampere's Law)

Since these equations are well established and a discussion of them can be found in any good physics text, I will not go into them here, except as needed in the following discussions of other electro-matter force equations.

To start that process we should begin with a form of the equation that deals with matter forces between electrically neutral bodies of matter on a large distance scale. We fundamentally have the same forces related to parton polarization in response to matter charge and matter moment, or we might call it matter magnetism, which is due to relative motion of matter in space. We can come up with a set of equations that is completely analogous to Maxwell's equations as can be seen in equations 17-14(a-d).

Equation 17-14

a) $$\int \mathbf{M} \cdot d\mathbf{A} = \frac{m_t}{\in_{mo}}$$

b) $$\int \mathbf{B}_m \cdot d\mathbf{A} = 0$$

c) $$\oint \mathbf{M} \cdot d\boldsymbol{l} = -\frac{d\Phi_m}{dt}$$

d) $$\oint \mathbf{B}_m \cdot d\boldsymbol{l} = \mu_{mo}\left(I_m + \in_{mo}\frac{d\Psi_m}{dt}\right)$$

Here I have adapted the symbol capital M to stand for the matter charge force, little m for matter charge, $\in_{mo}$ for the matter component of the permittivity of the vacuum, B_m for the matter magnetic force, μ_{mo} for the matter component of the permeability of the vacuum, likewise for Φ_m and Ψ_m the magnetic flux and matter flux respectively, and I_m the matter current.

As discussed previously in the text, matter charge will behave in precisely the same way as electric charge, except that it is lesser in magnitude due to the force differences between the two partons. We expect that the force due to matter charge is a factor of at least a thousand times less than electric charge. That is why that during high energy physics experiments, which is about the only chance we have to measure the difference in forces between matter and antimatter that we have not noticed a difference. Or, more precisely we attribute this force to something else, such as mass or moment.

We need to now look back at the electric charge equations alone in equations 17-15(a-d). Even though they are not really important since we have no bodies of mass that are matter neutral, it is an interesting step in the development of the theory. As with the matter equations above I use e subscripts to define electric charge only relationships.

Equation 17-15

a) $$\int \mathbf{E} \cdot d\mathbf{A} = \frac{Q_t}{\in_{eo}}$$

b) $$\int \mathbf{B}_e \cdot d\mathbf{A} = 0$$

c) $$\oint \mathbf{E}\cdot d\boldsymbol{l} = -\frac{d\boldsymbol{\Phi}_{\mathbf{e}}}{dt}$$

d) $$\oint \mathbf{B}_e\cdot d\boldsymbol{l} = \mu_{eo}\left(I_e + \epsilon_{eo}\frac{d\Psi_e}{dt}\right)$$

These equations, and in fact the values for each component of the equations, and the results are virtually indistinguishable from the original equations.

Now we only need to combine the two in order to have generalized equations for the electro-matter force at classical distances as shown in equation 17-16(a-d). Here I will adopt the use of the term P to refer to the combined electric and matter charge force due to parton polarization.

Equation 17-16

a) $$\int \mathbf{P}\cdot d\mathbf{A} = \frac{\mathbf{Q}_t}{\epsilon_{eo}} + \frac{\mathbf{m}_t}{\epsilon_{mo}}$$

b) $$\int \mathbf{B}\cdot d\mathbf{A} = 0$$

c) $$\oint \mathbf{P}\cdot d\boldsymbol{l} = -\frac{d\boldsymbol{\Phi}}{dt}$$

d) $$\oint \mathbf{B}\cdot d\boldsymbol{l} = \mu_{mo}\left(I_m + \epsilon_{mo}\frac{d\Psi_m}{dt}\right) + \mu_{eo}\left(I_e + \epsilon_{eo}\frac{d\Psi_e}{dt}\right)$$

In real world problem solving, where there is no such thing as charge without matter, we need to revert back to the original methods outlined in Maxwell's equations. They already take matter into account for calculating results for the electric portion of the large-scale electro-matter force equations. We will of course need to ignore the matter component addressed on the electric side of things when dealing with the matter force. This is fairly straightforward.

F. General Electro-Matter Theory

A more general theory is need to explain the strong nuclear force and weak electric force, in addition to explaining the differences we see when we are not in a plain vacuum media. To begin with, let us look at the charge force equation once again in equation 17-17.

Equation 17-17

$$\int \mathbf{P}\cdot d\mathbf{A} = \frac{\mathbf{Q}_t}{\epsilon_{eo}} + \frac{\mathbf{m}_t}{\epsilon_{mo}}$$

We notice immediately that the electric and matter charges will be generally fixed as two bodies approach each other, so if there is a near space effect, it has to be reflected in a change in the permittivity. We also know that the dielectric constant, which is the ratio of permittivities of a material and vacuum ϵ/ϵ_o is larger than one. So, as we exclude parton wavelengths by having atoms present, the permittivity increases and the force declines. We will of course expect the same thing to happen when the objects are so close together that wavelengths are excluded. That means that we will have a relationship such as the one shown in equation 17-18.

Equation 17-18

$$\epsilon = \frac{\epsilon_o}{b[c_e\int\omega_e\, d\omega_e + c_p\int\omega_p\, d\omega_p]}$$

In the above equation ω_e and ω_p represent the e-parton and p-parton frequencies. The designators b, c_e, and c_p are coefficients. We would expect that they would be some combination of the two most fundamental constants, π and h, but I will not attempt a more precise derivation here. As with the gravitational equations, we expect higher order terms as well. Suffice it to say for now, that the permittivity will vary in relation to the wavelengths of the two partons that are available for the interaction.

But where does the permittivity of the vacuum value come from? We would think that it is purely a function of the available partons and not an independent fundamental constant after all. So we would expect it to be described by an equation such as equation 17-19, with more detail and additional terms of course.

Equation 17-19

$$\epsilon_o = \frac{a}{b[c_e\int\omega_e\, d\omega_e + c_p\int\omega_p\, d\omega_p]}$$

Now if we look back at the charge equation and substitute, we have a more general form as seen in equation 17-20. Once again this is a very general form without higher order terms.

Equation 17-20

$$\int \mathbf{P}\cdot d\mathbf{A} = \frac{a_e\, \mathbf{Q}_t}{b_e[c_{ee}\int\omega_e\, d\omega_e + c_{ep}\int\omega_p\, d\omega_p]} + \frac{a_m\, \mathbf{m}_t}{b_m[c_{me}\int\omega_e\, d\omega_e + c_{mp}\int\omega_p\, d\omega_p]}$$

This simplistic derivation gives us a general idea of the form of the charge equation including the parton frequency response as it relates to the polarization force.

The second of Maxwell's equation shown once again in equation 17-21 is the one that states that there are no magnetic monopoles.

Equation 17-21

$$\int \mathbf{B}\cdot d\mathbf{A} = 0$$

Well, there are still no magnetic monopoles, so the equation can stand as is.

Next we need to consider the generalized version of Faraday's law, equation 17-22. This law states that the polarized charge force can be caused by a change in the rotational mode or magnetic spin state of the partons represented by the magnetic flux term, $\mathbf{\Phi}$.

Equation 17-22

$$\oint \mathbf{P}\cdot d\boldsymbol{l} = -\frac{d\mathbf{\Phi}}{dt}$$

The e-partons and p-partons both spin to induce what is classically called the magnetic field. Even if the relative percentage of the two partons changes due to wavelength exclusion due to spatial or other restrictions, it is still the rate of change of the flux that is important. So, the flux is not dependant on the wavelength relationship.

What is important for determining the nature of the force that we see in the circuit, is the nature of the material composition of the circuit. Is it electrically conductive or not? Is it matter conductive or not?

In an electrically conductive circuit we will see current flow in response to the change in the rotational state of the partons, just as we do in the classical version of Faraday's Law. If we have a solid non-conductive material, it will not respond to the changing field since the bonds within the material are too strong. But, if we have a nonconductive material that can flow, we will expect it to flow in response to the matter-moment produced by the electrons carrying the electrical current, as described in equation 17-9(c). Of course the terms solid and

non-conductive are subjective, and in fact we would expect some response in virtually every material even if we cannot see it.

The magnetic flux should not have an effect on matter except for maybe some small amount that is not completely cancelled out. There will be a small matter-moment that will induce a small amount of movement in matter. I personally have experience and experimental evidence of the cold cavitation of transformer oil induced by collapsing magnetic fields from repeated high voltage arc discharges. So I am quite confident in matter-moment induced motion in a very low conductivity material is both real and easily explained by applying Faraday's Law to matter.

To complete the general electro-matter equations we need to look into the general version of Ampere's Law, our last version is repeated in equation 17-23.

Equation 17-23

$$\oint \mathbf{B}\cdot d\boldsymbol{l} = \mu_{mo}\left(I_m + \epsilon_{mo}\frac{d\Psi_m}{dt}\right) + \mu_{eo}\left(I_e + \epsilon_{eo}\frac{d\Psi_e}{dt}\right)$$

With this equation we must consider the magnetic field induced by the motion of electric and matter charge. And, as we stated before, electric flux, Ψ_e, does by necessity include some small matter component, so we will consider those together as we have always done, and consider the matter flux, Ψ_m, alone in the other term of the equation.

We have already examined permittivity, so we expect that the same parton relationship must hold here, but we need to consider the permeability. Once again, considering only those things that we know to exist, we must conclude that the material spacing and composition affects which wavelengths and types of partons are available to take part in the magnetic spin response. We would expect then that iron and other ferromagnetic materials would exclude a significant number of e-partons, forcing a much higher percentage of p-partons to rotate, leading to a much stronger magnetic flux.

Paramagnetic materials would likely have a small excess of p-partons when compared to normal vacuum distribution, while diamagnetic materials would have an excess of e-partons available for rotation. The dynamics are much more complex than permittivity, since rotation is more complex to describe than polarization. In any case we would still expect it to have a parton dependent mathematical form, such as equation 17-24.

Equation 17-24

$$\mu_o = \frac{\alpha}{\beta[\gamma_e \int \omega_e \, d\omega_e + \gamma_p \int \omega_p \, d\omega_p]}$$

There will of course be higher order terms as well, which will most likely be critical for describing the strong magnetic response of ferromagnetic materials. If we substitute the general equations for permittivity and permeability into equation 17-18, we get simplified general form of Ampere's Law shown in equation 17-25.

Equation 17-25

$$\oint \mathbf{B} \cdot d\boldsymbol{l} =$$

$$\frac{\alpha_m}{\beta_m[\gamma_{me} \int \omega_e \, d\omega_e + \gamma_{mp} \int \omega_p \, d\omega_p]} \left(I_m + \frac{a_m}{b_m[c_{me} \int \omega_e \, d\omega_e + c_{mp} \int \omega_p \, d\omega_p]} \frac{d\Psi_m}{dt}\right) +$$

$$\frac{\alpha_e}{\beta_e[\gamma_{ee} \int \omega_e \, d\omega_e + \gamma_{ep} \int \omega_p \, d\omega_p]} \left(I_e + \frac{a_e}{b_e[c_{ee} \int \omega_e \, d\omega_e + c_{ep} \int \omega_p \, d\omega_p]} \frac{d\Psi_e}{dt}\right)$$

We should also note that while we viewed the constants from the standpoint of atomic spacing within materials, the theory extends into the subatomic and even sub-particle realm, including the weak force and strong nuclear force.

To conclude, we have now developed a simplified electro-matter theory where all the known forces are described by a system of five equations, 17-7, 17-20, 17-21, 17-22, 17-25. These equations describe, in order, the parton pressure force, the parton polarization force, the parton rotation force, the rotation induced parton polarization force, and the polarization induced parton rotation force.

G. The Future

There are a dozen or more thought experiments within this monograph that deserve attention, and hundreds if not thousands more experiments or theories that should be reexamined in light of these theories. But, that is far more than one physicist can hope to accomplish in a lifetime, or possibly even a generation of physicists can hope to accomplish, so I have decided to stop here for now, and appeal to others to chose a topic that interests them and work on it.

I am an experimentalist at heart, and have built an electro-matter transformer with wire windings on one side and non-conductive liquid windings on the other to see if I can measure some of the fundamental electro-matter relationships. I detected a small degree of motion in the fluid that was dependant on current motion. I need to repeat the experiments under more controlled conditions before publishing the results.

For now I hope that these thought experiments have given some small weight to the idea that universal forces are conducted by and dependent on Zero-Point Energy as it is found in the virtual particle pair stew that inhabits all space.

I hope it will allow some people to achieve a better understanding of the universe while others will have some additional incentive to keep exploring our world, so that we can conceive of and build even greater technological marvels in the future.

References

C.W. Misner, K.S. Thorne, J.A. Wheeler, ***Gravitation***, (Freeman, San Fransisco 1973).

M. Bordag, ***The Casimir Effect 50 Years later***, (World Scientific Publishing, Singapore 1999).

P.J.E. Peebles, ***Principles of Physical Cosmology***, (Princeton, Princeton 1993).

P. Lorrain, D.R Corson, ***Electromagnetic Fields and Waves***, (Freeman, San Fransisco 1970).

E. Hecht, ***Optics***, (Addison-Wesley, Redding MA, 1987).

H. Aspden, The Photon-The State of The Art, Web publication (www.energyscience.co.uk), 1998

J.L. Powell, B. Craseman, ***Quantum Mechanics***, (Addison Wesley, Reading MA 1961).

J.M. Blatt, V.F. Weisskopf, ***Theoretical Nuclear Physics***, (Dover, New York, 1979).

T.L. Brown, H.E Lamay,Jr., ***Chemistry***, (Prentice-Hall, Englewood Cliffs, New Jersey 1977).

J.D. Anderson, et.al., Phys Rev, **81**, 2858, 1998.

H.E. Puthoff , Gravity as a zero-point force, Phys Rev A, **39,** 2333-2342 1989.

B. Haisch, A. Rueda, H.E. Puthoff, Inertia as a zero-point field Lorentz force, Phys Rev A, **49**, 678-694, 1994.

M. Ibison, H.E. Putoff, S.R. Little, The speed of gravity revisited, Institute for Advanced Studies at Austin, Web Publication (www.earthtech.org).