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ON THE QUANTUM AS A PHYSICAL ENTITY

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THE QUANTUM AS A PHYSICAL ENTITY

(A PHYSICAL MODEL FOR QUANTUM MECHANICS)

THE "HIDDEN VARIABLE" SOLUTION PREDICTED BY EINSTEIN.

PREFACE

ALTHOUGH AN ERUDITE WORK INVOLVING QUANTUM MECHANICS, THIS MONOGRAPH CAN BE EASILY ASSIMILATED BY INDIVIDUALS NOT WELL VERSED IN THE DISCIPLINE. THIS VERSATILITY EXISTS NOT BECAUSE THE PRESENTATION IS SIMPLIFIED OR TECHNICALLY DEFICIENT BUT BECAUSE THE VERY NATURE OF THAT TO BE PRESENTED IS SIMPLE (INCLUDING THE MATHEMATICS). EINSTEIN IS REPUTED TO HAVE SAID, "If we really understood the universe we could teach it to children. THIS SENTIMENT MAY BE ALSO STATED AS A GENERALITY: The unknown is complicated and vague, the known is simple and clear.

QUANTUM REALITY

I don't know who Nick Herbert is, that is I am not privy to his vitae. However, I judge the man by his writing wherein I find him very erudite and a superior communicator.

I am referring to his book Quantum Reality (Anchor Books) which unfortunately gave absolutely no information on his background.

To me the book is excellent because it not only summarizes the fundamental concepts of quantum theory but is an avant garde dissertation on the state of the art. It is written for consumption by those of ancillary disciplines and therefore kept simple -- but with the essentials ably explained.

The main thrust of the book is not to explain quantum theory but to discuss the frontier of that discipline. To those who have not read it, I highly recommend they do so.

I will use the thrust -- and some quotes -- of his writing because Herbert not only can put forth the concepts better than I but certainly with more authority.

He poses questions. I will attempt to answer them in the context of my theory, The Quantum as a Physical Entity,(A Physical Model for Quantum Mechanics)

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The first sentence of the Preface sets the thrust of his book:

"One of the curious features of modern physics is that in spite of its

overwhelming practical successes in explaining a vast range of physical phenomena from quark to quasar, it fails to give us a single metaphor for how the universe actually works."

The first sentence of the second paragraph:

"The search for a picture of 'the way the world really is' is an enterprise that transcends the narrow interests of theoretical physics."

The first sentence of the first chapter is a quote:

"The essential point in science is not a complicated mathematical formalism or a ritualized experimentation. Rather the heart of science is a kind of shrewd honesty that springs from really wanting to know what the hell is going on!

--- Saul-Paul Sirag"

And, finally, the first sentence of Chapter 2:

"One of the best kept secrets of science is that physicists have lost their grip on reality."

Amen!

One of the foremost anomalies of quantum mechanics is the wave/particle duality.

In the context of that duality the characteristics and utilization of the proxy wave, psi, are logical even though the exact nature of the connection is not known.

Nick Herbert also refers to what he calls "quantum stuff":

"New quantum facts destroy the once sharp distinction between matter and field. With two magic quantum phrases we can translate at will between the particle quantities ... and the wave quantities ... ,turning matter into field and vice versa. It's beginning to look as if everything is made of one substance -- call it 'quantum stuff' -- which combines particle and wave at once in a peculiar quantum style all its own."

Ten years before Herbert's publication this author developed a concept of "the quantum as a physical entity". This entails a physical construct, a model that incorporates both particle and wave characteristics. One could say that the material composition of this entity is Herbert's" quantum stuff".

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The essence of mathematics is the perception of relationships, some are of nature, others of concepts in the mind.

Caution must be exercised to not over mathematize and thereby miss the essence of the physical universe.

This monograph is a comprehensive effort to unveil the anatomy, the physiography of the quantum complex. It deals strictly with this issue not engaging in the typical calculations nomenclature or techniques of the discipline. The concept was to utilize a completely fresh approach with the sole purpose of unveiling the physiography the only criteria being that the new

structure be self-consistent and also consistent with empiricism and well accepted laws. The physical description of quantum characteristics herein described leads to a gestalt experience.

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It might be stated at the outset that -- although I was not aware of it at the time -- the model developed in this work is a furtherance of the basic concept of Schrodinger.

Isaac Asimov describes Schrodinger's concept thus*:

> **As soon as Schrodinger learned of the matter waves postulated by de Broglie and the concept of the electron as having wave properties, it occurred to him that the picture of the atom as built up by Bohr could be modified to take those waves into account. Once this was done, the Bohr atom might even be improved.**
>
> **In Schrodinger's atom the electron can be in any orbit around which its matter waves can extend in an exact number of wavelengths. *This produced a standing wave*** ((emphasis added)) and therefore did not represent an electric charge in acceleration, so that the electron, as long as it remained in orbit, need not radiate light and did not violate the conditions of Maxwell's equations.**

*** Asimov's Biographical Encyclopedia of Science and Technology, Doubleday & Company, N.Y. 1964, p 510**

**** The standing wave concept is central to my hypothesis.**

> **Furthermore, any orbit between two permissible orbits where a fractional number of wavelengths would be required is impermissible. This accounts for the existence of discrete orbits, with nothing possible in between, as a necessary consequence of the properties of the electron, and not as a mere arbitrary deduction from spectral lines.**

THE PROCESS AT WORK:

> **The truth is in one way hard and in Another easy. For it is evident that no one can master it fully nor miss it wholly. But each adds a little to our knowledge of nature, and from all the facts assembled there arises a certain grandeur.**
>
> **- ARISTOTLE -**

Come with me on a great adventure extending from the far reaches of the universe to its smallest niche. We will behold a simple but grand and wondrous symphony a harmonious whole that gives a new meaning to "<u>uni</u>verse".

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Mathematics is ritualized logic. Intuition is non-ritualized logic. Intuition innovates, mathematics quantifies, implements and extends. Ultimately, mathematics is the creation of intuition.

A problem arises in that mathematics does not always represent the physical. Pure mathematicians don't care, theoretical physicists should. For them mathematics is but a tool used to ultimately explain the physical. Therefore, extreme caution must be exercised in interpreting mathematical results. The end result must be physical not mathematical, else the work is incomplete or in error.

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What is needed is a fresh approach to search the Universe through the eyes of a child, keeping a firm hold on reality.

The following description of the quantum and its self interactions are commensurate with the body of knowledge accumulated regarding the physics of our universe.

To be purely philosophical, why would one suppose other than in its ultimate composition the universe must be utterly simple? It stands to reason that if we must choose between a complicated or a simple underlying construction, we must opt for simplicity -- if for no other reason than it is just more likely.

We should not be swayed by the complexities we do behold. There are many examples of complexities being generated by a few simple elements. Fractals is one such example. Chess and the ancient Chinese game of Go are others. The thickest novel, composed of only twenty six letters, is another.

Displayed in these pages is the ultimate in simplicity. The entire universe is shown to be constructed of one solitary type particle assembled together in accordance with a very few innate characteristics. Deep down in our soul that seeks unity with the universe do we not instinctively believe this to be so?

What is the difference in the veracity of a theory if it predicts (a) that which is not yet known against (b) that which is already discovered? In either case if the corroborating discovery is independently predicted by the theory, then the theory is equally valid. If this were not so, a theory would become less valid as its predictions became discovered - an anomaly. That a theory "predicts" that which is already known is a reaffirmation of its veracity and consistency, with the proviso that the "prediction" clearly develops from the theory. The time an empirical fact is established in relation to a theory is immaterial. It is as important for a theory to correlate known facts as it is to predict new ones. Both situations are part of the same process -- that of explaining the universe.

As stated before, perhaps the most universally pressing problem in modern physics is to ascertain the true underlying nature of what is most generally termed the 'quantum reality'.

The wave function quantum theory has been eminently successful in results but there is no understanding of just *how* it works and the reality behind it.

Such things as non-locality, uncertainty, wave/particle duality, wave entanglement all cry out for a physical representation or explanation.

Such is offered here in the thesis at hand.

There is no claim that all the puzzling aspects of quantum theory are worked out -- nor is it admitted that the answers do *not* lie in the model. The assertion is that it explains a great deal, and with further endeavor by many may possibly explain all.

There are only two requirements of the theory here evolved, that it interpret the universe true to a basic postulate, and that it be consistent both internally and with experiment.

There is no requirement that the accepted criteria of quantum physics be met.

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The reader is advised to dispense with *all* preconceived quantum mechanical concepts -- or at least set them aside until the present thesis is understood.

Accept nothing learned before as absolute. Do accept that which is presented here on its face value -- provided the self consistency, consistency with empiricism and consistency with the postulate are maintained.

Following is a proposed model that explains much of the workings of QM (quantum mechanics).

Much is not explained. The presentation here should be considered only as a blueprint or scaffolding that supplies a substructure upon which can be built further knowledge and upon which new heights can be reached.

At first it may appear too simple, however a complexity will soon be apparent.

One of the problems in assimilating this model is that it is in actuality a new paradigm. Therefore, one must open ones mind to new vistas and a fresh viewpoint. One must exercise patience to go further, having faith that all will "fit" in the end.

Great care has been taken to make certain the theory is consistent within itself *and* consistent with empiricism. Any theory meeting that criteria should be acknowledged as equal in stature to any existing theory if not a replacement for it.

Prediction is a fallout. The primary purpose of any theory is to explain interconnecting phenomena.

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Post scriptº In all candor I sometimes wonder whether the mechanism displayed is a discovery or an invention; except for the fact that at all points it nestles in harmony with empiricism and <u>well established</u> theory.

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ON THE QUANTUM AS A PHYSICAL ENTITY

(A PHYSICAL MODEL FOR QUANTUM MECHANICS)

THE "HIDDEN VARIABLE" SOLUTION PREDICTED BY EINSTEIN.

Dedicated to the memory of my daughter Vivian
and her life extension Catrina

Dedicated also to Kirk and Karen McLoren
without whom this work would not have been possible.

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Postulate Base for a Theory of the Universe

Einstein based his special relativity theory on two postulates, the present theory is based on one.

We must, in composing a theory of the fundamental construction of the universe, commence with a clear ideal.

This means we start at the very basic, most simple, yet comprehensive level.

Being aware that the universe is in a great measure the way we see it the postulate must exclude anthropological interpretation. Therefore,

THE POSTULATE

The *objective* universe consists only of matter, space between matter, and the motion of matter through that space, the rest is anthropocentric interpretation.

In elucidation thereof:

Man perceives matter, to quantify it he conceptualizes "mass".
Matter exists objectively, mass is a concept.

Matter resists motion or alteration of motion. Man perceives that as "inertia" which in turn quantifies mass.

Matter moves with varying degrees of motion. Man compares all motion to one used as a standard which is constant. This standard motion is divided into arbitrary units. The transit of the standard through one unit is designated as

time. (The rotation of the earth is a standard motion. One rotation is designated as a day {time} with arbitrary subdivisions.) All other motions are then compared to a unit of time. Thus, at base, time is the comparison of motions, nothing more.

The quantification of motion in terms of time is conceptualized as "velocity". Ultimately this is a comparison of motions against the standard.

The quantification of the motion of matter in terms of mass and velocity is conceptualized as "momentum", i.e., there is a simultaneous determination of the quantity of matter *and* the quantity of motion it possesses.

Matter moves and changes that motion by interaction. Man perceives the rate of change as "force", i.e., the change of momentum with respect to time. Collaterally he perceives "acceleration" as the change of velocity with respect to time.

Matter interacts with matter forming an altered configuration. Man regards that as "energy", ultimately energy is matter (mass) in motion.

There is space between matter. Man perceives that and quantifies it by arbitrary standards of matter. Thus is created the concepts of "dimension" and "distance".

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So we see that dimension, space, time, mass, inertia, momentum, acceleration, force, and energy are all subjective interpretations by man of matter and its motion through space.

DETERMINATIONS

This model of the quantum as a physical entity determines:

(a) the density of neutrons, protons and electrons

(b) minimum force

(c) minimum torque

(d) minimum linear momentum

(e) minimum angular momentum

(f) minimum energy

(g) minimum angular energy

(h) minimum angular velocity

(i) the constancy and value of the equatorial velocity of particle spin

(j) the constancy of angular momentum

(k) the radii of the electron, proton and neutron

(l) that special relativity does not apply to subatomic physics

(m) the nature of the binding forces

(n) the mass-range and composition of the neutrino

(o) the mass of the photon

(p) that the rest mass and the moving mass of the photon are the same -- i.e., the moving mass is absorbed to be rest mass incorporated into the absorbing body.

(q) that the apparent increase in the inertial mass of a particle accelerated in an accelerator is in reality a physical mass accrual due to the absorption of mass from the impelling radiation.

(r) that the density of fermions and photons is directly proportional to the fourth power of the frequency and inversely proportional to the fourth power of the radius -- and the causal mechanics of this phenomenon

(s) that the quantum is the ultimate particle of the universe, the composition of matter and radiation. Its characteristics generate the electric, magnetic, nuclear, binding and gravitational forces.

(t) a resolution of the wave/particle duality

(u) the mechanism of the fundamental forces

(v) the quantization of gravity

(w) the mechanism of gravity

(x) the mechanism of the strong force

(y) the structure of the neutron

(z) that the nature of quantum aggregates is such that statistical mechanics and wave mechanics are the optimum techniques to deal with them.

(A) the deterministic cause of the characteristics of light polarization

(B) a possible explanation for wave entanglement and non-locality

(C) a plausible explanation for the greater than c non-thermal expansion in the "inflationary model" of the Big Bang theory

(D) the reason the charges on the electron and proton are equal.

... and more

If this seems like a cornucopia, one should not be surprised. Is it not likely that finding the key to the basic structure of the universe would unlock many puzzles and answer many questions? That, after all, is the purpose of a key.

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THE CORPUS QUANTUM

THE COULOMB FIELD AS THE BASIC PARTICLE OF THE UNIVERSE

INTRODUCTION

I have had reason to have a closer look at my theory --- and as a result, have come up with a great clarification that constitutes a breakthrough. I present it here.

What follows is for the intelligent reader open to new ideas.

THE COULOMB FIELD AS THE BASIC PARTICLE OF THE UNIVERSE

Thanks to Coulomb, we have measurable electrostatic and magnetic fields that stand alone. That is, when they are not in motion.

Given motion, the two fields form a union - orthogonally to each other - which we call an electromagnetic field (e.m. for short).

Nieto & Goldhaber, experimenters (among others), determined the approximate mass of these fields. (See Scientific American, May, 1976, "The Mass of the Photon", by Nieto & Goldhaber) . As their experiment progressed over time, they refined their technique such that the result became progressively smaller - and eventually approached very close to the figure given here. There were anomalies of the curve caused by their examining other fields than the coulomb fields. These should be ignored. Their lab tests of Coulomb's law yielded $4x10^{-48}$ g.

Note, the title of their research is a misnomer. They were not obtaining the upper limit of the photon but of the Coulomb field. If one were to seek the upper limit of the photon, they would be required to specify *what photon.* This was never done. What they were really seeking was the mass of a single Hz. or frequency, i.e., the mass of the *minimum* Coulomb field.

When in motion, we classify the e.m. fields as radiation. And we establish that radiation has mass.

A single minimum e.m. field consists of one electrostatic and one magnetic field. Its mass determined by this theory is 7.3720385 x 10^-48 gram. How this was arrived at will now be discussed.

This mass x c2 = 6.62566 x 10^-27 erg (on the cgs scale).
Where nu =1, h nu = 6.62566 x 10^-27 erg also.

A DISCUSSION OF h

h = 6.62566 x 10^-34 joule-second (mKgs scale) or
h = 6.62566 x 10^-27 erg-second (cgs sale).

1 joule = 6.2415 x 10^18 eV. h = a fraction of that:

6.62566 x 10^-34 * 6.2415 x 10^18 = 4.135406 x 10^-15 eV =
4.135406 x 10^-21 MeV and
4.135406 x 10^-21 MeV * the conversion factor (5.6098576 x 10^26) =
7.371677 x 10^-48 gram.

So we see that the mass of h is the same as the mass of the single minimum e.m. field.

We also see that this common mass * c2 = 6.63566 x 10^-27 erg.

The correct common mass is 7.3720385 x 10^-48 gr and shall be used throughout.

This mass times c^2 = 6.625661 x 10^-27 erg -- times one sec = h.

Since hf = E of the photon, we note that the mass of the minimum single e.m. field times the square of its velocity (c) is also its E. And this energy times 1 second is a unit of action = to h.

Thus we can say that a minimum single e.m. field traveling at c is equivalent to h --- or conversely, h is equivalent to a minimum single e.m. field traveling at c. In both cases E = 6.62566 x 10^-27 erg--and an erg second is h.

EXAMINING THE COMMON MASS

The mass common to both h and the single e.m. field shall henceforward be denoted as m_q (mass of the quantum)for convenience.

m_q * c = p , the basic, smallest momentum of the universe.

m_q *c2 = E, the basic, smallest unit of energy in the universe.

(where n is the frequency number or coefficient of f)
m_q n = mass of the photon where f is that of the photon.

Where f is that of the electron, proton or neutron
m_q n is the *mass of the respective particles.* (n = f number)

The reason for this is clear:

The minimum e.m. field not only comprises the photon, it also comprises the electron, proton, and neutron, i.e., matter.

We also note that the minimum single e.m. field is the single oscillation of radiation and matter. Thus the number of oscillations times m_q gives the mass of any particle (regarding the photon as a particle).

WAVE/PARTICLE DUALITY.

We see that since the base e.m. field is the constituent of radiation and matter, -- and the nature of the e.m. field is waves, then we see the why of the dual nature of radiation and matter - and why one can be converted to the other.

As radiation, the e.m. fields are in a tandem mode. When a photon of sufficient energy/density strikes a backstop, the tandem mode collapses into a concentric mode and becomes an electron and a positron.

All matter consists of minimum e.m. fields in a concentric mode. Since, in pair production, a photon converts into an electron and positron, we conclude, therefore, that radiation consists of matter and antimatter in radiation form.

We also conclude this is a matter of spin --- 50% right hand, 50% left hand. That is why radiation has no charge. As to the 50%, recall that a long penny toss results in a 50/50 heads/tails. So the 50% left hand and 50% right hand spin is a matter of randomness.

We will now consider this ultimate particle, "*the* quantum".

It is the ultimate particle of the universe of which all else is composed.

We will henceforth refer to "the quantum" without quotation marks.

First, we shall consider a single free standing quantum.

It is composed of a material/electric field that has five (5) characteristics, each of which is *quantitatively* determinable. These five characteristics are sphericity, mass, perfect elasticity, co-spatial ability (permeability), and spin. In combination these characteristics create the universe.

SPHERICITY:
When fully expanded the diameter of the sphere is one light second (LS), 2.9979254 x 10^10 cm. When fully contracted it may be considered a point. The transition rate is c.

MASS:
Having material characteristics, the quantum has mass, 7.37203854 x 10^-48 gr.

PERFECT ELASTICITY:
Originally set into motion probably by collision (in aggregate) the quantum expands and contracts ad infinitum as there is no internal friction to degrade it.

The measurement of the elasticity is the energy expended in the expansion, 6.62566 x 10^-27 erg. In the expanding mode the energy may be considered kinetic. That same energy in the fully contracted form may be considered potential. Thus, under these conditions, the energy may be considered internal and equal to h/1 sec.

CO-SPATIAL ABILITY (Permeability):
It is here that material on the quantum level differs from that which we are accustomed to on the macro-level. Two quantum particles may occupy the same space at the same time. This is due to the extreme rarefaction of the individual quantum. In large aggregates, due to the increase in density, this ability ceases.

The measurement of this characteristic is the aggregate limit to which it will endure.

SPIN:

All astronomical bodies in the universe rotate, so do quanta. We call it spin, and it is commensurate with the standard calculations of angular momentum.

ENERGY AND THE QUANTUM

Given: For a ponderous body in free space kinetic energy accrues only during acceleration. Therefore, we can write

$E_k = m\ a\ d = mv^2$ (m = mass, a = acceleration, d = distance)

But v is an *averaged* velocity based on the mid-point of a constant acceleration. So we write

$$E_k = mv^2/2 \quad \text{or} \quad \frac{1}{2} mv^2$$

This is a Newtonian expression and valid for relatively low velocities. By considerations contained in the Dual Velocity Theory of Relativity (another work of this author) the factor 1/2 is replaced by

$$\frac{1}{R + R^2}$$

[where R = Lorentz transformation, i.e., $\sqrt{1-v^2/c^2}$]

Thus we write the expression for kinetic energy as

[Eq. 1]

$$E_k = \frac{mv^2}{R + R^2}$$

It will be found this is exactly equal to Einstein's

$$E_k = mc^2 \left(\frac{1}{R} - 1\right)$$

and good for all velocities.

THE CORPUS QUANTUM

In the existing model a "quantum" is also thought of as an increment. We speak mainly of quantum increments in energy levels. Thus "a quantum" is also thought of as a quantum of energy.

Planck's constant h is a unit of action and may be written m a d t. (which is energy x time or momentum x distance)

Based on certain magnitudes of m, a, d and t -- h/t = the basic unit of energy and is 6.625661 x 10^-27 erg. We may call this unit the "Planck"

and denoted it as h_0.

$$\text{Thus} \qquad \frac{m\ a\ d\ t}{t} = mad = h_0$$

The energy of radiation is given as h nu. Now nu, being frequency, can be interpreted as n times per second or n/sec. Thus E = h n/sec.

We write h, the unit of action, as m a d t, and nu as n/sec :

$$\text{thus} \qquad h\ nu = \frac{madt\ n}{t} = n\ mad$$

Thus if we equate n to frequency, i.e., n/sec = nu = n. then we may write the energy of radiation as nh_0.

For clarification,

$$h\ nu = \frac{madt}{t} * \frac{n}{t} = mad\ n = h_0\ n$$

"One second" arises here as an arbitrary unit of choice determined by the frequency being given as n per second. Although "t" may be any interval of time, in reference to radiation it is one second. This in turn determines the magnitudes of a and d which are a = c/sec , and d = one light second (LS). m = 7.37203854 x 10^-48 gr. Thus, m a d = 6.625661 x 10_27 erg. This is the energy contained in one quantum. This energy times time (one second) is Planck's h.

Therefore, in ferreting out the characteristics of the quantum *in radiation*, one second, though arbitrary, is considered a fundamental unit. The magnitudes of acceleration and distance are determined by it. It will be found that the quantum so determined *is fundamental to particles as well.*

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Often the objection is voiced that the "quantum" can't be a particle because it is merely an increment in energy (although h is a unit of action).

The quantum as a unit of energy is most apparent in radiation where E is given as h nu, meaning n units of energy.
The question is, how can we equate that to a particle?

We close our eyes and reach out into that great black void searching for *something* to give us a clue.

Wait a minute, let's try this. Energy is matter in motion. Then we can conclude that *something* has to move -- and in increments of 6.625661 x 10^-27 erg.

That "something" has to be a particle.

How would it move in those increments?

A certain linear distance? No. First of all, what would determine that distance? Second of all energy times distance is *not* a unit of action. Energy times *time* is.

We begin to think in terms of rotation. Even though known particles have spin, that does not give us much of a clue. But it does suggest something similar, expansion and contraction.

We examine radiation (light, etc.) for more clues.

Since radiation energy is equated to frequency, i.e., vibrations or oscillations per second and is "energy increments" times n (where n is equivalent to nu) then we try to isolate it by extrapolating down to a frequency of one per second.

A picture emerges of a particle that expands and contracts once per second, that expansion, or contraction, to be associated with 6.625661 x 10^-27 erg -- which we call "a Planck" and denote by h_0. Thus we have the mass of the particle expanding over one light second. This is the motion we seek.

Since that expansion/contraction takes place over the distance of one light second (the wavelength of a frequency of one) in one second, we conclude that the velocity of expansion/contraction must be c.

We define energy as mass in motion. Therefore, we now seek the mass of the expansion/contraction, i.e., the mass of the particle as it expands/contracts (pulsates).

We take mass as E/c^2, or h_0/c^2, i.e., mv^2/v^2. This gives us a mass of 7.37203854 x 10^-48 gr. we label this m_q.

***That* it seems is our basic particle. It now behooves us to add other attributes to it that fit and answer other parameters and phenomena to hopefully give us a new perspective on quantum mechanics.**

IN SUMMARY

The individual freestanding quantum consists of a greatly rarefied, *perfectly* resilient, non-divisible *substance* extending to a finite spheroid boundary. It is internally frictionless and pulsates (expands and contracts) continually. When expanding it may be considered to be in the kinetic energy mode, when contracted -- and to the extent contracted -- the potential energy mode.

Notwithstanding their individual indivisibility, quanta in the low quantity modes of agglomeration are mutually permeable or co-spatial. The permeability is conditional, dependent upon the density, i.e., as the quantity of quanta increases the density increases and permeability is increasingly resisted. upon reaching a certain point it is no longer tolerated.

The quantum, being substance, has mass. A single quantum has a mass, m_q, of 7.37203854 x 10^-48 gram.(We say "substance" but actually it is a Coulomb field.)

The energy of expansion and contraction is 6.625661 x 10^-27 erg (h_0). This energy is potential when the quantum is fully contracted, and kinetic when expanding.

When fully expanded the diameter is one light second (LS). The velocity of expansion and contraction is c.

The quantum also has spin. That will be dealt with in some detail later.

Force applied to a free body will impart motion, and thereby kinetic energy, to it. We may therefore consider force as the transference of energy.

The transference of energy from the internal (contracted) mode to the external (expanded) mode can be considered force and is 2.21008 x 10^-37 gr cm/sec^2. This is the minimal force and will be explained in more detail later.

We continue.

When escaping particles (large agglomerates), the individual quantum attains an escape rate of c instantaneously taking one second to fully escape.

If we use the definition of force as the change of momentum with respect to time, /\P//\t, we see that in the primal case at hand /\P proceeds from 0 to m_q c during the course of the one second escape. Therefore, although the *rate* of escape is attained instantaneously, the condition is expressed as /\P//\t. Where /\t = 1 second, the /\ P is the change of momentum accruing in the escaped portion of the quantum during that second. Thus the fully escaped quantum has a momentum, m_qc attained in one second which we may write as

$$\frac{/\backslash P}{/\backslash t} = \frac{/\backslash m_q\, c}{sec} = \frac{2.21008 \times 10^{-37}\ gr\ cm/sec}{sec} = force$$

We note with interest this description is devoid of acceleration, although if

$$\frac{/\backslash\ (m_q\, c)}{sec} \text{ is read as } m_q \frac{LS}{sec^2} \text{ such could be construed.}$$

Thus, for the individual quantum the kinetic energy may be written

$$E_k = F * d = \frac{/\backslash\ (m_q\, c)}{sec} LS = m_q\, c^2 = 6.625561 \times 10^{-27}\ erg$$

or it may be written in the form

$$E_k = F * d = m_q\ a\ d = 7.37203854 \times 10^{-48} \frac{c}{sec} LS = 6.625661 \times 10^{-27}\ erg$$

But the latter is not an accurate representation of the conditions as it involves a pseudo acceleration of c/sec whereas the acceleration is nonexistent.

The energy of the quantum may be more accurately portrayed by

$$E_k = m_q c^2 = 6.625661 \times 10^{-27} \text{ erg} \qquad (h_0)$$

called the Planck and considered the smallest unit of energy extent. All this reinforces the position that in quantum considerations the concept of force being mass times acceleration is not valid. Einstein expressed trepidations about its use in his 1905 paper.

Note: when there is acceleration, the expression for E_k contains a

modifying factor $\frac{1}{R + R^2}$. When acceleration is not a factor the

modifying function should be absent. *It is.* For emitted radiation quanta $E_k = m_q c^2$. There is no function.

Also of note is that special relativity does *not* apply to the radiant state of matter.

Relativity is the mechanics of fast moving (cosmological) bodies interacting through *observation* ,i.e., with radiation as the intermediary. It does not apply to the radiation itself which, additionally, does not qualify as a "ponderous" mass.

It follows that it is inappropriate to apply *any* relativistic equations to the photon (except in the case of aberration and the Doppler effect which involve the effect on light by the movement of emitter and observer).

-<*>-

We now wish to reconcile the kinetic energy of particles or ponderous mass with the kinetic energy of electromagnetic radiation.

It is more apropos to consider the latter as photons rather than waves. The photon may be thought of as an electromagnetic particle. As such we seek its mass, and subsequently its kinetic energy and momentum, in terms of mass and velocity rather than h nu.

The mass is given in terms of (n m_q) where n corresponds to nu or n/t. This is based on evidence (displayed later) that the photon is comprised of a multiplicity of quanta and that each quantum creates one vibration per second due to its pulsation. Thus the number of quanta in a photon corresponds to nu. The pulsation velocity of course is c.

The momentum of the photon is given as h nu/c which is equivalent to $(nm_q)c$.

Likewise for energy h nu = $(nm_q)c^2$ which is of the form mc^2.

Where m = m_q, a = c/sec, d = LS and t = 1 second, this may be developed by

$$h\,nu = madt * \frac{n}{t} = n\,mad = (n\,m_q)\,\frac{c}{sec}\,LS = (n\,m_q)\,\frac{LS}{sec}\,LS$$

$$= (n\,m_q)\,\frac{LS}{sec^2}\,LS = (n\,m_q)\,\frac{LS^2}{sec^2} = (n\,m_q)\,c^2$$

The momentum can be developed by the same process.

Note, this supports the dimensions of the quantum given above.

Experimentally E = cP. By the above, E = c (nm_q)c = (nm_q)c^2

Note: These equations are for mass in the form of radiation, i.e., free quanta traveling at c, grouped in a Gaussian group wave pattern, and following the laws of superposition but essentially in a sequential mode.

It stands that there are two *basic* forms of matter, both comprised of quanta. One is radiation as described above, the other is ponderous bodies comprised of quanta that are *concentrically* grouped. Thus they form particles the mechanics of which are governed by Newtonian and relativistic mechanics.

The radiation quanta are of such quantities that their density easily allows co-spatial existence.

Particles, on the other hand, are comprised of such quantities that co-spatial existence has reached its tolerance level and further quanta are resisted, eventually to be rejected.

There are two things to note in this regard, one, the rejection of additional quanta takes place in a zone rather than suddenly. Thus we see the situation where "*hard*" photons begin to exhibit particle characteristics. The harder the photon, the more particle-like it becomes. In fact we see activity (pair production, beta decay, etc.) in which photons change into particles and particles change into photons.

The ubiquitous electron may be considered to be the inhabitant of the "twilight" zone. Loosely speaking it is semi particle, semi radiation -- but favoring the particle (ponderous mass) mode.

Having laid the foundation, we now proceed.

The core of the endeavor to reconcile the kinetic energy of an electromagnetic particle with the *corresponding* kinetic energy of a ponderous particle is the correlation of the velocity c of the former with the sub c velocity of the latter.

Seeking a bridge, we write,

$$h\,\nu = n(m_q c^2) = mc^2 \left(\frac{1}{R} - 1 \right)$$

The crux lies in the second and third terms which we write

$$(nm_q)c^2 = mc^2 \left(\frac{1}{R} - 1 \right)$$

Where nm_q = m_ph , mass of the photon:

$$m_{ph}c^2 = mc^2 \left(\frac{1}{R} - 1 \right)$$

Thus if $m_{ph} = m$, $\left(\frac{1}{R} - 1 \right)$ must be equal to 1 to maintain the equality.

If R = .5 this requirement is met. A velocity of .8660254 c or

(.75)^1/2 c has the requisite R of .5

Therefore, by utilization of nm_q we conclude that (for example) a photon of frequency 1.23561 x 10^20 has a mass equal to that of the electron and that both will have the same kinetic energy when the velocity of the electron is (.75)^1/2 c.

To restate the case for clarity:

If a photon (velocity c) were to suddenly transform into a particle of identical mass it would, in obeying the conservation of kinetic energy, have a velocity of .8660254 c

Photon Absorption

When a photon is *completely* absorbed, typically by an orbiting electron, its kinetic energy (n m_q c^2) is transferred. Concurrently, its mass n m_q is added to that of the electron. The photon ceases to exist as a photon and in that context we can say the rest mass of the photon is zero. However, what *was* the photon is incorporated into the electron, both its mass and kinetic energy.

The kinetic energy resides in the form of an elevated energy state of the electron. However, inasmuch as no *external* motion results we see an illusion that the kinetic energy of the photon is converted to mass for there is additional mass with no increase in velocity of the absorbing *body*. One often hears dictum to the effect that "kinetic energy of the photon disappears and mass is created in its place." (or vice versa). Obvious error.

In addition to raising energy states, the transferred kinetic energy, *when sufficient*, may also result in motion to the absorbing body.

A photon may be only partially absorbed, the remainder being a recoil or scattered photon (elastic collision).

The absorbed portion is the *inelastic* portion of the collision and carries the kinetic energy transferred.

EMPIRICAL CONFIRMATION

An analysis of the Compton effect will substantiate the above by tracing an actual photon collision with an electron.

THE COMPTON EFFECT

(illustration below)

A 1 MeV photon in a direct collision (scattering angle 180 deg) with a free electron (considered at rest) will impart a recoil velocity to it such that E_k = .797 MeV --[[Scientific Encyclopedia, Van Nostrand, 5th ed.p. 638]]--

Converting the 1 MeV to ergs and utilizing $\nu = E/h$, we ascertain the frequency of the incident photon to be 2.418024×10^{20}.

To ascertain the frequency of the recoil photon we utilize

[Eq. 2]

$$h \nu' = \frac{mc^2}{1 - \cos\theta + \frac{mc^2}{h \nu}}$$

(m = electron mass)

(Continued below after illustration)
%%%

A mass m_q may be assigned to each cycle of frequency which in turn is representative of one individual quantum.

m_q = quantum mass = $7.3720385 \times 10^{-48}$ gr
m_{ph} = photon mass
m_e = electron mass   R = Lorentz transformation

```````````````````````````````````````````````````````````````````````

In this work there are a few fundamental physical constants used in a variety of relationships that may not be the same as more modern determinations.

Often one that is quite accurate in one relationship does not maintain that accuracy in another but are acceptably close. They are:

h = $6.625661 \times 10^{-27}$ m a d t (erg second) (momenton light second)

c = $2.9979254 \times 10^{10}$ cm/sec

$m_e$ = $9.1089534 \times 10^{-28}$ gr

$m_q$ = $7.37203854 \times 10^{-48}$ gr

```````````````````````````````````````````````````````````````````````

MASS AND ENERGY TRANSFER IN A COMPTON COLLISION

[Fig. 1]

$E = h\nu = 1.602101 \times 10^{-6}$ erg
$\nu = 2.418024 \times 10^{20}$

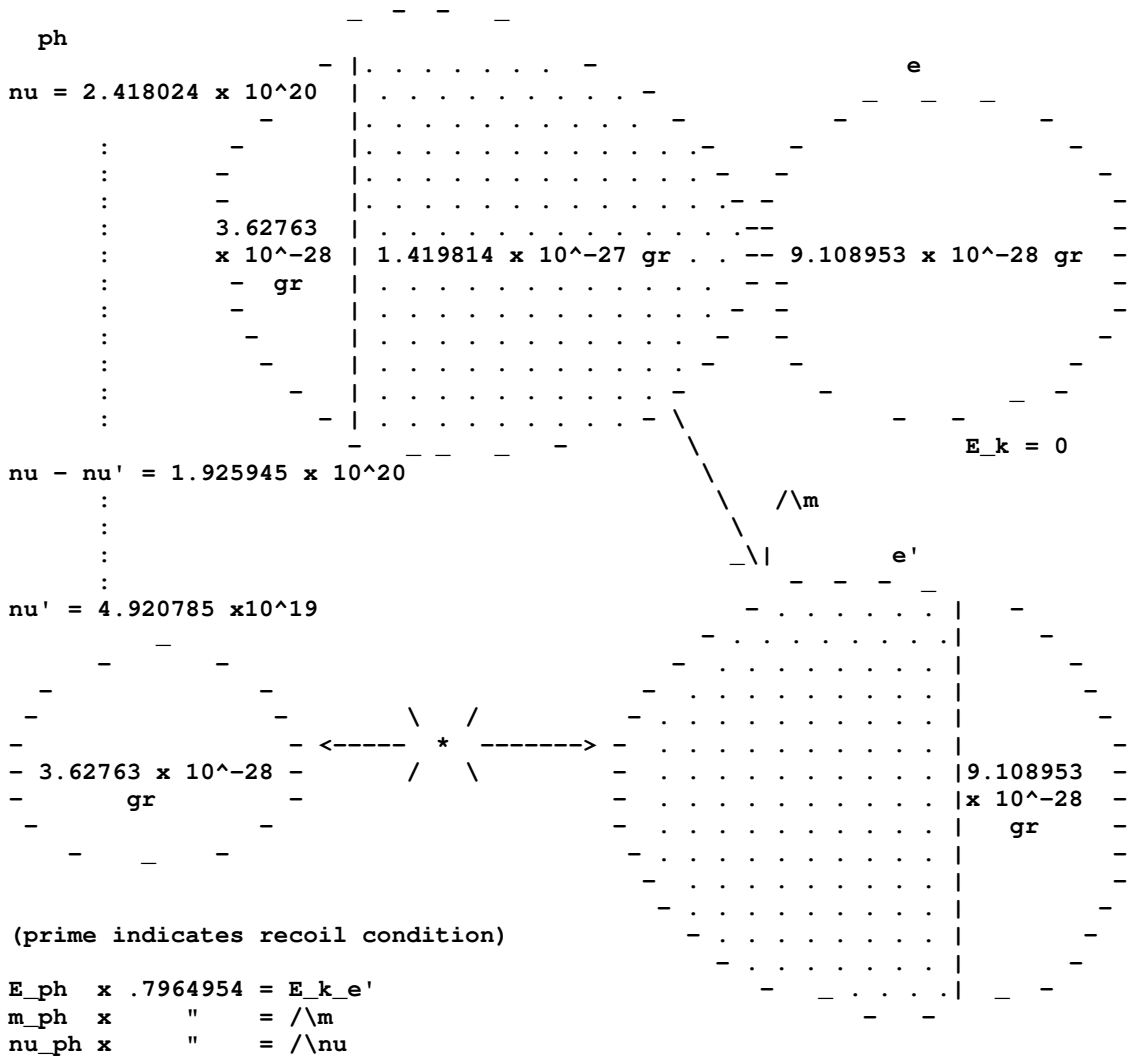
m_ph = 1 MeV = 1.782576 x 10^-27 gr

CAPTION FOR Fig. 1

BEFORE AND AFTER COLLISION OF A 1 MeV PHOTON WITH AN "AT REST" ELECTRON.

The two spheres at the top are at the moment of contact; those at the bottom are immediately afterward. The incident photon (top left) has almost twice the mass of the electron. The shaded portion is the portion of the incident photon that transfers to the electron on contact. Having mass, this portion carries momentum and energy with it. The *quantitative* results are exactly the same as those given by relativistic mechanics.

(Next page)



(prime indicates recoil condition)

E_ph x .7964954 = E_k_e'
m_ph x " = /\m
nu_ph x " = /\nu

E_ph x .2035046 = E_ph'
m_ph x " = m_ph'
nu_ph x " = nu_ph'

v = .9204658 c
E_k = .7965 MeV
= 1.276066 x 10^-6 erg
= /\m c^2

(1/R - 1)m_e = /\m

$$(1/R - 1)m_e c^2 = E_{k\_e'} = \frac{m_e v^2}{R + R^2}$$

m_e' = m_e + /\m = 2.330709 x 10^-27 gr

$$\frac{m_e}{R} = m_e'$$

nu e' = 3.161554 x 10^20

%%%

(Continued from above)

We find the frequency of the scattered photon to be 4.920785 x 10^19, a

frequency loss nu − nu' of 1.925946 x 10^20. Since each element of the frequency represents a quantum, this figure represents the quantity of quanta n lost to the photon and absorbed by the electron. Thus

$$(nm_q) = /\backslash m_{ph} = /\backslash m_e = 1.419814 \times 10^{-27} \text{ gr}$$

and is the mass transferred. The energy of this mass is $(nm_q c^2) = 1.276066 \times 10^{-6}$ erg (hnu) which manifests as kinetic energy transferred to the recoil electron. This converts to .7965 MeV which agrees quite well with the .797 MeV of experiment.

The only energy imparted to the electron is that contained in $/\backslash m_{ph}$.

Thereby $/\backslash m_{ph} c^2$ is converted to

$$(1/R - 1)\, m_e c^2 \qquad \text{[Eq. 3]}$$

Thus $/\backslash m_{ph} c^2 = (1/R - 1)\, m_e c^2$ [Eq. 4]

Therefore $/\backslash m_{ph} = (1/R - 1)\, m_e$ [Eq. 5]

Finally $/\backslash m_{ph} = (m_e/R - m_e) = /\backslash m_e$ [Eq. 6]

which clearly demonstrates that *the relativistic expression in the center is nothing other than the mass, $/\backslash m_{ph}$, absorbed from the photon* and which carries the total kinetic energy now resident in the recoil electron (on the assumption that the free electron is considered essentially at rest.

For clarification, we can write Eq. 6 as

[Eq. 6A]

$$\frac{m_e}{R} = (m_e + /\backslash m_{ph}) = (m_e + /\backslash m_e)$$

Hence the term "increase in inertial mass" has a clear mechanistic explanation not forthcoming in relativity theory. Note, this is so only for e.m. accelerated particles.

We also note from Eq. 6A that the ratio of the electron mass before and after absorption is equal to the Lorentz transformation:

$$\frac{m_e}{m_e + /\backslash m_e} = R \ .$$

and Eq. 5 shows that $(1/R - 1)\, m_e$ is the quantity of mass transferred in the collision.

We summarize the conditions:

If the quanta absorbed by the electron is $nu - nu' = nu'' = n$,

then $E_k = h\, nu'' = (nm_q) c^2 = /\backslash m_{ph} c^2 = (1/R - 1)\, m_e c^2$.

from which we can readily calculate R and v.

The shaded portion of the incident photon is the /\ m_ph that transfers in the collision, imparting a velocity of 92% c.

The rebounding photon, having suffered the loss of /\ m has a frequency that is lowered by /\ m/m_q.

The percentage loss of mass by the photon is /\ m_ph/m_ph x 100.
This is a 79.65 % inelastic collision. Consequently, that is the Percentage of the photon mass transferred

m_ph x .7964952 = 1.419814 x 10^-27 gr = /\m

MOMENTUM

Here the situation is a bit more complicated than for energy. Therefore, it may be best to proceed on a step by step basis at the end of which the proportionality of momentum distribution will be clearly evident. Then, following, will be a table displaying the proportionality of distribution for mass, energy, momentum and frequency.

(Continued below)
##

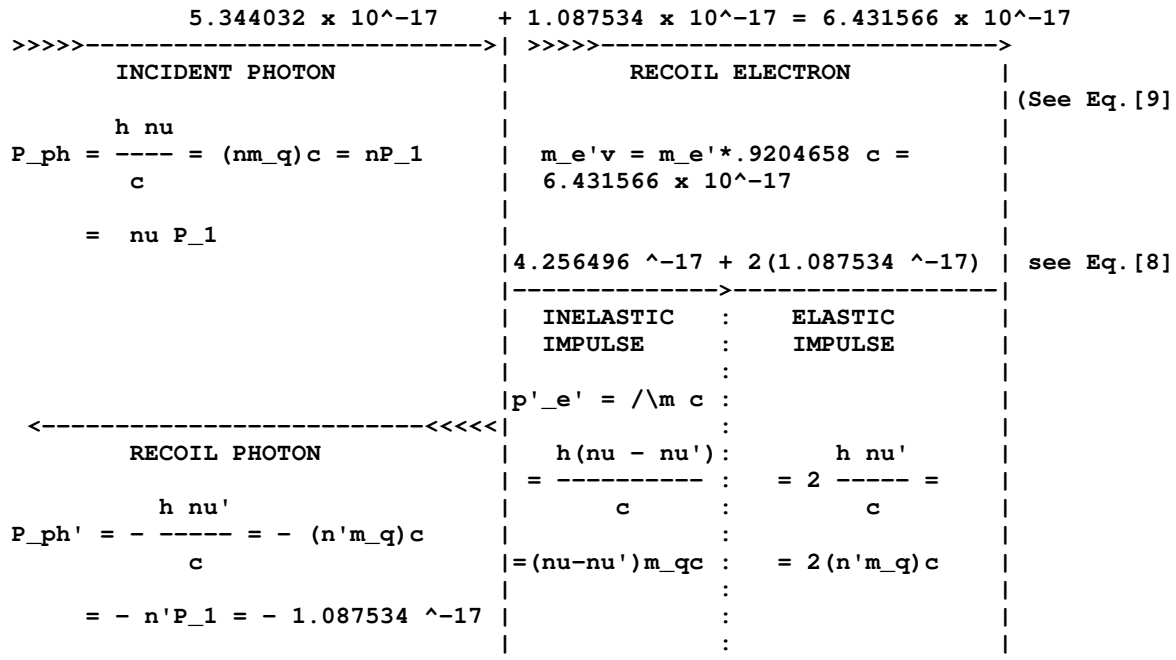
A SCHEMATIC MOMENTUM DIAGRAM OF THE COMPTON EFFECT

[Fig. 2]

(not to scale)
(See next page)

[prime sign indicates recoil condition]

ph' reaction*



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* To every action there is an equal and opposite reaction.

THE ABOVE IS A NON-STANDARD METHOD OF MOMENTUM NOTATION

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STANDARD CONSERVATION OF MOMENTUM STATEMENT

P_ph + P_e = P_ph' + P_e'

==========

P'_e' = Elastic impulse of recoil electron

P_e' = Recoil electron momentum

P_e = Momentum of initially at rest electron

P_ph' = Momentum of recoil photon

P_ph = Incident photon momentum

P_1 = Absolute minimum momentum, m_q c

n = nu , frequency or, equivalently, number of quanta

##########

(Continued from above)

We have for the momentum of the recoil electron

$$(m_e + /\ m_{ph})\ v = P_e' \qquad \text{[Eq.7]}$$

The more usual expression for same is $\frac{m_e v}{R}$.

Therefore, $(m_e + /\ m_{ph})\ v = \frac{m_e v}{R}$

which is a simple non-relativistic explanation of the erroneous expression for the relativistic increase in momentum due to the increase in mass. (see Eq.6A) In short, in inelastic collisions, the mass transfer (increase) is real.

The transfer of momentum, despite its apparent simplicity, is not so straightforward as Eq. 7 would indicate. This equation is for *perfectly inelastic* collisions. As there is a recoiling photon, it is obvious that we do not have such a collision.

Neither do we have a perfectly elastic collision; not only because of Eq. 7 but because the *total* velocity before and after impact is not equal. This equality is characteristic of the perfectly elastic collision.

Note:

BEFORE IMPACT: velocity of photon = c
velocity of electron = 0

AFTER IMPACT: velocity of recoil photon = c
velocity of recoil electron = v

c + 0 (not = to) c + v

--[[These measurements are of the laboratory frame where c + v is permissible because each velocity is relative to the frame.]]--

What we do have is a *combination* elastic-inelastic collision. Following is a discussion of the proportional distribution:

IN A PERFECTLY ELASTIC COLLISION THERE IS 0 MASS TRANSFER.

IN A PERFECTLY INELASTIC COLLISION THERE IS A 100% MASS TRANSFER.

Therefore,

IN AN X % INELASTIC COLLISION THERE IS AN X % MASS TRANSFER.

Thus we may discuss photon-electron collisions in terms of being a certain percent *inelastic,* i.e., this percentage is the percent of the mass transferred. The balance of course is the percentage of mass recoiling, viz., the mass of the recoil photon.

This proportionality also holds for energy and momentum.

FOR ENERGY:

$$\text{Inelastic portion (in Mev)} = \frac{h\,\nu - h\,\nu'}{h\,\nu} \text{ or } \frac{h(\nu - \nu')}{h\,\nu} \text{ or } \frac{\nu - \nu'}{\nu}$$

$$\text{Elastic portion:} = 1 - \frac{\nu - \nu'}{\nu}$$

	incident photon momentum		reaction impulse of ph'	
$P_{e'}$ =	$(\nu\, m_q)\, c$	+	$(\nu'\, m_q)\, c$	
=	$m_{ph}\, c$	+	$m_{ph'}\, c$	
=	P_{ph}	+	$P_{ph'}$	[Eq. 9]

(See Fig. 2)

Here is another example of the caveat we must heed when dealing with mathematical treatments (and this is the most simple mathematics). There is much that is concealed from view by nature. Sometimes mathematical treatments enhance that concealment. (See "*Standard Conservation of Momentum Statement*", -- Fig. 2)

Following is a table displaying the characteristics of each portion of the combination collision:

ELASTIC PORTION	INELASTIC PORTION
$\frac{\nu'}{\nu}$	$\frac{\nu - \nu'}{\nu}$
$\frac{\nu'}{\nu} \times m_{ph} = m_{ph'}$	$\frac{\nu - \nu'}{\nu} \times m_{ph} = \mathbin{/\!\backslash} m_{ph} = \mathbin{/\!\backslash} m_{e'}$
$\times P_{ph} = P_{ph'}$ (negative)	$\times P_{ph} = P_{e'}^{*}$ (impulse)
$\times E_{ph} = E_{ph'}$	$\times E_{ph} = E_{e'}$
$\times \nu_{ph} = \nu_{ph'}$	$\times \nu_{ph} = \nu - \nu'$

++

For those inclined toward visualization, this example of the Compton effect presents a beautiful picture.

What we notice in the main is that when the electron is impacted by the photon the kinetic energy of /\ m *passes through unchanged* and is the kinetic energy of the recoil electron, i.e., of the *entire* electron mass the same as does momentum in a perfectly inelastic collision). Note:- /\m c^2 is the relativistic expression for kinetic energy.

In a compound collision the momentum of /\ m passes through to the electron -- but to it is added the momentum of the part of the incident photon that reacts in an *elastic* manner, i.e., the photon is part elastic and part inelastic in its collision. This proportionality is (in this example).7965 inelastic to .2035 elastic. The inelastic portion determines the mass and energy transfer. In the beginning we had a big banner to that effect: It was stated, A 1 Mev photon imparted .7965 MeV to the recoil electron.

The above proportions are for the example given. Collisions at other angles and energies will have other proportions.

*****

Is the inelastic portion of the incident photon momentum -- and is the momentum *impulse* to which is added the additional elastic impulse of 2 P_ph', yielding the total P_e' .

RADIATING QUANTA

A photon of n quanta will escape a source in $t = D/c = \frac{LS}{n} / c = \frac{1\ sec}{n}$.

(Where D = diameter of photon , t = time for photon to exit at c, and n = numerical value of nu.) D = LS/n.

The ratio of mass of one quantum to its internal energy is 7.37203854 x 10^-48 gr to 6.625661 x 10^-27 erg which is the ratio of 1 to c^2.

We write this $\frac{m_q}{h_0} :: \frac{1}{c^2}$ **the cross product being h_0 = m_q c^2 or,**

generally, E = mc^2.

For each quantum emitted from a body, that body will lose m_q which manifests as h_0. Thus for each gram released |c^2| ergs of kinetic energy manifests.

AGGLOMERATION

There are two basic forms of quanta agglomeration:

(1) In an escape mode, traveling sequentially at the speed of light.

(2) In a concentric (particle) mode, each and every quantum sequentially expanding and contracting.

In the first mode the quanta escape from matter in great quantities forming multiple trains traveling in a common direction at slightly varying velocities. As a result of their perfect resiliency and their ability to permeate each other, they undergo the mechanics of waves including superposition.

This results in an interference pattern traveling in the opposite direction at the same velocity. (Such waves are predicted by Maxwell's equations which show *infalling* waves arriving at the transmitter from an infinite distance.)

In consequence, there is produced a *standing group wave* having no motion with respect to a source and any observer. Only the frequency is affected by the relative motion of the two.

The standing group wave consists of complex sub-waves traveling back to front (source to observer). These are photons. Their velocity through the standing group wave is constant, and as the standing group wave has no velocity with respect to source and observer, then the velocity of the photons is constant with respect to source and observer -- regardless of any motion. *Thus there exists the phenomenon of the constancy of the velocity of light*.

The process of superposition effects the merging of quanta into photons. As the number of quanta in each photon increases, i.e., as the frequency rises, the photons become smaller in "effective" diameter and higher in energy as well as more massive. In this process they gather more and more of the standing group wave unto themselves. At extremely high frequencies, so much of the standing group wave is gathered to the photon that it becomes increasingly particle-like. This process continues through the range of x-rays to gamma rays where the photon consists of 1 x 10^20 quanta or more.

The frequency (nu) is equivalent to the number (n) of quanta in a photon. Therefore, the mass of the photon is nm_q, and its effective diameter is LS/n. (where LS = light second)

The veracity of this is immediately apparent if we introduce the time parameter into the expression:

$$\frac{\frac{LS}{1\ sec}}{n} = \frac{c}{nu} = lambda = \frac{LS}{n} = diameter$$

(Note the qualifying term, "effective". This is used for particles also. Whenever the wavelength or particle diameter is spoken of, the appellation includes, unspoken, the term "effective", the reason being that the diameter of *all* quanta agglomerations is one light second because that is the full extent of the pulsation of the individual

quanta. However, due to density falling off as the *fourth* power of the radius the *effective* size of the particle is at the dense core. This is analogous to *considering* the mass of a body as being located at its center of mass. There are exceptions in both cases.)

The dimensions and manifestations of lower frequency photons are more vague than those of higher frequency. The particle-like characteristics of high energy photons such as those of x-rays or gamma rays become clearer when the energy is expressed as $E = h \nu = (n m_q) c^2$.

Considering the mass aspect of the photon it should offer no surprise that the vector of a photon is altered by a strong gravity field although the response may differ from that of ponderous mass.

CORPOREAL AND RADIANT MASS

We have noted before that a photon and particle of equal mass have differing velocity requirements in generating an equal E_k, i.e., although the mass of a particle and the mass of a photon are equal, they require different velocities to generate the same kinetic energy.

This means that the mechanics for ponderous particles is different from the mechanics for radiation. The mechanics for ponderous mass is relativistic, -- and therefore the mechanics for radiation is *not* relativistic. Thus, we can say that special relativity is not applicable to the photon (except in case of aberration and the D oppler effect which entails the observations between moving bodies and the observer.

The difference between relativistic/Newtonian (corporeal) kinetic energy and that of radiation is that in the *latter* acceleration does not exist. Therefore, d is given as v t *not* 1/2a t^2, and F is given as

$\frac{\Delta P}{t}$ *not* m a. Thus we write for the photon

$$E_k = F * d = \frac{\Delta P}{t} vt = \frac{mv}{t} vt = P v = mv^2$$

and since v = c, we have $E_k = Pc = mc^2$.

REST MASS OF THE PHOTON

A photon may be *considered* to be at rest when it is absorbed by matter, in which case a photon of $(nm_q)c^2$ energy adds (nm_q) mass to the body absorbing it. Therefore, (nm_q) may be considered the rest mass of the photon as well as its mass in motion. Here, again, we observe that the

Lorentz transformation does not apply. We also observe that the mass times c^2 yields the energy -- both "rest" and kinetic. Thus we may consider rest energy as potential energy.

We note, however, that the absorbed photons lose their identity and in that respect the rest mass of the photon is a moot concept. Here we see the reverse process of the release or conversion of "rest energy" $(nm_q)c^2$ to kinetic energy which takes the form of radiation or neutrinos.

MATTER

Quanta agglomeration in the concentric mode manifests as matter, i.e., electrons, protons, and neutrons. these three (plus the photon) are the only stable particles in the universe. In fact they are the only particles. The members of the "subatomic zoo" are not particles. More on that later.

A particle consists of n concentric spherical quanta sequentially expanding and contracting. A most central quantum expanding to the outer limit in one second will replace n cresting quanta, thus giving rise to a frequency of n which is nu.

Given the parameters of the quantum, we can calculate the density and *effective* diameter of particles.

The *prime* density , D_1 is the density of one quantum fully expanded, i.e., the diameter d = one light second (LS) and therefore the radius r_q = 1/2 light second.

If we visualize a particle as a series of concentric spheres (quanta) we observe that those more centralized are more contracted and therefore more dense. As one proceeds from the core outward, the density diminishes as the *fourth* power of the radius. This is a rather rapid rate. Therefore, in experimental procedures it is the core that is considered the particle.

What would be considered as the surface is tenuous and indefinite and, therefore, so would be the radius, volume, and density.

To determine the density of a particle we consider the following:

A particle of n quanta has an *effective* radius considered to be

$$\frac{r_q}{n} \quad \text{or} \quad \frac{1/2 \text{ LS}}{n} = r \, .$$

The density of a solitary fully expanded quantum is

$$D = \frac{m_q}{4/3 \, \pi \, r_q^3} \text{ or } D_1$$

and equal to 5.225484 x 10^-79 gr/cc. This is the "primal" or minimum density in the universe.

The core density of a particle of n quanta is

Eq. [10]

(where r = effective or core radius)

$$D_p = \frac{nm_q}{4/3\ \pi\ r^3}$$

Since $r = \frac{1/2\ LS}{n}$, we write Eq. 10 as

Eq. [10a]

$$D_p = \frac{nm_q}{\frac{4/3\ \pi\ (1/2\ LS)^3}{n^3}} \quad \text{or} \quad \frac{n^4\ m_q}{4/3\ \pi\ (1/2\ LS)^3}$$

Thus we see the particle density varies as the fourth power of n.

As $\frac{m_q}{4/3\ \pi\ (1/2\ LS)^3}$ is the primal density, D_1, we may also state that the particle density at the core is n^4 times the primal density, D_1, or $D_p = n^4\ D_1$.

Since n represents the frequency as well as the number of quanta , we conclude that the density also varies as the fourth power of the frequency. We also note that, as all particle quanta are in various stages of expansion and contraction and presumably evenly distributed, commencing from the core the density falls off inversely as the fourth power of the radius.

A MORE DETAILED EXAMINATION OF PARTICLE RADII

As stated, for a sphere of ever diminishing density proceeding outward from the core, a true surface is none existent. Therefore, the radius cannot be measured from center to surface.

We establish a theoretical, or "essential" radius by the following reasoning.

The mass of a sphere can be treated as though the *entire* mass were located at the center. *We so regard fermions*. Thus, we regard (say) the electron as having its entire mass at the center.

There the analogy seemingly ends. Whereas a non-compressible uniform sphere has a uniform density, the electron does not. In calculating the density of the non-compressible sphere we utilize the radius as extending from the center to the surface. This is denied us in the case of the

electron as there is no definite surface.

Therefore, we seek a viable *essential* radius by noting that the electron is comprised of n concentric quanta. We regard the nth, or most central quantum as also being the spatial essence of the electron. Thus the mass center and the spatial center coincide.

What we have then is a defined sphere of definite mass and radius. The mass is nm_q and the radius is

$$\frac{1/2\ LS}{n}$$

We refer to this radius as the "essential" radius. However, in the text it is referred to simply as the "radius". We must be constantly aware though that the *full* radius is 1/2 LS.

We now consider another approach:

Consider the relationship $\text{volume} = \frac{\text{mass}}{\text{density}}$

from which the radius is obtainable:

$$r = \sqrt[3]{\frac{\text{vol}}{4/3\ \pi}}$$

As an example, given the mass of the neutron as 1.674954 x 10^-24 gr, the frequency m/m_q (equivalent to n) is 2.272037 x 10^23.

The mean center density, then, is n^4 D_1 = 1.392477 x 10^15 gr/cc.

This density is confirmed by the known density of neutron stars.

Thus we have $\text{vol} = \frac{\text{mass}}{\text{density}} = 1.202860 \times 10^{-39}\ \text{cc}$

and $r = \sqrt[3]{\frac{\text{vol}}{4/3\ \pi}} = 6.597440 \times 10^{-14}\ \text{cm}.$

The $\frac{1/2\ LS}{n}$ **used earlier yields the same result. -- which is not surprising for if we substitute the apropos elements into the above equation for r it reduces to**

$$\frac{1/2\ LS}{n}$$

The elements:

$$\text{density} = n^4 D_1$$

$$\text{mass} = n\, m_q$$

$$D_1 = \frac{m_q}{4/3\ \pi\ r_q^3}$$

We remain aware that in actuality fermions have a varying density. By rewriting Eq. 10 we have an equation that determines the density of a particle at any distance from the absolute center:

Eq [10b]

$$D = \frac{r_q\ m_q}{4/3\ \pi\ r^4}$$

Note, r is the only variable. We accept it as correct since it yields D commensurate with the density of the neutron (in turn confirmed by the density of neutron stars). Also, at the very extremity the density is the primal (least) density D_1

Where m_p (mass of the particle) is the only variable we have

Eq [10b-1]

$$D = \frac{6\ m_p^4}{\pi\ LS^3\ m_q^3}$$

Equation [10b] differs from equation [10] in that it displays density in terms of only *one* variable, that variable being the radius. In Equation [10] both n and r are variable (but interdependent).

We see by equation [10a] the density is directly proportional to the fourth power of n -- and by equation [10b] the density is inversely proportional to the fourth power of r, and by equation [10b-1] the density is directly proportional to the fourth power of the particle mass.

Note, in equation [10b] if r = 1/2 LS, i.e., the outer limit of quantum expansion, D = D_1.

ENERGY DENSITY -- MASS DENSITY

Mass density is the more familiar density. However, there is also an energy density D_E which consists solely of internal energy, i.e., the degree to which quanta are agglomerated is the degree to which the density increases -- both mass density and energy density.

One quantum fully extended has full kinetic energy (h_0) and zero potential energy. Such is expended in the expansion of m_q within a particle.

The same quantum fully contracted has zero kinetic energy and h_0 potential energy (analogous to a coil spring). There are, of course, conditions between.

Consider the first condition -- fully expanded. We may write the kinetic energy as

$$E_k = m_q c^2 = h_0 .$$

We may also write it in terms of

Energy Density x Volume = Energy

(Which is analogous to Mass Density x Volume = Mass.)

Having considered and formulated mass density, we now examine energy density D_1_E (primal energy density).

Eq. [10c]

$$D\_1\_E = \frac{h_0}{4/3\ \pi\ r_q^3} = 4.696433 \times 10^{-58}\ \text{erg/cc}$$

Thus for the fully expanded quantum we have

D_1_E x Vol = E_k = h_0

4.696433 x 10^-58 erg/cc x 1.410786 x 10^31 cc = 6.625662 x 10^_27 erg

We now consider the second condition, fully contracted. The fully contracted solitary quantum has zero kinetic energy, all its energy is potential, E_p, i.e., internal. The extent contracted is determined by the *radius* of the particle. (Note:- The individual quantum may be part of a group that is in translatory motion. In which case it would also possess a kinetic energy involving that motion and its mass m_q. We see here the concept of total energy.)

For the *individual fully contracted* quantum at the center of a particle we write (using as an example the radius of the electron):

D_E x Vol = E_p_q = h_0

$$\frac{h_0}{4/3\ \pi\ r_e^3} \times 4/3\ \pi\ r_e^3 = E\_p\_q = h_0$$

Therefore, we see expanded (kinetic) energy is converted to an equivalent contracted (potential) energy thus the kinetic energy of the quantum equals the potential energy of the quantum,

$$E\_k\_q = E\_p\_q$$

Thus the energy is sequentially and cyclically converted back and forth.

However, the energy in both phases is internal and remains so, irrespective of translatory motion.

We have discussed the individual quantum. We now discuss the energy density of particles

Where n = number of quanta in an electron

$$n E_{p_q} = m_e c^2 = \text{potential energy}$$

$$n E_{k_q} = m_e c^2 = \text{kinetic energy}$$

Collectively (in both phases) this oscillating energy is known as rest energy or internal energy, E_0 or E_i.

The motive power for quanta expelled from matter is the density factor which forbids occupancy to excess quanta. Since these quanta can no longer remain, when expanded to the kinetic energy phase they simply keep going -- at the expansion rate of c. Therefore, the translatory kinetic energy is equal to the internal energy and the mass of the internal quanta is converted to kinetic energy $m_q c^2$.

Note:- This equivalent kinetic energy is in the form of radiation and not to be confused with the energy of translatory motion of the body. This conversion holds for the electron, proton and neutron. In the case of the photon its internal energy, i.e., mass is not conversionable for it is the result of a prior conversion. The internal energy is, however, *transferable* to a particle. That is to say, a photon absorbed transfers its kinetic energy, $m_q c^2$ and maintains its internal energy h_0 (or $m_q c^2$) which bec omes part of the internal energy of the absorbing particle.

THE RELATION OF BOTH DENSITIES TO BOTH ENERGIES

Mass density, energy density, internal energy and kinetic energy are all related through the innate characteristics of the quantum,

We now ask:

What is the relation between mass density and energy density?
As one would expect, we find the relationship to be c^2. It is the factor relating mass to energy ($mc^2 = E$) and it likewise is the factor relating mass density to energy density.

Thus we write

$$D_{1_m} \times c^2 = D_{1_E}$$

$$5.225484 \times 10^{-79} \text{ gr/cc} \times c^2 = 4.696433 \times 10^{-58} \text{ erg/cc}$$

By rewriting equation [10b], the energy density of a particle at any distance r from the center is

Eq. [10d]

$$D_E = \frac{r_q h_0}{4/3 \pi r^4}$$

For verification:

(utilizing the electron)

$$D_E = \frac{r_q\, h_0}{4/3\ \pi\ r_e^4} = \frac{m_e}{4/3\ \pi\ r_e^3}\ c^2$$

As a reminder in dealing with the co-spatial tolerance of quanta agglomeration, there are only two resonant frequencies that produce stable particles, that of the electron and proton.

Upon inspection of equations [10b] and [10d] we observe what at first glance appears to be a dilemma, both the electron and the proton have the same density at a distance from the *point* center equal to the radius of the electron.

This poses a question: If there are 1836 times more quanta in a proton than in an electron, and considering they both have the same *one light second diameter* volume, then the proton must have a much greater mean density; how so, then, at equal distances from the point center both particles have equal densities (mass and energy)?

Answer: The essential radius of the electron is the radius of the centermost quantum of the particle. We now imagine adding 1836 times as many quanta to the electron transforming it into a proton. The quantum that was the center of the electron is no longer the center. The additional quantum content has introduced a great many more quanta *inside* the electron radius thus creating a new - much smaller -- center.

Succinctly, the quantum that was the center is no longer the center -- not that it has moved outward -- a new *smaller*, denser center of additional quanta was created. So, whereas the electron radius is of the center in an electron, this same distance is somewhat to the exterior of the radius within the proton.

The ratio of the new center radius to that of the old center radius is 1:1836. This is measured from the true point center.

ELECTRONS

Although high energy photons are particle-like the electron is the threshold to the true particle state.

PAIR PRODUCTION: photon <=====> electron + positron

Experimentally, a high energy photon (1.022 MeV +) upon arriving in the vicinity of a heavy nucleus (which merely acts as a backstop) may transform into an electron-positron pair (evidencing the *matter/antimatter* composition of the photon.) each particle consisting of a mass of .511 MeV. Excess energy manifests as kinetic energy of the particles.
This tells us that matter and radiation are built of the same basic building block.

1.022 MeV is equivalent to 1.637346 x 10^-6 erg. From the equation

$$\frac{E}{h} = nu$$

we get a frequency of 2.47122 x 10^20 cycles/sec, the minimum frequency for pair production. Therefore, it consists of that many quanta, each of mass m_q. Thus the mass of the photon is 1.821793 x 10^-27 gr, which, divided by two gives 9.10896 x 10^-28 gr, the mass of the electron and positron.

Thus we see a high energy photon composed of sufficient quanta to equal two electron masses alter its mode by collision thereby changing into a concentric, altered state. We may say as a casual observation that this new state (the positive and negative electron) is a semi ponderous one. It is half way between a true ponderous state and that of radiation. Thus we perceive three states of matter.

We see the product of photon conversion also contains opposite spins that in the new concentric mode are mutually exclusive. Due to the density the newly formed particle must undergo fission, one half being of negative spin, the other half positive. Any excess energy manifests as kinetic energy.

Here we see the process of agglomeration bridge the gap between the radiant mode (photon) and that of the true particle by simply altering from the consecutive mode to the concentric mode.

The reverse process also exists, an electron-positron pair merging to form two photons.

This is an example of the much vaunted "Annihilation" of matter that takes place when matter and antimatter meet. The opposite spins are disruptive, causing the particles' composition to disassociate and assume the radiation mode where matter-antimatter spins are compatible. Thus, we see there is no annihilation of matter, just an alteration in form. Mass and energy are thereby conserved.

SPIN, CHARGE AND MAGNETIC MOMENT

To avoid confusion in assigning spin this author uses the conventional clockwise (CW), counterclockwise (CC) notation. The direction is, of course, in relation to an axial vector. It is assumed the "observer" is peering in the direction of the vector (positive or negative). By this means we identify a particular spin regardless of spatial orientation, i.e., the spin is in relation to the charge vector.

The quantum and therefore the electron, proton and neutron have spin. In a three dimension manifold, a given direction of spin *but not the notation* may be reversed by rotating the axis 180 degrees. In that case we term it "contra" spin as opposed to "reverse spin" which is in respect to the axial vector.

The question arises, what *is* electric moment and why are there two kinds?

Why are the opposite elemental charges exactly equal when the masses of the particles (proton and electron)carrying them are unequal?

Also, *what* is magnetic force?

In these pages we will attempt a physical explanation employing the philosophy that *any* attempt is better than none.

Let us approach the characteristics of spin in the most literal sense and see how far we can progress.

Our particles are considered spherical. Since they have mass and spin we write the standard equation for angular momentum

(where theta is a fraction of a radian)
(iota omega will, for convenience, be IW)
(r_q = 1/2 LS)

Eq. [10g]

$$IW = 2/5\ m_q\ r_q^2 * \frac{\text{theta}}{\text{sec}}$$

This for a solitary quantum.

Taking spin angular momentum to be 1/2 h-bar as developed by P.A.M. Dirac, the angular momentum of the individual quantum is

$$IW = 2/5\ m_q\ \frac{LS^2}{2^2}\ \frac{\text{theta}}{\text{sec}} = 1/2\ \text{h-bar} \quad \text{or} \quad \frac{h}{4\ pi}$$

$$\text{(where} \quad \frac{\text{theta}}{\text{sec}} = .7957747 \quad \text{or} \quad \frac{10}{4\ pi} = \text{omega\_q)}$$

For n quanta we write IW as

$$IW = 2/5\ \ (n\ m_q)\ \frac{r_q^2}{n^2}\ \frac{n\ \text{theta}}{\text{sec}}$$

We observe the angular momentum to be conserved even though mass is added for n cancels out.

Pictorially, the addition of mass (quanta) increases the angular moment tending to *slow* the revolutions whereas this same addition reduces the effective radius which *increases* the angular velocity. These parameters offset each other to a nullity. Thereby we see that any fermion will maintain the constant spin momentum of h/4 pi.

We note that for the solitary quantum, I = 1/10 the coefficient of h, and

$$W_q = \frac{1}{2/5\ pi}\ \text{rad/sec} = \frac{10}{4\ pi}\ \text{rad/sec}$$

We also note that since the spin angular momentum is constant, it is therefore the spin angular momentum of the individual quantum, and thus we regard it as the *absolute minimum spin angular momentum*.

It could be assumed the absolute spin angular kinetic energy would be given by the classical momentum x velocity. Analogous to E=pc for radiation:

[/_ = angular]

$$/\_ E_k = \frac{IW\ theta}{sec}$$

which yields 4.195748 x 10^-28 erg and is the rotational analogue to _ _

E_K = mv^2. There is no 1/R + R^2 because special relativity is not applicable to the quantum world.

It may also be written analogously to E_k = m a d:

(where d = theta)

$$/\_ E_{k\_q} = I\ \frac{theta}{sec^2}\ theta$$

However, it should be noted that the acceleration $\frac{theta}{sec^2}$ is fictional.

This fictional acceleration determines the minimum torque (L) as

L_1 = Ia which is analogous to F = m a.

We might also state the absolute minimum torque in the form

$F = \frac{/\backslash P}{t}$ as $L_1 = \frac{/\backslash (IW)\_q}{t}$, and equal to 5.272533 x 10^-28 dyne cm.

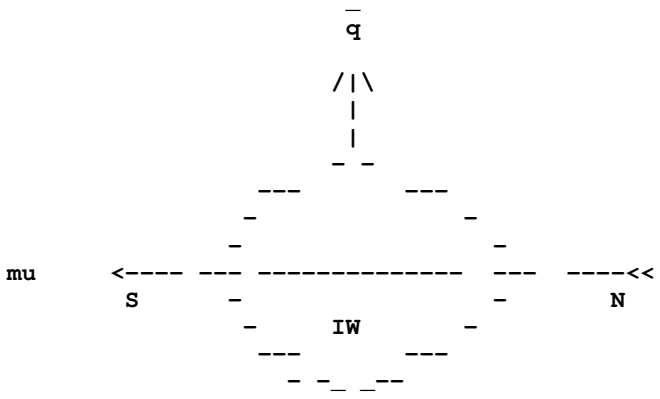
As quanta agglomerate and their effective radii become smaller, there is an increase in angular velocity. We note two things: (1) the inner quanta spin faster than the outer quanta, and (2) the increments in velocity are due to the conservation of momentum -- *not* to an applied force.

We now consider an illustration of our spinning fermion and shall regard the resultant parameters in a slightly different manner than customarily done.

$\bar{q}$, unit in cgs scale is statcoulomb

$$\text{For electron, } \frac{c\,e}{10} = \text{stat } c$$

(e = 1.602314 x 10^-19 Coulomb.)



We assert that the spin creates angular momentum and that the spin angular momentum in turn creates the magnetic moment, mu. This is quantified as

$$\frac{IW}{\backslash t} = F = mu$$

To obtain t we note $F \times t = P$ and therefore $t = \frac{P}{F}$.

Where P = IW, F = mu_B, the Bohr magnaton, which is given as 9.27467 x 10^-21 ampere-centimeter^2, we find t = 5.684874 x 10^-8 sec. This figure shall emerge again, shortly.

The Bohr magnaton is given as $\frac{h\,\bar{q}}{4\pi m_e c}$ and for purposes here is considered the theoretical magnetic moment of the electron.

Whereas IW is considered a polar vector its resultant is not so considered. In a pragmatic vein, we consider magnetism to be a current or "wind" of quantum substance and as such capable of applying force. This current is equatorial -- as in the illustration. Consequently, it consists of closed loops which we observe. The north, south denotations reflect those made on the macroscale and are arbitrary.

Normal to the equatorial magnetic current we observe the polar vector q which is the electric force. This is usually denoted, e, and given as a fraction (1.602 x 10^-19) of a coulomb in SI units rather than the cgs which is utilized in this work. In this scale, the basic electric charge is the statcoulomb, being the charge required to create one dyne of force at a distance of one centimeter. Thus the basic electric charge is

4.803618 x 10^-10 statcoloumb. To differentiate it from the standard e, we use the symbol $\bar{q}$, the bar signifying that the charge is minimum and negative.

The Bohr magnaton is given in terms of $\bar{q}$ utilizing the statcoulomb. Thus, so far we have considered three basic parameters of a spinning electron, IW, mu_B, and $\bar{q}$. We shall now observe a fourth. For the moment we will regard it as "modular momentum".

The electron consists of n = 1.235608 x 10^20 quanta, each of which oscillates (expands) once per second. The velocity of oscillation is c. Therefore, the momentum of *each* quantum is m_q c or 2.210082 x 10^-37 gr cm/sec (P_1). Thus the total oscillatory (or modular) momentum of the electron is nP_1 or

$$1.235608 \times 10^{20} \times 2.210082 \times 10^{-37}$$

$$= 2.730796 \times 10^{-17} \text{ gr cm/sec} = m_e c$$

(m_e = mass of electron)

Magnetic moment is circular in form and is related to the orthogonal electric moment which is a linear vector. By the same token angular momentum is circular in form and is related to the orthogonal "modular momentum" which is a linear vector (and in this case equal to m_e c .)

The modular momentum may be considered linear in the sense that the radii of expansion/contraction is linear. The force is most effective where the circularity is maximum and the density the greatest, i.e., the polar axis. Thus the force is a polar vector.

There becomes apparent immediately a series of interesting relationships:

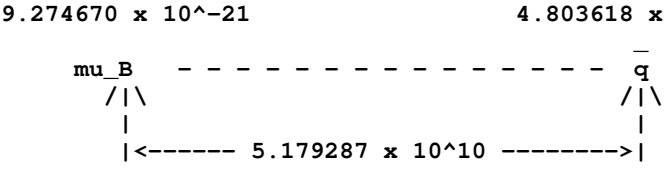
First, we note that of the four parameters, two are momentum, m_e c, and IW -- one linear the other rotary. The remaining two, $\bar{q}$ and mu_B are considered force fields, one linear and the other rotary. Upon examination we see that (See illustration below.)

(i) the ratio between momenta is the same as the ratio between forces.

(ii) the ratio between the linear momentum and its charge $\bar{q}$ (force) is the same as the ratio between angular momentum and its force, mu_B

Therefore, we are induced to the conclusion that the forces are a direct manifestation of momenta -- two types of momentum, two types of charge, all in direct proportion and configuration.

With a graphic display, the relationships become perspicuous:



Thus

$$\frac{\mu_B}{IW} :: \frac{\bar{q}}{P}$$

We see the force to momentum ratios are equal and are 1.759054 x 10^7 to one.

also

$$\frac{\mu_B}{\bar{q}} :: \frac{IW}{P}$$

the ratio of forces and the ratio of momenta are equal.

All the relationships of proportionality follow.

The function connecting the forces to their respective momenta is one of time (F x t = P). {{This is the t obtained above in ascertaining mu_B.}}

Thus we see magnetic moment as the force created by angular momentum, and electric charge as the force created by modular momentum.

We will now display the momenta and charges in terms of their physical constants:

$$\frac{h\,\bar{q}}{4\pi\, m_e\, c} \qquad \frac{e\,c}{10}$$

$$\mu_B \;\text{---}\; IW \qquad \bar{q} \;\text{---}\; P$$

$$\frac{4\pi}{D_e} \quad \text{or} \quad \frac{4\pi\, m_e}{m_q\, LS}$$

$$\frac{h}{4\pi} \qquad m_e\, c \quad \text{or} \quad \frac{h}{D_e}$$

{ where D_e = electron diameter } Note: D_e * m_e c = h = momentum x distance.
{ e = 1.6023 x 10^-19 coulomb }

With this array before us we are able to make some very interesting observations and deductions.

Earlier we queried as to why the basic positive and negative electric charges were equal when the particles carrying them were of such disparate

mass (1 : 1836). We shall see the answer is that both charges are a consequence of IW, which of course is constant.

We have established that the relationship of $\bar{q}$ to P and mu_B to IW is one of time.

$\bar{q}t = Ft = mc = P_e$ (From here forward we specify electron parameters.)

and likewise $mu_B t_e = IW$

(We label this particular time /\t_e for it is specifically of the electron.

The question arises, what is the relationship of IW to P_e and mu_B to $\bar{q}$?

Taking $\frac{P_e}{IW}$ we see the result is one of motion -- both linear and angular:

Eq. (A)

$$\frac{P_e}{IW} = \frac{m_e c}{\frac{h}{4\pi}} = \frac{\frac{nm_q LS}{sec}}{\frac{m_q LS\ LS\ sec}{sec^2\ 4\pi}} = \frac{n\ 4\pi}{LS} = \frac{4\pi}{\frac{LS}{n}} = \frac{4\pi}{D_e}$$

(We note that 4 pi = 2 rotations.)

Here we see a ratio between the electron's diameter and its 4 pi rotation.

Since 4 pi equals two rotations, it might be clearer to state the ratio as

$\frac{2\pi}{r_e}$. Thus we have a direct relationship of one revolution to the radius.

The relation of $\bar{q}$ to P_e :

The electric charge can be considered a force.

F x t = P

thus $\bar{q} \times t_e = P_e$

$4.803618 \times 10^{-10} \times 5.684874 \times 10^{-8} = 2.730796 \times 10^{-17}$

the time t_e is given as t in the first diagram above.

Observing our graphic display we see the following relationships:

Eq. (B)

$$mu_B = \frac{\bar{q}\ IW}{P_e} = 9.274671 \times 10^{-21} \text{ erg/oersted}$$

This is the relationship for the electron. We now ask, what is the relationship for the proton and calculate mu_N, proton magnetic moment. We do this by substituting the proton mass in place of that of the electron.

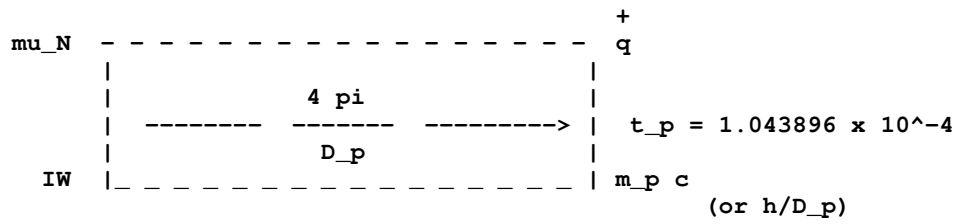
Eq. (C)

$$mu_N = \frac{+q\ IW}{P_N} = \frac{+q\ IW}{m_p\ c} = 5.050825 \times 10^{-24} \text{ erg/oersted}$$

By the standard model mu_N is given as $\frac{+q\ h}{4\ pi\ m_p\ c}$ which yields the same:

5.050825×10^{-24} erg/oersted

Thus we have



These variations, of course, are all in the ratio of the electron to proton mass.

Rewriting equation B and C we have

$$\bar{q} = \frac{mu_B\ P_e}{IW}$$

and

$$+q = \frac{mu_N\ P_p}{\quad}$$

We now perceive the answer as to why particles of such disparate mass as the electron and proton have quantitatively the same (although opposite) charge, IW is constant and $\mu_B P_e = \mu_N P_p$.

As to the charge being opposite, it is well accepted that this is due to the reverse spin, although it is not quite clear. This subject shall be dealt with later.

Another obvious conclusion is that the polar vector q is the motive force for the *electron* current, I. When a wire is moved across magnetic lines the magnetic moment of the quanta in the wire (grouped into electrons) aligns with the magnetic field thus orienting the orthogonal electric moment to be unidirectional, creating a current. We note the *left* hand rule applies as q is in the opposite direction of the current**

** "Current" direction is customarily given as opposite to the direction of electron flow. In this work it is considered to be in the *direction* of electron flow and termed *electron current* vs *electric* current. It seems inapropos to carry on a tradition, a misconception born in the dawn of understanding.

We now examine magnetic moment from a different view:

Examining equations (B) and (C) we observe that μ is inversely proportional to the mass of the particle -- and since the radius is inversely proportional to mass, then μ is directly proportional to the radius.

This should not be surprising inasmuch as we attribute μ to an equatorial wind or current and we would expect the radius of the particle to affect this; the less the radius, the less the magnetic flux. We note that the ratio of μ_B to μ_N is the same as the ratio of the radius of the electron to that of the proton.

There is an overriding minor variation which will be discussed more fully in the next section.

We note some relationships by way of confirmation:

Eq.(A) may be written as

$$IW\,4\pi = P_e D_e, \text{ which is equal to } h.$$

Substituting $\left(IW = \frac{h}{4\pi}\right)$, we have $\frac{h}{4\pi} \times \frac{4\pi}{1} = h = P_e D_e$

As all parameters are constant this holds for protons, neutrons and photons.

An interesting note:

$$h = P \times D = \frac{nm_q\ LS}{sec} \times \frac{LS}{n} = m_{qc} \times LS = P_1\ LS$$

where P_1 is *absolute minimum* momentum.
n is particle mass/m_q and equal to the frequency number of the particle.

Of special interest -- toward verification -- is the photon.

Lamda = wavelength = distance, d = c/nu.

P = momentum = h nu/c

Eq. (D)

$$Pd = \frac{h\ nu}{c} \times \frac{c}{nu} = h$$

We note that the measurements for the above equation are accurately determined empirically. Thus if the relation h = Pd is true for the photon -- and the theoretical considerations are consistent for radiation through particle, then we can assume that h = Pd (where d is diameter) is true for particles; which means our concept of quantum spheres and the method of determining diameter, momentum and mass is verified. This is the foundation supporting the rest of the theory.

We also note that the Compton wavelength is given as $\frac{h}{mc} =$

$\frac{h}{\text{particle momentum}}$ and is equal to $D = \frac{LS}{n}$. Both expressions hold for particles *and* photons (where D = lambda).

The considerations for momentum and h carry for energy also.

In consideration of P c = E we write

$$\frac{h\ nu}{c} \cdot \frac{c}{1} = h\ nu = E$$

Subst.: (nu = n/sec) We reiterate,

Eq. (E)

$$\frac{m\ a\ d\ t\ n}{t} = n\ m_q\ ad = n\ h_0 = n(m_q\ c^2) = (nm_q)c^2 = m_{ph}\ c^2 = E_k$$

(where a = c/sec. d = LS)

When absorbed, the photonic mass h nu/c^2 is incorporated into the elevated electron from which it is ejected upon returning to a lower energy level. When incorporated in and a part of the electron, it can be considered rest mass. Therefore h nu/c^2 rest mass is converted to h nu/c^2 photonic mass.

(h nu/c^2 = nm_q)

EQUATORIAL VELOCITY

For the solitary quantum, the equatorial velocity V_1 is

$$V_1 = \frac{\text{theta}}{\text{sec}}\, r_q \ .$$

(where theta = 10/4 pi)

The minimun velocity is 1.1928366 x 10^10 cm/sec = .3978874 c .

This can be shown to be constant for any fermion:

For a particle of n quanta $V = n \frac{\text{theta}}{\text{sec}}$, and $r = \frac{r_q}{n}$.

Thus equatorial velocity for a particle, V_p is

$$V_p = n \frac{\text{theta}}{\text{sec}} \times \frac{r_q}{n} = \frac{\text{theta}}{\text{sec}}\, r_q = k$$

We note n cancels leaving only the constants.

Since the equatorial velocity is constant and minimum we denote it as V_1.
This velocity is appreciably close to that of light.

Although quanta are very tenuous, given the high equatorial velocity,
it can readily be seen why magnetic flux is appreciable.

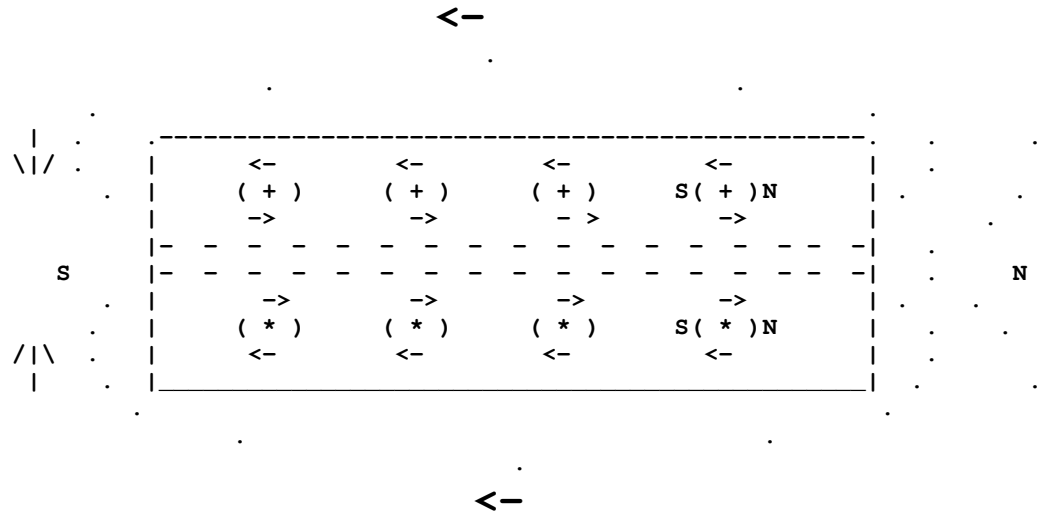
MACROCOSMIC MAGNETIC FLUX

With quanta grouped into electrons, the magnetization of a bar magnet
may be schematically represented thus:

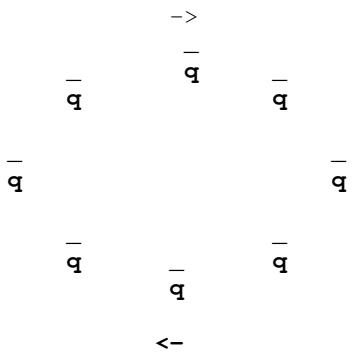
(+ indicates electric vector pointing downward through page.)

(* indicates electric vector pointing upward from page.)

(The *left* hand rule applies.)

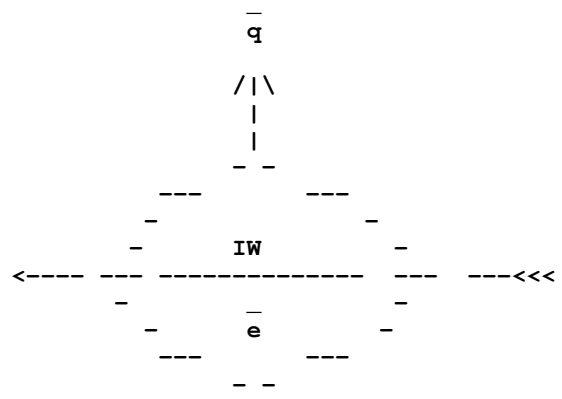


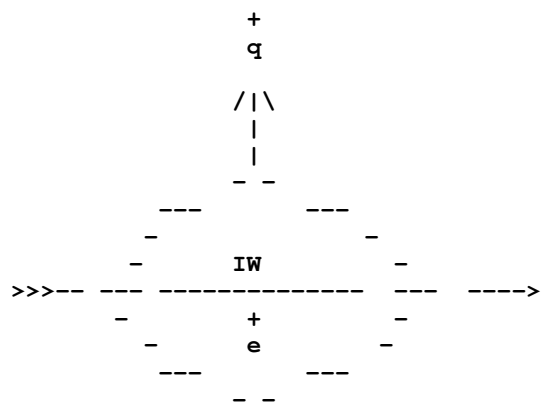
N end view



ATTRACTION, REPULSION AND ANTIMATTER

Let us regard an electron-positron pair of particles as matter, antimatter.



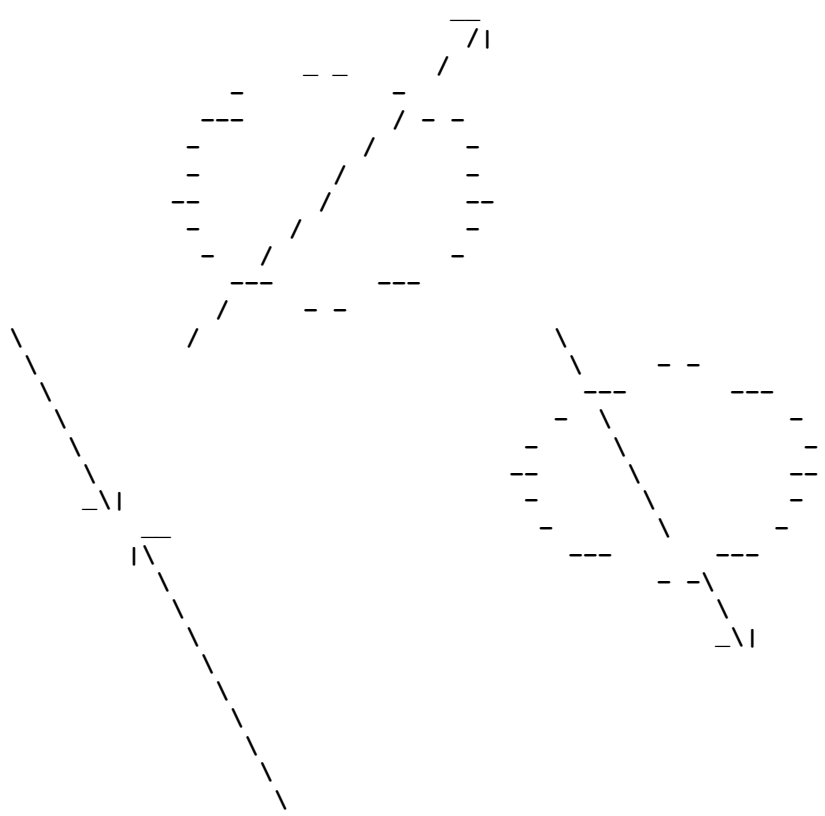


We note the distinction is a *reversal* of spin, i.e., the q forces are unidirectional whereas the spins are reverse. Opposite spins or *anti parallel* spins, say of electrons, may be achieved by acquiring a 180 degree orientation, *but the q forces are then opposing*.

Thereby lies the uniqueness of spin REVERSAL versus *opposite*, *counter*, or *anti parallel* spin. We reserve the meaning of REVERSE spin to be in

reference to parallel q forces. It is here lies the basis for antimatter. More later.

Next, let us suppose two particles approaching each other or separating with their spin orientations at approximately 90 degrees (as an extreme case)



We speak here of counter or opposite spins, i.e., 180 degree orientations.

Let us constantly be conscious that in actuality "particles" are huge spheroids of 1 LS diameter. Thus *in approach* the two particles become entangled -- at first in their extremely rarefied zones -- and through mutual influence must eventually re-orient in relation to each other such that their equatorial planes are parallel. Thus there are only two possible resultants, parallel or anti parallel spin. Therefore, we posit that all particles whose cores are in close proximity are aligned equatorially in parallel or anti parallel spin.

The entanglement phenomena accounts for the empirical experience of non-locality, diffraction, refraction and other wave/particle phenomena and may manifest with particles separating.

We now examine the dynamics of partially merged *full diameter* (1LS) fermions. It will be found to be complex, *very* complex (and surprising). Therefore, the methodology employed here will be crude but hopefully sufficient to correctly display the results with a fair degree of accuracy. We speak of "partially merged" fermions for although the cores are in close proximity on a LS scale, the rest of the 1 LS diameters are merged.

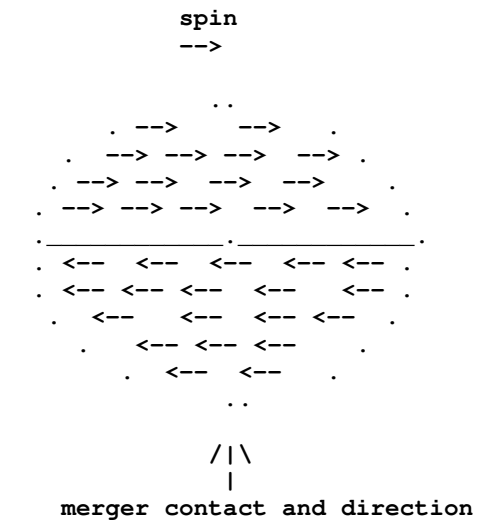
To illustrate the complexities we display the approach and merging of two fermions of parallel spin.

(It may augment the illustration if one connects the "dots".)

==========

In these illustrations it sometimes becomes a bit difficult to visualize the interactions of the zones for spin and contra spin events. The reader can make a workable moving model quite easily by taking two circular pieces of tissue paper or tracing paper, draw curved lines representing the currents, and then simulate a merger by superimposing the circular pieces -- sliding one past the other.

To simplify the confusion of arrows that results, it is sufficient to draw them so:



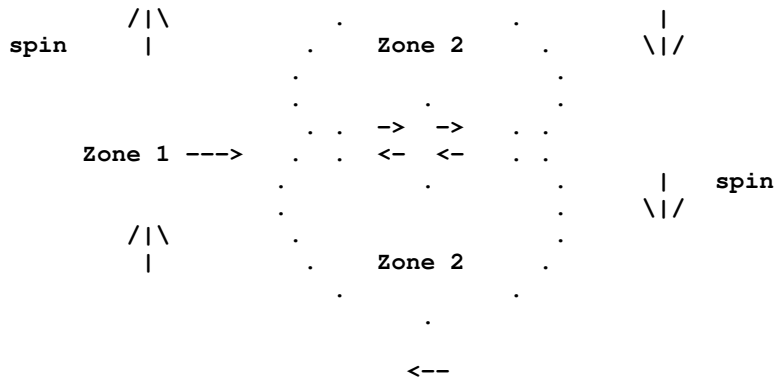
merger contact and direction

We thus simplify the flow of each hemisphere. By superimposing the tissues and observing them through a light, one *approximates* the dynamics.

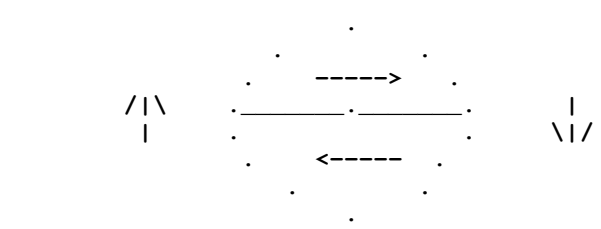
Matching spins and contra-spins are achieved simply by "flipping" one of the tissues.

MERGING PARALLEL SPINS

spin -->

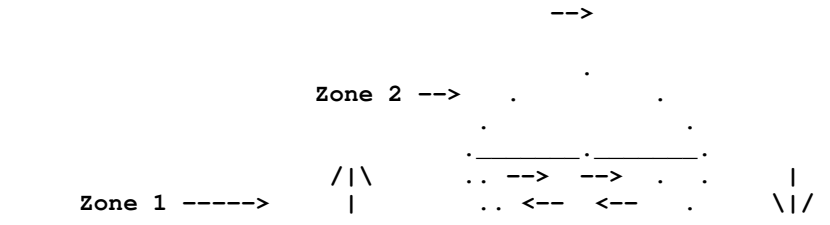


Zone 1 (the region merged) is a counterforce region, and increasing.
Only rarefied regions of the particles are involved.



The diameter is dividing line for current vectors. (drawn straight instead of curved -- ASCII restriction) Axis is vertical to page.

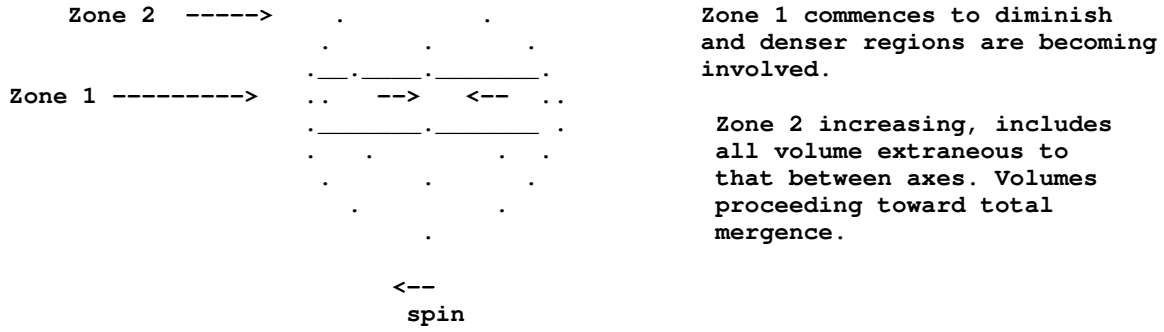
End of PHASE I, start of PHASE II



Zone 1 at maximum. The surface of each sphere reaches the diameter (axis) of the other.

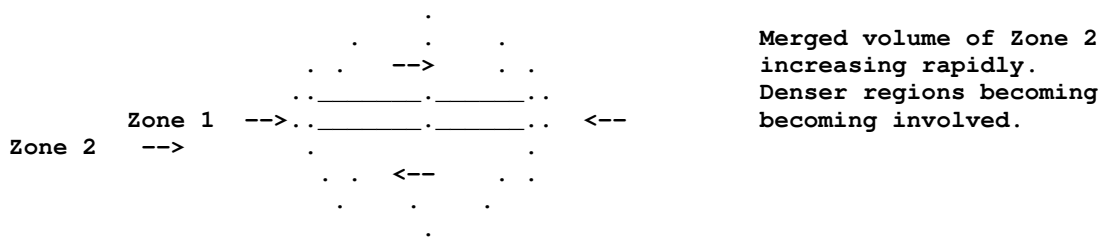
The extremely rarefied region of each particle is involved with the very dense region of the other. Thus zone 1, at maximum, is not very influential. We note, also, that the volume of zone 1 at maximum is somewhat less than the rest of the spheres.

PHASE II



Zone 1 commences to diminish and denser regions are becoming involved.

Zone 2 increasing, includes all volume extraneous to that between axes. Volumes proceeding toward total mergence.



Merged volume of Zone 2 increasing rapidly. Denser regions becoming becoming involved.

END OF PHASE II

The parallel forces of Zone 2 will become stronger until the *effective* surfaces (i.e., cores) are nearly engaged and an equilibrium with the Zone 1 counter force *achieved*, that is to say the attraction force of Zone 2 will reach an equilibrium with the repulsion force of Zone 1.

However, because the dense *effective* surfaces are in opposition the repulsive force dominates and the reaction is stabilized at repulsion. Thus we see that like forces repel.

Although the volume of Zone 1 reduces to a comparatively minute quantity the repulsive q force is very strong as the region is extremely dense. The cores are close together and q increases inversely as the square of the distance

The reason q varies inversely as the *square* of the distance rather than the fourth power (as does density) may be explained by the following.

As Zone 1 approaches terminus its volume approaches the configuration of a disk having a virtually constant diameter. The cores lie at the center of the intersect planes of the disk shaped zone and as the planes approach each other the volume becomes *directly proportional* to the square of the distance, between cores. The force is proportional to the volume and the density of that volume.

We now summarize a *contra* spin merger.

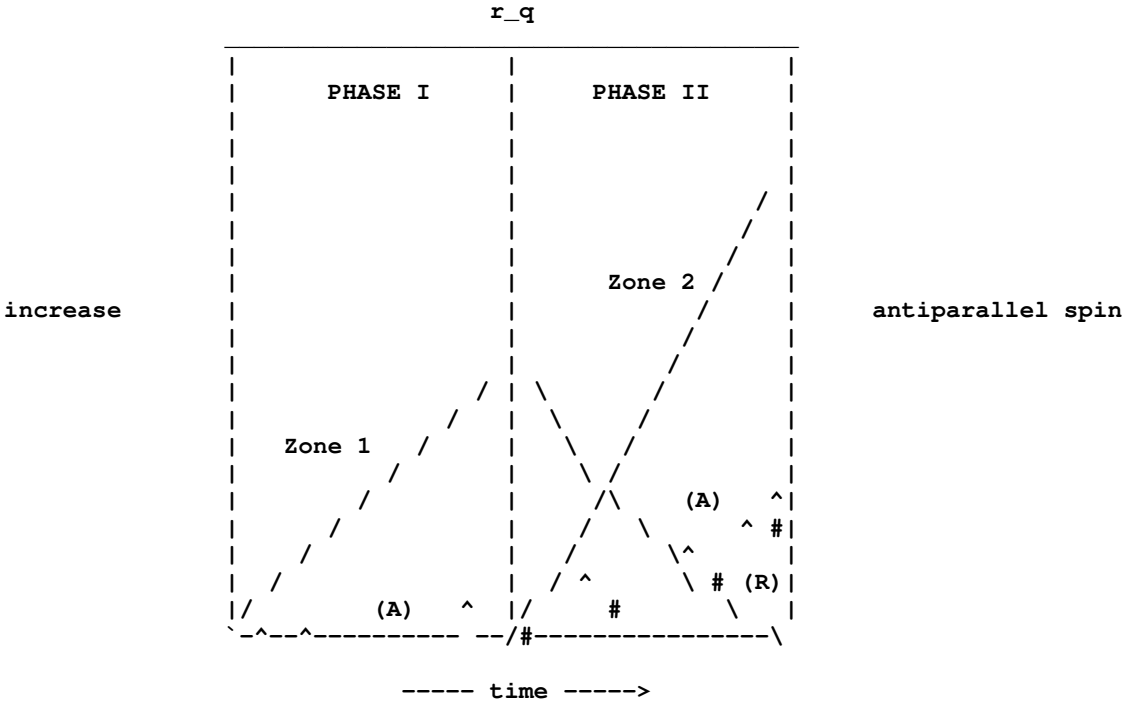
The contra spin merger is the same except the forces are reversed -- Zone 1 is attractive while Zone 2 is repulsive. It follows, the attraction of Zone 1 proceeds to the point where the repulsion of Zone 2 reaches an equilibrium with it. Thus the particles are not drawn into contact by the attraction force but establish a balanced position where the attractive force predominates.

In the case of photons they will each continue on their course because the density is such that they do transit each other -- and because they are constructed in a sequential (wave) pattern.

The contra-spin merger can be illustrated simply by "flipping" one of the tissues.

Below is a graph that *roughly* aproximates the conditions.

(apologies for the graph but ascii is ascii. However, connecting the "dots" on a print out helps tremendously.



Referring to the graph for antiparallel spin:

The abscissa is time as the particles merge. The ordinate is increase -- in both volume and force. The dash lines are volume, the (^) and (#) lines are force (labeled A and R for attractive and repulsive).

There is a vertical bisect labeled r_q, radius of the quantum (1/2 LS).

It is at this point (distance traversed in merger) that Zone 1 reaches its maximum volume and commences to decrease. This is labeled Phase I

Phase II commences as Phase I ends.
Zone two (*) commences growth to become virtually the entire *united* volume.

In Phase I, as Zone 1 grows from its inception to full volume, the force it generates is shown by either the A curve or the R curve depending on spin orientation (anti-parallel in the illustration and therefore attractive).

In Phase II, as the volume of Zone 1 *decreases* the force continues to *increase,* as the central -- dense -- cores are approaching proximity.

In phase II the volumes of Zone 2 become interactive and proceed toward an almost complete merger. It is at this point that the Zone 2 force commences. It is opposed to that of Zone 1 but always lesser.

We note that in the anti parallel event the attractive force A is at all times greater than R the repulsive force. Therefore the anti parallel situation is considered one of attraction.

Conversely, in the parallel spin situation the dominant curve is labeled R and we have a repellant condition.

Thus we see the proton and electron (hydrogen atom) are held in an attractive electromotive force which is varied depending on the spin orientation.

An alteration of electron spin from parallel to anti parallel results in an energy drop in the form of a photon of 21.11 cm wavelength.

Referring to the merger mechanics we see that in the parallel case the repulsive force dominates. Thus the proton and electron maintain a more distant relationship than that of a proton and electron with anti parallel spins, which is predominantly attractive. It is the latter which probably accounts for the proton with an electron in close proximity which we know as the neutron.

The energy difference of the two levels is 9.41 x 10 ^-18 erg. There has been observed from deep space a radiation of wavelength 21.11 cm and it is hypothesized that the origin is free hydrogen atoms, the electrons of which "flip".

*** * ***

Of interest is the magnetic moment of the "bare" proton and neutron vs the magnetic moment of the *nucleonic* proton and neutron.

The moment mu_e of the electron is

$$\frac{h\,\bar{q}}{4\pi\, m_e\, c}$$

The only variable is mass. One would suppose, therefore, that the proton magnetic moment would be

$$\frac{h\,q^{+}}{4\pi\, m_p\, c}$$

which yields 5.050824 x 10^-24 erg/gauss

But this is not the case. This quantity is mu_N, the *nuclear* magnetic moment or "nuclear magnaton".

The moment of the "bare" proton (mu_p) and neutron (mu_n) is more than mu_N by a factor of 2.792845 for the proton and -1.913 for the neutron.

There are explanations given for the differential of the "bare" magnetic moment from mu_N but this author has yet to find an explanation for the difference between the "bare" proton and neutron, i.e., the factor 2.79 for the proton vs −1.913 for the neutron. That the factor for mu_n is given a minus sign indicates a reverse spin, confirming experiment showing the neutron to have a negative envelope. This leads to the following explanation.

If one examines the above graph they will find the key to the riddle. The neutron consists of a combination of one proton and one electron. Thus we have contra spins and the union is one of attraction. The electron, being of larger diameter, *encases* (as opposed to *orbits*) the proton. The reverse spins are opposite and *this tends to neutralize the core-proton magnetic moment* -- succeeding in mitigating it so that the net neutron factor is only 1.91 mu_N instead of 2.79.

The electric moment -- a core situation the vector of which is polar -- is quite different. There the close proximity works so as to effect a full nullity of charge and the neutron is thus neutral electrically.

Experiments sending free neutrons through a magnetic field found them reacting in such a manner as to indicate that although they are totally neutral electrically, the neutron is electrically negative on the surface and positive toward the core; the maximum negativity occurring at 1 x 10^−13 cm from the center (whereas, the present theory shows the radius of the proton to be *less* at 6.6 x 10^−14 cm).

A question arises: If we have an electron and a proton, why do we not have a hydrogen atom?

The answer seems to be that for some reason during the original formation of the pair there was enough energy available to supply a binding energy thereby effecting a more closer union than that of the hydrogen atom. This binding energy in large part accounts for the antineutrino in beta decay.

There are several factors to note: (a) As already stated, the *effective* radius of the neutron is 6.6 x 10^−14 cm whereas the experiment mentioned above gave 1 x 10^−13 cm as the maximum radius of the "negative envelope", much closer to the core than an electron *in "orbit"*.

(b) The extra energy in the formation that was assumed to be present is substantiated by the additional mass of the neutron over that of the hydrogen atom -- a mass that accounts for the energy of beta decay and its concomitant antineutrinos (approximately 1.5 electron masses).

(c) The magnetic moment of the neutron, being less than that of the proton indicates that the spins of the neutron's constituent electron and proton are anti parallel. This anti parallelism would mitigate the magnetic moment. However, a perusal of the graph shows the anti parallel state to be *primarily* attractive -- which is the state we would expect in order to induce and maintain the close association. Further, we note that the magnetic moment of the two constituent particles are opposed and posit as a consequence there is an eventual erosion of Zone 1 caused by the opposition of Zone 2. Observing the graph once again we see that this would mitigate the status of the pair reducing the attraction status such that the equilibrium is upset. The consequence of this would be to *trigger* a disruption of the close association (a manifestation of Pauli's exclusion principle) creating a beta decay.

The extra energy incorporated during the formation, which we may call binding energy, is then released as antineutrinos impelling the electron and proton so far apart that a hydrogen atom cannot be formed. We have here, of course, a description of beta decay of the *free* neutron. The inclusion of the

binding energy probably prevents a mass defect as occurs in the hydrogen atom. The binding energy mass is that of the antineutrino mass and must enter in the calculations.

The interaction of nuclear protons in close association with the nuclear neutrons in some way defuses or alters the magnetic moment trigger, probably by forming Zone 1 attractive associations with the outer electron casing of the neutrons thereby defusing the disruptive activity.

We also note that the magnetic moment is a weak force in comparison to the electric force (which in this case is nullified) and this would explain the inordinately long lifetime required to achieve disruption (decay) which is approximately a half-life of 12.8 minutes in the free state.

As if all the above were not complex enough, we have one more force to contend with that superimposes itself over the entire process just described (and may be *the* factor in nucleonic neutrino stability). That force is the nuclear force.

Earlier it was discussed that particles consist of concentric quanta and that as one proceeds from the exterior to the interior the quanta rotate at an ever increasing rate.

Thus we have a vortex with an accompanying vortex current and a resultant vortex force directed toward the center. And so with the addition of this force we see the quantification of particle mergers as *very* complex.

We will now analyze this force.

THE NUCLEAR FORCE

To the time of this writing the nuclear force has remained an enigma. Very little of a concrete nature is known about it except for some basically inexplicable empirical data.

We shall attempt here a physical explanation that is admittedly of a very general and approximate nature. However, it seems a good beginning and commensurate with the rest of this work --- which purports to be nothing more than a blueprint, the details to be filled in by others.

A most cogent reference is a remarkable text [[[[Physics, K.R. Atkins, John Wiley & Sons, Inc. 1966, Chpt. 30]]]] most noteworthy because of its clarity, simplicity, and unerring aim at essentials. Most of the guidelines (clues) were obtained therein:

The clues:
(See illustration)

(a) "The radius of the proton is believed to be 8 x 10^-14 cm."

(b) "It is not known exactly how the nuclear force varies with distance between nucleons, although it is quite certain that it does not vary inversely as the square of the distance ..."

(c) "When two nucleons are farther apart than 10^-12 cm the nuclear force is negligible."

(d) "As they are brought closer together, to distances less than 10^-12 cm, the force is attractive and increases rapidly --

more rapidly than 1/R^2."
(R = radius)

(e) "At a distance of about 2 x 10^-13 cm, the force becomes much stronger than the electrostatic repulsion between two protons at the same distance apart."

(f) "At distances below about 5 x 10^-14 cm, the attraction probably changes into a strong repulsion."

(g) ". . . the two neighboring nucleons settle down at a distance 1.9 x 10^-13 cm apart, where the attractive force is still large."

(h) "To an accuracy of about 1% the force between two protons is the same as the force between two neutrons or the force between a proton and a neutron. This is called charge independence of the nuclear forces."

(i) ". . . in the case of two protons there is an additional electrostatic repulsion, but at a distance of 1.9 x 10^-13 cm this in fact is less than 1% of the nuclear force."

(j) In addition, the work explains the mass defect of the deuteron showing it to be 3.96 x 10^-27 gr. This establishes the binding energy to be mc^2 or 3.559072 x 10^-6 erg.

(k) "The nuclear force does seem to depend on whether the two nucleons are spinning in the same or opposite directions. It is much weaker when they are in opposite directions."

(Note that this seems contrary to the merging characteristics recounted above. Anti parallel spins should attract and thus the force should be greater. However, since neutrons outnumber protons in nuclei, we can assume in general proton/neutron couplings. Recalling that although the neutron is assigned a spin in a given direction *its outer casing is spinning in the opposite direction.* Thus when a neutron and proton are considered as spinning in opposite directions, they are in fact [as far as their outer casings go] spinning in the same direction. Thus the weaker force.)

With these fairly well established quantities and characteristics we proceed with our own posits and deductions:

In view of statement (i) we take the nuclear force to be approximately

100 times the electrostatic force $\frac{+}{q}$ at 1.9 x 10^-13 cm. Thus, where the

$$\frac{+}{+} \qquad \frac{+}{q^2}$$

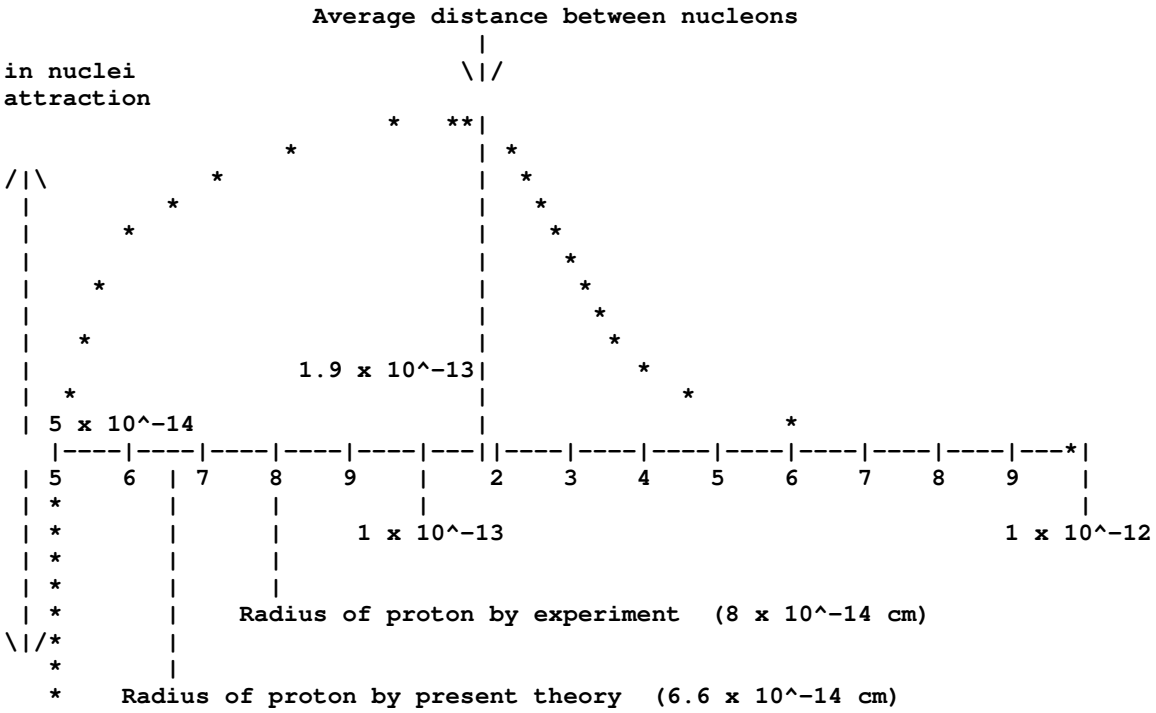
statcoulomb q is 4.803618 x 10^-10, ------ = 6.391896 x 10^6 dynes at
                                       d^2

that distance.

We then perceive the nuclear force, F_n, to be 100 times that or
6.391896 x 10^8 dynes (approx). This gives us a quantitative location
on the illustrated curve:

[[[[also from PHYSICS, K.R. Atkins, John Wiley & Sons, Inc, Chpt. 30]]]].

Strength of nuclear force:



Variation of a nuclear force with distance

Likewise, we observe on the curve that at approximately 9 x 10^-13 cm
                                                          +
F_n approximately equals q. We also note that the greatest rate of change
(maximum) of the increasing curve is approximately 3 x 10^-13 cm.

In statements (a) and (f) we see a parallel: (a) "The radius of the proton

is believed to be 8x 10^-14 cm." (f) "At a distance below about 5 x 10^-14 cm the attraction probably changes into a strong repulsion." (This statement is reflected in the graph.)

INTERPRETING THIS IN VIEW OF THE PRESENT THEORY:

The effective radius for the proton given by the present theory is (developed prior in this work)

$$r = \frac{1/2\ LS}{n} = 6.61 \times 10^{-14}\ cm$$

where LS = light second and
n = number of quanta in particle
= particle frequency

Thus at 2r or 1.32 x 10^-13 cm the nucleons would be in *effective contact* with each other. We note that the effective surface is not definite --but a zone. ---

****
It is shown earlier that the density of a particle falls off as the *fourth* power of the distance from the center. Consequently, there is no surface as such but a zone, a condition somewhat analogous to the "surface" of a star.
****

As the two surface zones meet we would expect the attractive force to no longer increase and that as the nuclei attempted to merge -- what this theory sees as the Pauli exclusion principle (adopted from the classic: two bodies cannot occupy the same space at the same time) would manifest and the mutual attraction would be transformed to mutual repulsion. This is what the curve shows. At almost exactly 1.32 x 10^-13 cm the curve changes from attraction to repulsion and increases negatively in an asymptotic manner.

* * *

It was shown earlier that as one progressed from the outer region of a particle toward the core the quanta spin velocity (i.e., angular velocity), quanta to quanta, increased but the *equatorial* velocity, V_1, of each quantum remained constant.

However, the increasing *angular velocity* as one approaches the core establishes a vortex condition. It is this vortex that creates the vortex force drawing ambient quanta into the particle (see gravity) and also draws nucleons to each other. This is the strong or nuclear force.

The question arises, how do we quantify this vortex force? I found a dearth of information on the subject. What there is deals with hydrodynamics and aerodynamics. Furthermore, the descriptions are essentially cubic -- or Cartesian ,i.e., a circularly moving surface in conjunction with a height or depth. None seemed applicable to the present situation which is *spherical*. In addition the substance here is neither liquid nor gas.

Consequently, the author was left quite out on a limb as to how to proceed. However, one light shown in the dark; a statement was made in one text

that the vortex force is a function of the circularity divided by the area within the curve or streamline. Thus the vortex force increased toward the center as the area reduced.

Applying that to the present problem indicated that the vortex force could be arrived at by taking the circularity to be the equatorial velocity (invariable) and instead of the enclosed *area* we should utilize the enclosed *volume.*

(where phi = vortex force)

This gives us $\text{phi} = \frac{V_1}{\text{volume}}$ **. The volume is determined by 4/3 pi r^3.**

Thus for the *full* proton (diameter = 1 LS) the vorticity is

$$\text{phi} = \frac{1.192836 \times 10^{10}}{4/3\ \text{pi}\ (1/2\ \text{LS})^3} = 8.45512 \times 10^{-22}$$

This is the vorticity 1/2 LS from the center.

Note, we give vorticity as a force, yet the dimensions of velocity/volume are not those of force. How, then, can we consider phi a force?

By way of analogy let us regard the surface of the earth, say at the equator. Because of the rotation every body on the surface regardless, of mass, is undergoing an acceleration toward the center of the earth.

***This acceleration is the same for all bodies regardless of mass*. If we regard force as m x a , and a is constant but m varied, then we conclude the centripetal force varies directly as the mass. We see the situation as one where larger masses have larger forces working on them and smaller masses smaller forces. Thus for all bodies the centrally directed acceleration is equal. *Therefore, we may discuss force in terms of acceleration without regard to mass*. We assume this characteristic for the vortex.**

There is an ancillary view of the analogy. In the case of the earth, we have various masses at the surface placed in the influence of its gravity field. In the case of the nucleus, we have ambient masses (other nuclei) placed in the influence of the vortex force. Both can be expressed by centripetal acceleration.

In summary, phi = vorticity = centripetal *acceleration*

and phi x m = force

We may regard mass as unity as it does not alter acceleration.

Therefore, phi correspnds to F

Thus we discuss force in terms of vorticity, i.e., acceleration without regard to mass.

We restate and simplify the equation for phi:

$$\text{(where } V_1 = \frac{\text{theta}}{\text{sec}}\, r_q\text{)} \qquad \text{and theta} = \frac{10}{4\,\text{pi}}$$

$$\text{phi} = \frac{V_1}{\text{Vol}} = \frac{(\text{theta/sec})\, r_q}{[4/3]\ \text{pi}\ r_q^3} = \frac{\text{theta}}{[4/3]\ \text{pi}\ r_q^2\ \text{sec}}$$

Thus at the *full* radius of the proton

$$\text{phi} = 8.455122 \times 10^{-22} \text{ gr cm/sec}^2 \text{ (dyne)}$$

This is the vortex force *at the very extremity of the proton*.
($r_p = r_q = 1/2$ LS)

As a given mass is drawn toward the center, the volume reduces

Therefore, $$/\backslash\ \text{phi} = \frac{v_1}{/\backslash\ \text{vol}} \qquad (/\backslash = \text{delta})$$

We now consider two protons in proximity. The phi of each then interacts with the other. Thus we have, analogously to Coulomb's law,

(where F_n = nuclear force)

[Eq. F]

$$F_n = \frac{\text{phi}}{d^2} \times \frac{\text{phi}}{d^2} = \frac{\text{phi}^2}{d^4}$$

We observe from

Eq. F that the vortex force varies inversely as the *square* of the distance from the center. Therefore , with *interacting* protons the variation is inversely proportional to the fourth power of the distance, d, between centers. This is not surprising in as much as the density of the nucleons also increases inversely as the fourth power of the radius.

Thus as a general statement:

($r_q = r_p$ because the outer limit of the proton is determined by the maximum expansion of the component quanta, *not* to be confused with the *effective* radius which is the radius of significant density.)

In summary, we write:

$$\text{Nuclear force,}\quad F_n = \frac{\phi^2}{d^4} = \frac{\dfrac{\theta^2}{([4/3]\,\pi)^2\, r_q^4 \sec^2}}{d^4} = \frac{k}{d^4}$$

$k = 7.148909 \times 10^{-43}$ (Note: k consists of all constants.)

We now construct a table making comparisons between q^+ and F_n at key distances. Notice how closely they follow the above graph.

The distance between nuclei is in the center line.

The line above is the repulsive electrostatic force.

The line below is the attractive strong force.

Below that is the relative strength

$\frac{q^{+2}}{d^2}$	6.4×10^6	2.6×10^6	9.2×10^5	2.4×10^5
(d)	1.9×10^{-13}	3×10^{-13}	5×10^{-13}	9.9×10^{-13}
$\frac{k}{d^4}$	5.5×10^8	8.8×10^7	1.1×10^7	7.4×10^5
relative strength	85.93	33.8	11.95	3.1

(continued)

@@

1.9×10^5	1.0×10^5	1.0×10^3	9.2×10^{-1}

```
================================================================================

   1.1 x 10^-12      1.5 x 10^-12      1.5 x 10^-11        5 x 10^-10

================================================================================

   4.9 x 10^5        1.4 x 10^5         1.4 x 10^1         1.1 x 10^-5

     2.6               1.36               .014              .000012

@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
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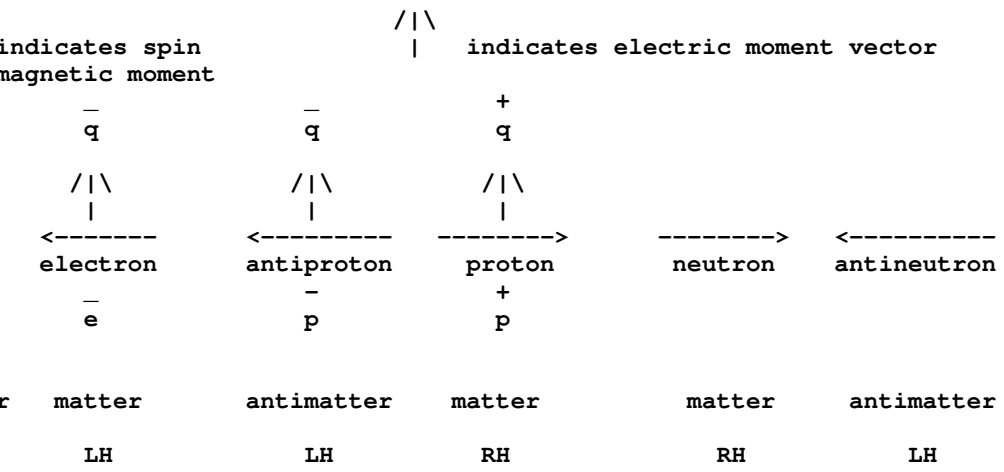
Thus we see that at 1.9 x 10^-13 cm the electrostatic repulsion is 1.16% of the nuclear force [see (i)]. At 1.5 x 10^-11 cm, F_q is approximately 86 times stronger than F_n, and at 5 x 10^-10 cm, it is approximately 83,600 times as strong.

PARTICLE-ANTIPARTICLE

We assemble our particles in an orderly fashion, i.e. we group them in particle-antiparticle pairs:



At this juncture we use the RH, LH notation simply because, being anatomical, it is more graphic.

For clarification: "Left hand" is the view from the equator -- if viewed along the axis in the direction of the charge LH is clockwise (CW). So RH is CCW and left hand is CW.

The LH spin for the electron was chosen because the left hand rule is used for the electron (discussed elsewhere in this work). The other spins follow.

Since the neutron is, mass-wise, predominately a proton it is assigned the same spin, although it has an electron casing of opposite spin which technically

gives it a net of zero spin. (more details on the neutron later.)

Inspection immediately reveals that the determining factors for matter-antimatter is charge and spin -- given conditions where

* the polar vectors are unidirectional and

* mass is identical

reverse spin creates opposite charge which in turn creates an antiparticle.

There is an interesting situation in the disruption of an electron-positron pair. We have two particles of opposite charge and equal mass that *should* disrupt each other immediately upon contact. That does not happen. Instead they orbit each other for a brief period, and for that period of time are considered a quasi atom called positronium.

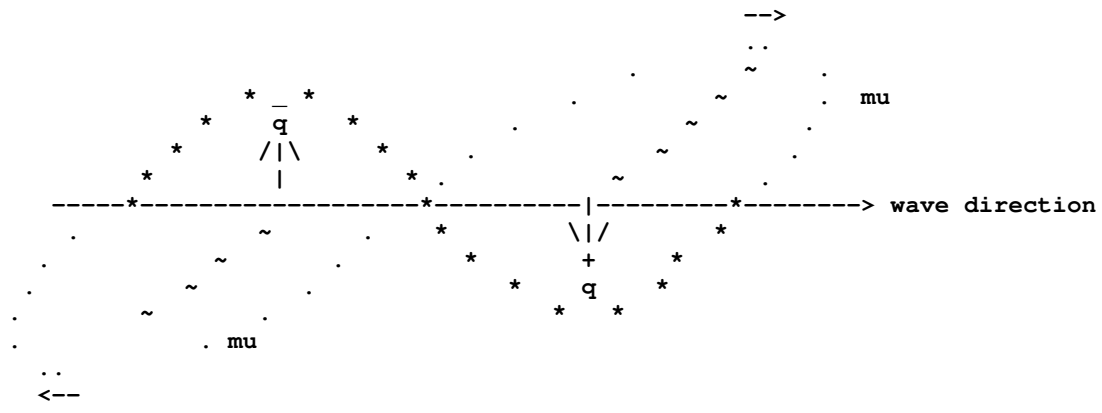
What is of interest is the lifetime of positronium for the anti parallel spin case, 1.25 x 10^-10 sec, and the parallel spin case, 1.39 x 10^-7sec. Thus we see the parallel spin case as being over one thousand times longer.

In observing the merger chart we see that in the parallel case the *repulsion* force is the stronger until equilibrium. It, therefore, is not surprising that this predominance would tend to keep the particles apart and thereby slow the ultimate disruption. Of course the reverse is true for the anti parallel case.

PHOTONS - LIGHT WAVES

As shown earlier all free quanta groups are drawn into one spin orientation or the other. Thus photons and their composite waves consist of quanta of both spins with the resulting electric and magnetic moments 90 degrees to each other.

The magnetic flux comprises the magnetic wave component. The electric wave component (q) has an orientation of 90 degrees to that. One half of the q vectors point "up", the other half, "down". This combination comprises the electric wave component.



Thus we have in combination an electromagnetic wave considered to be of the transverse type, each component field normal to the other and traveling a ray vector normal to both.

The composition of the electromagnetic (e m) wave, or more specifically, the photons is not simple and will therefore require some analysis.

We have in effect great quantities of quanta emitted in a linear fashion with the ability to merge and exist co-spatially. These quanta also consist of equal quantities of reverse spin as well as opposite electric moments. Their co-spatiality and perfect elasticity results in the phenomenon of superposition creating the familiar wave characteristics of the electromagnetic spectrum.

We also note that there are two types of quanta groupings. One has the potential formative gathering of the electron -- the other has the potential formative gathering of the positron.

We also note that the spins of these embryonic particle groups -- which are actually photons -- are parallel. This means they are mutually repulsive. Thus they will maintain a separation.

The positive charges alternating with the negative charges tend to draw the photons together but the repulsive force that dominates upon close proximity of the centers keeps them apart. Thus there is an equilibrium that accounts for the longevity of photons. which, of course runs into billions of years.

When photons of sufficient energy are involved and they are stopped by a non absorbing nucleus we have the reaction known as pair production. The above wave train collapses from its consecutive pattern to form a concentric one. The new conglomerate consists of both matter and antimatter, and in this new configuration divide into two separate groups: electron and positron.

Thus we conclude that the constitution of light consists of both matter and antimatter.

We project that more massive matter-antimatter particles would be produced should the incident photons be of sufficient energy.

Making the assumption that reverse rotating groups of quanta will, in forming a wave train, pair off in all possible combinations, we now ascertain the possible combinations in order to discuss photon characteristics.

However, there is a matter of more general nature that needs be addressed before we proceed,

We note here a startling under-stressed phenomenon: *One half of the photons consists of antimatter* -- or more exactly, of *antimatter quanta*, i.e., reverse rotating quanta. Thus there is far more antimatter in the universe than heretofore estimated.

In the radiation mode matter and antimatter not only exist harmoniously but do so for billions of years.

This matter-antimatter relationship shall be clearer as we proceed with the analysis of the quanta combinations forming photons.

Returning to the assumption that reverse rotating groups of quanta will pair off in all possible combinations, we now ascertain the possible combinations in order to discuss photon characteristics.

We will see that photons must statistically consist of both positive and negative electric moments -- with the concomitant magnetic moments. Thus

photons consist of two halves or "couplings", i.e., 50% of one kind, 50% of another -- co-spatially existent, and electrically and magnetically neutral.

There are four -- and *only* four possible combinations of the reverse rotating quanta couplings.

(1)	**Anti parallel:**	**Left-Right**	**(A || - LR)**
(2)	**Anti parallel:**	**Right-Left**	**(A || - RL)**
(3)	**Parallel:**	**Right Right**	**(|| - RR)**
(4)	**Parallel:**	**Left-Left**	**(|| - LL)**

It is apparent immediately that the anti parallel couplings, both Left-Right and Right-Left are *indistinguishable* from each other, whereas the parallel couplings -- both LL and RR *are* distinguishable as LL is a left rotating photon and RR is a right rotating photon.

Therefore, of the four possible couplings

2 are A || (anti-parallel)

1 is LH

1 is RH

Put another way the photon make-up (spin-wise) of *non* polarized light is

50 % A || (i.e., no spin effect)

25 % LH

25 % RH

Yet at the base (individual quantum) level the spin/anti spin ratio is 50%-50%.

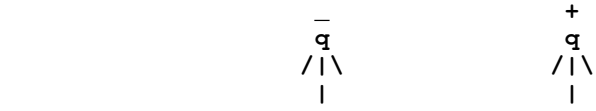
A schematic representation may clarify:

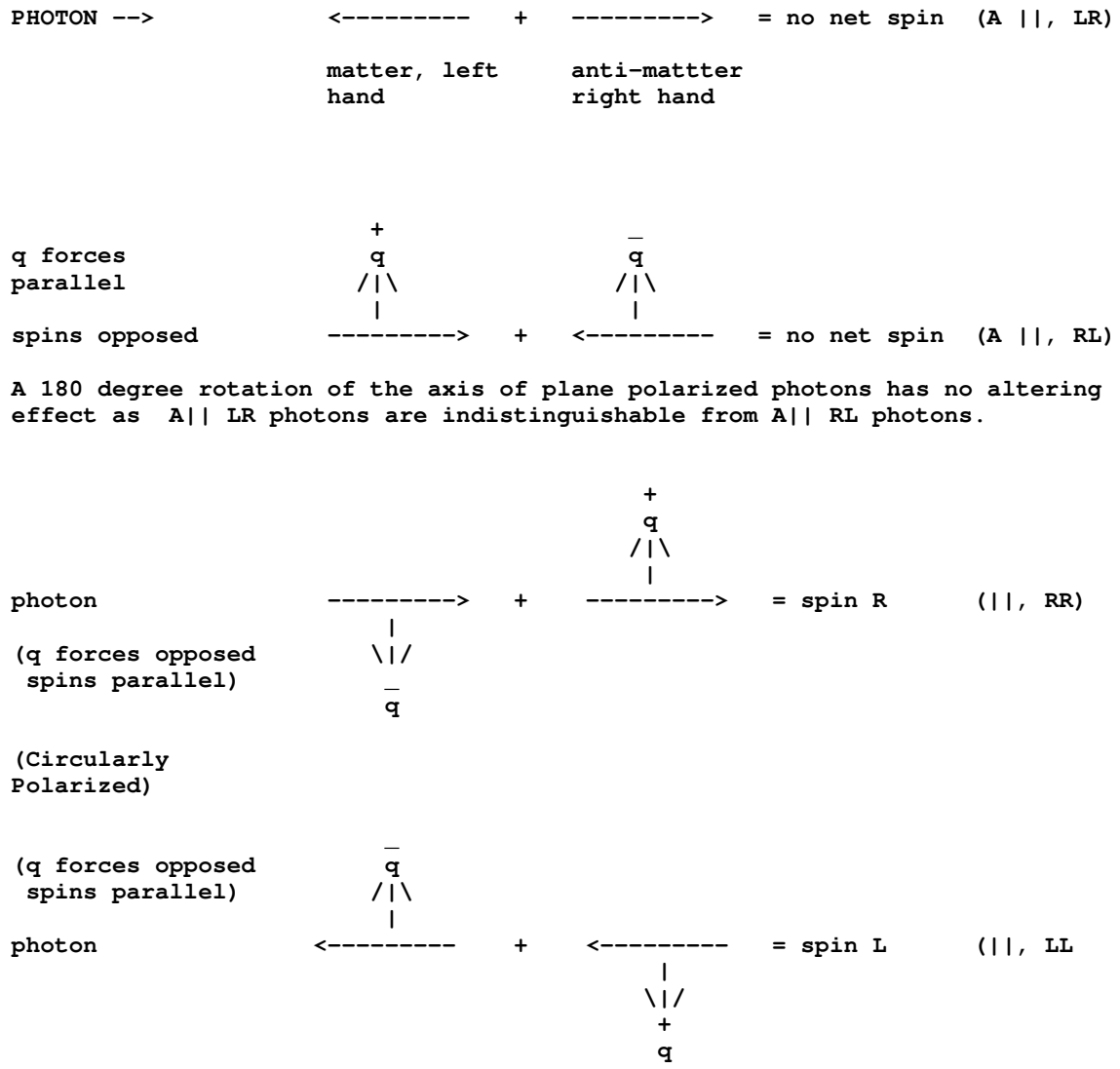
= =

Photons are actually co-spatial but composition is shown separately, i.e., *the two types of quanta (shown horizontally) are contained co-spatially in a single spheroid photon*.

50 % ANTIMATTER, 50% MATTER

PLANE POLARIZED PHOTONS





A 180 degree rotation of the axis of plane polarized photons has no altering effect as A|| LR photons are indistinguishable from A|| RL photons.

Thus, essentially, we have RH photons and LH photons both containing matter and antimatter quanta.

We also have photons of no net spin -- which also consist equally of matter and antimatter.

Rotating the axis of circularly polarized photons converts them from LH spin to RH or vice versa.

In summation, in an unmodified non polarized beam, the mix is 50% A|| (i.e. no spin) 25% L and 25% R spins. Nonetheless, en toto the composition is 50% "matter" quanta and 50% "antimatter" quanta.

= =

The following is an excerpt from "LIGHT" by R.W. Ditchburn, Blackie & Son Ltd. London, p 639. The author is one of the foremest authorities on light.

" ... These results suggest a very simple 'picture' in which photons are of two kinds -- one without spin representing plane polarized light, the other either with right - or left-hand spin representing circularly polarized light."

After a short discussion on the superposition of states, he goes on to say,

"... While the resolution occasions no difficulty in the mathematical formulation of Quantum mechanics, it shows the inadequacy of the simple concept (above). If circularly polarized light 'consists' of particles with spin, it cannot be regarded as a mixture of two sets of particles neither of which have spin. In a similar way, if a photon, corresponding to a plane polarized light is essentially a particle with some axis which defines its plane of polarization, it cannot be regarded as the 'resultant' of two particles which have their axes in different planes. These and many other considerations show that the word picture suggested (above) does not completely correspond with the situation described in the mathematical equations."

* * *

To this author it seems Ditchburn has made an "either/or" assumption. If he were to regard the photon composition given in this text he would have available to him photons consisting *simultaneously* of "... sets of particles neither of which have spin." -- i.e., A|| elements, and "... two particles which have their axes in different planes" -- i.e., ||L and ||R.

The A|| couplings can be considered self-antiparticles whereas the || couplings are each antiparticle to the other. Thus 50% of the photon population is particle/antiparticle and 50% self-antiparticle. The over all effect:

A photon stream contains particle/antiparticle elements and self-antiparticle elements. Either can be revealed by proper influence on the stream.

25% of the elements have spins of one orientation, 25% spins of the opposite orientation, while the balance manifest no spin, i.e., there are spins equally of + and - h/4 pi. Combined, they produce zero spin.

However, when compressed into a concentric matter configuration, the result is 1/2 matter, 1/2 antimatter because the self-antiparticle elements are composed of both matter and antimatter.

The thesis displayed above is reinforced by experiment using circularly polarized light where the angular momentum of the photon was transferred to a suspended half-wave plate and the motion measured.*

That the photon contains equal quantities of matter/antimatter quanta is irrefutably evidenced by such phenomena as pair production.

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* LIGHT, R. W. Ditchburn, Blackie & Son Ltd., London. p 561.

Experiment reference: GEIGER & BOTHE : Z. PHYSIK, 1925, B.D. 32, p 639.

MINIMUM MOMENTA

As a matter of corroboration, we develop another approach to spin angular

momentum, showing the results to be identical.

Just as there are two approaches to force ($F = m a$ and $F = \frac{\Delta P}{\Delta t}$)

we perceive two approaches to angular (/_) momentum -- spin and orbital.

A particle with a linear momentum vector $\vec{P}$ orthogonal to a point A at a

distance d has an angular orbital momentum vector $\vec{J}$ about the point A

Eq.(11)

given by

$$\vec{J} = \vec{P}\, d$$

==========

For use below: (in angular motion of a sphere)

/_ m is the center of mass for a *rotating* sphere = 2/5 m

"I" is mass moment = /_ m * r^2

"W" is angular velocity in n theta/sec. theta = $\frac{10}{4\pi}$ radian.

V_1 = orbital velocity = theta * r_q/sec = k for all particles.

$\vec{P}$ = *linear* momentum vector of rotating center of mass = /_ m * $\vec{V}_1$

d = r

==========

Considering any rotating particle, we regard 2/5 m as a *point mass*
(/_ m) located at the *effective* equator. Then /_ m * V-1 = $\vec{P}$ and
$\vec{P}$ * d = orbital angular momentum (where d = effective radius 1/2 LS/n).

By writing Eq.11 in the form

$$\vec{J} = [2/5\ (n\ m_q)\ V_1\ ]\ \frac{1/2\ LS}{n},$$

we see it holds for all particles as n cancels. Further, we see it can be written for one quantum:

$$\vec{J} = /\_\ m_q \quad V_1 \times r_q = \vec{P}\, d$$

Comparing the equations for $\vec{J}$ and (IW) in the primary (single quantum)

form -- good for all particles -- we have

$$\vec{J} = \vec{P}\, d$$

$$/\!\_\, m_q \; V_1 \qquad r_q$$

$$(IW) = I \qquad W$$

$$/\!\_\, m_q \; r_q^2 \qquad \text{theta/sec}$$

Since all parameters are constants $\vec{J} = (IW)$

That the parameters utilized produce consistent results tends to substantiate the correctness of the effective surface concept (with its effective radius) and the equatorial velocity as given.

SOME INTERESTING RELATIONSHIPS

We note that for the individual quantum, the linear momentum *component* is $\vec{P}$.

This is the *minimum linear component* of angular momentum and is less than P_1. In short there are two absolute minimum linear momenta. One is linear momentum (m_q c) and the other is a linear momentum *component* (/_ m V_1) of angular momentum.

Some interesting relationships follow:

[where $\vec{P}_1$ = absolute minimum angular momentum *component*, a vector therefore linear.]

[a] $$\frac{P_1}{\vec{P}_1} = 2\pi$$

[b] $$\frac{IW}{\vec{P}_1} = r_q$$

[c] $$\frac{h}{P_1} = 1 \text{ LS}$$

[d] $$\frac{h \text{ bar}}{\vec{P}_1} = 1 \text{ LS}$$

In variation we note:

for [a] $\vec{P}_1 \; 2\pi = P_1$ minimum linear momentum

[b] $\vec{P}_1 \; r_q = IW$ minimum angular momentum

[c] $P_1 \; 1 LS = h$ minimum linear unit of action

[d] $\vec{P}_1 \; 1 LS = h\ bar$ minimum angular unit of action

In another view h divided by 2 pi, i.e., one revolution in radians, or an angular frequency of one gives us

$$\frac{h}{2\pi} = h\ bar \quad \text{and} \quad \frac{P_1}{2\pi} = \vec{P}_1$$

By way of analysis we perceive the physical *meanings* of these equations on the basis of the *individual quantum* but good for all particles:

[a] Minimum angular momentum *component* for one revolution expressed as 2 pi radians is equal to the minimum linear momentum ($m_q c$).

$$\vec{P}_1 \, 2\pi = P_1$$

[b] Minimum angular momentum *component* traversing an orbital arc equal to the radius of the quantum produces the angular momentum of the quantum (where $\wedge t = 1$ sec).

The multiplicand, r_q, is *not* the radius. In angular notation one radian is subtended by an *arc* equal in length to the radius. In this case r_q refers to the length of the arc. Thus

$$\vec{P}_1 \, r_q = IW$$

Š[c] The minimum *linear* momentum applied across the diameter of the quantum is the minimum unit of action

$$P_1 \, LS = h$$

[d] The minimum angular momentum *component* applied across the diameter of the quantum yields h bar or h/2 pi. (h bar thru one revolution = h.)

$$\vec{P}_1 \, LS = h\ bar$$

The minimum angular momentum *component* applied through a circumference with a radius of 1/2 light second (r_q) produces h/2.

$$\rightarrow \quad P_1 \pi 2r_q = h/2$$

The same applied for *two* revolutions produces one h.

The equation may be rewritten

Eq. [e]

$$\rightarrow \quad P_1 r_q 4\pi = h$$

which is the same as IW 4pi = h

A disturbing question arises: Why does it require *two* revolutions of the minimum angular momentum component to produce *one* h? Intuitively, it should be *one* revolution. (This is one example that we do not abandon intuition but examine more closely instead.)

The answer:

First we note that h is linear, i.e., h = P d = P_1 LS (for the individual quantum as an example).

Next we note that our question posed is angular. So we seek to transpose the linear to angular.

$\rightarrow$

Although P_1 is the angular momentum *component* it nonetheless is linear and we see that it is less than P_1 by a factor of .1591549 (or the reciprocal of |2 pi|). Thus (to attain h) it will have to travel 1/.591549 or 6.283185 as far as P_1 -- but along the *circumference* rather than the diameter.

$\rightarrow$

Note:- P_1 and P_1 ARE LINEAR, 2 pi BEING MERELY THE RATIO OF MINIMUM LINEAR MOMENTUM TO THE MINIMUM LINEAR MOMENTUM *COMPONENT* OF ANGULAR MOMENTUM.

$\rightarrow$

Succinctly, $P_1 \times |2\pi| = P_1$

and $P_1 \times LS = h$

$\rightarrow$

So we write $h = P_1 |2\pi| LS$

Substitute: $LS = 2r_q$

$\rightarrow$

then $h = P_1 |2\pi| 2r_q$

$\rightarrow$

which we write h = P_1 |4pi| r_q

This is Eq. [e] that led us to ask the question.

Mathematics -- even simple mathematics -- can be misleading.
The 4 pi was always assumed as rotational but here we see the |2pi| as merely the ratio of two linear parameters -- and the other 2 being the number of radii in a diameter.

ALL THIS IS SO IF WE REGARD h AS A LINEAR QUANTITY WHICH , IN THE MAIN, IS WHAT WE DO.

HOWEVER, IF WE WISH TO REGARD h IN AN ANGULAR MODE (WHICH "ANGULAR MOMENTUM *COMPONENT*" INDICATED WE ARE DOING, THEN WE TAKE ANOTHER VIEW:

-->
We take P_1 x r_q = IW (angular momentum)

and IW x 4pi (two revolutions) = h.

If we wanted to be picky, we could call this "angular h" (versus "linear h").

If we recognize angular h as a different genre than the linear h then we no longer intuitively desire h to be one revolution.

Apparently, here, we have
ascertained a distinction, angular h and linear h.
LINEAR AND ROTATIONAL ANALOGS

As quanta agglomerate and their *effective* radii become smaller there is an increase in angular velocity. We note two things: (1) The increments in velocity are due to the conservation of momentum -- *not* to an applied force, and (2) the increments are discontinuous, in quantized steps. Each quantum joining the agglomeration adds one step, viz., n is given in whole numbers and therefore n theta/sec is incremental.

We observe the following relations to be the rotational analogs of linear parameters. They are minimals, i.e., d = theta.

(where "cor" = corresponds to ...)

d cor theta = .7957747 radian or 10/ 4 pi radian.

$$v \text{ cor } W_q = \frac{\text{theta}}{\text{sec}} = .7957747 \frac{\text{rad}}{\text{sec}}$$

m cor I = 2/5 m_q r_q^2 = |h|/10 gr cm_^2

$$a = \text{acceleration} = \frac{\text{theta}}{\text{sec}^2} \quad \text{(pseudo)}$$

P cor [IW]_q = I theta/sec = 5.272533 x 10^-28 gr cm/sec or h/4 pi radians

$$F = \frac{/\backslash P}{/\backslash t} \text{ dyne cm cor } L \ . \qquad \frac{/\backslash \text{ I theta/sec}}{\text{sec}} = L_1 = I \frac{\text{theta}}{\text{sec}^2} \quad \text{(pseudo a)}$$

$$E_k = mc^2 \text{ cor } \angle E_{k_q} = I \left|\frac{\theta}{\text{sec}}\right|^2 = 4.195748 \times 10^{-28} \text{ erg}$$

There is no divisor, 2, because there is no acceleration. The situation is analogous to that of light and mass-to-energy conversion, i.e., mc^2. (One might say "the velocity already exists, i.e., was never generated from zero.")

$$E_k = (Fd) = \frac{/\backslash P}{/\backslash t} d \text{ cor } \angle E_{k_q} = L_1 \theta = 4.195748 \times 10^{-28}$$

$$h = (Pd) \text{ cor } \angle I \frac{\theta}{\text{sec}} \theta = \angle h = \angle E_{k_q} \sec = \frac{h}{4\pi} \theta =$$

4.195748 x 10^-28 madt

Note:- This is the angular *analog* of h -- not the angularly generated h.

We now extend the rotation from theta to one full rotation, i.e., d = 2 pi rad.

$$E_k = (Fd) \text{ cor } \frac{/\backslash I \text{ theta/sec}}{\text{sec}} 2\pi \text{ rad} = \frac{1}{2} h_0 \quad \text{(two rotations = } h_0\text{)}$$

$$h = (Pd) \text{ cor } \angle h = \frac{I \text{ theta/s}}{\text{sec}} 2\pi = \frac{1}{2} h \quad \text{(two rotations = h)}$$

$$\text{Of interest: } \frac{10 \text{ rad}}{4\pi \text{ rad}} = \theta. \quad \text{Also } \frac{|h|}{10} = I, \frac{|h|}{10} \frac{\theta^2}{\text{sec}} = \angle E_{k_q}$$

$$\text{and } \frac{2}{5} \pi \theta = 1 \text{ rad} \;.\;. \; \pi = \frac{5 \text{ rad}}{2\theta} \text{ and } \pi\theta = 5 \text{ rad}/2$$

In addition we note there is no innate or universal relation between momentum and kinetic energy except that it is the cross product of momentum and velocity in a general way with specificity by application.

Some Examples

Radiation: $P c = E_k$

Elastic-inelastic (Compton) collision: $(Pe' + 2 P_{ph}') c = E_k$

Linear mechanical: (Newtonian) $P v/2 = E_k$

Relativistic: $P = \gamma m v$ and $P \frac{v}{\text{-----}} c^2 = E_k$

1 + R

Note:- The last equation is both Newtonian and relativistic -- as is Einstein's $E_k = (\text{gamma} - 1)m c^2$. Both will, *at very low velocities*, yield quantities extremely close to the Newtonian. However, at appreciable velocities Einstein's equation yields $n mc^2$ whereas the author's equation yields $nv^2 mc^2$.

* * *

In the first graphic display we observed the relationship between the angular parameters (IW and mu_B) and the linear parameters (p and q) to be 5.179287 x 10^10. We find a pursuit of these relationships to be of interest.

Utilizing the cross products of proportions we have

$$(IW)\ \left|\ \frac{\bar{q}}{mu\ B}\ \right| = P_e \qquad \text{and} \qquad mu\ B\ \left|\ \frac{P_e}{IW}\ \right| = \bar{q}$$

We now state the bracketed ratios *in terms of their physical constants* --

For (IW) Eq. (10g) is used: $IW = 2/5\ m_q\ r_q^2\ \frac{\text{theta}}{\text{sec}}$.

Also P_e is written m_e c, but we keep in mind m_e/ m_q = n, c = LS/sec and

$r_q^2 = (LS/2)^2$.

We note the bracketed terms are conversion factors converting the angular momentum to linear momentum and the magnetic force (curvilinear) to electric force (linear) and -- and that these factors are equal.
(See SPIN, CHARGE AND MAGNETIC MOMENT)

The first factor reduces to $\frac{4\ pi\ mc}{h}$, where m = m_e and n = n_e or m_e/m_q

the second to $\frac{10\ n}{LS\ theta}$

$$\frac{10\ n}{LS\ theta} = \frac{4\ pi\ mc}{h}$$

cross multiplying, $10\ nh = 4\ pi\ mc\ LS\ theta$

thus $nh = mc\ LS$

(as 4 pi theta = 10)

$$\text{or} \qquad h = \frac{mc\ LS}{n} = \frac{n\ m_q\ c\ LS}{n} = m_q\ c\ LS = P_1\ LS$$

Thus, by the first equality, we see h is the momentum of the electron across its diameter (LS/n) by the third equality, it is the momentum of one quantum across its diameter -- and by the final equality, h is the primary (absolute minimum) momentum across 1 LS,.

This is true for all particles and the photon, for the general equation is

$$P * diam = P * d = n\ m_q\ c * LS/n = P_1 * LS = h$$

"n" (which cancels) means it holds for *all* particles, P_1 and LS are constants.

The same result is obtained from

(in this case IW is written h/4 pi)

$$\left(\frac{\bar{q}}{P_e} \quad " \quad " \quad \frac{\bar{q}}{h/D_e} \right)$$

In this case the brackets contain the relationship between the forces and their respective momenta. (curvilinear to curvilinear -- and linear to linear)

$$\mu_B \left| \frac{P_e}{\bar{q}} \right| = IW \qquad \text{and} \qquad \bar{q} \left| \frac{IW}{\mu_B} \right| = P_e$$

(where $D_e = LS/n$) (where $\mu_B = \frac{h\bar{q}}{4 \pi mc}$)

Reducing the factors,

$$\text{the first factor} = \frac{n\ h}{LS\ \bar{q}} \qquad \text{and the second factor} = \frac{mc}{\bar{q}}$$

$$\text{Since these factors are equal} \qquad n\ h = \frac{LS\ \bar{q}\ mc}{\bar{q}} = LS\ mc$$

and since m = n m_q, we have n h = LS n m_q c

$$\text{or} \qquad h = LS\ m_q\ c = LS\ P_1$$

Also we can write the above equation as

$$n\ h\ \bar{q} = LS\ \bar{q}\ m$$

$$\text{therefore,} \qquad h = \frac{LS\,\bar{q}\,m\,c}{n\,\bar{q}} = D_e\,m\,c = D_e\,P_e$$

$$(LS/n = D_e)$$

Thus h = the momentum of a particle across its diameter.

THE ELECTRON

Given the mass of the electron (m_e) as 9.108953 x 10^-28 gr'

$\frac{m_e}{m_q} = n_e$, the number of quanta in an electron.

As each quantum creates a pulse, n_e cor to freq. $nu_e = 1.235608 \times 10^{20}$.

$$\text{Thus} \quad \frac{n_q E_q}{h} = \frac{(n_e m_q)c^2}{h} = \frac{m_e c^2}{h} = \frac{E_i}{h} = \frac{n_e}{\text{sec}} = nu_e$$

(where E_i = rest or internal energy)

Since the mass of the free electron is $n_e m_q$, the momentum is

$P = (n_e\ m_q)\ \text{gamma}\ v$. (where v = velocity)

The effective diameter of the electron is

$$D_e = \frac{1\ LS}{n_e} \quad \text{or} \quad \frac{1\ LS\ m_q}{m_e} = 2.426275 \times 10^{-10}\ \text{cm.}$$

EMPIRICAL VERIFICATION

In the concentric mode the electron oscillating quanta are analogous to an oscillating electromagnetic cavity the *resonance radius* of which is given as

$$a = \frac{2.41\ c}{2\ pi\ nu}$$

Following are two results for calculating the radius of the electron. The first (r) is by the present theory, the second (a) is by utilizing the resonance cavity expression above.

$$r = \frac{1}{2}\frac{LS}{n} = 1.213137 \times 10^{-10} \text{ cm}$$

$$a = 9.306301 \times 10^{-11} \text{ cm}$$

Acceptably close.

The same comparative relationship holds for the proton and neutron (and photon).

The closeness of the results are reassuring. What is most certainly ascertained here is that the electron of radius r does oscillate in resonance as does the proton and neutron. What is not ascertained is whether there is an exclusiveness or uniqueness to these radii, or whether resonance is available to particles of any other size. In this respect, more consideration must be given to the standing group wave aspect of particle pulsation and its relationship to resonance.

Ideally, it should be found that in the concentric pulsating expansion/contraction wave mode there are only two numerical configurations that establish a stable resonating standing group wave. These would be n = 1.235608 x 10^20 of the electron and n = 2.268909 x 10^23 of the proton, the only stable and therefore only true particles in the universe (the neutron being a composite of the two).

The photon, though stable, should not be considered a true particle as it is essentially a sequential group wave having radiation characteristics following the Bose-Einstein statistics, whereas the electron and the proton follow the Pauli exclusion principle.

In fact since particles and photons are both comprised of quanta we are justified in proclaiming that there exists in nature *two forms* of matter -- *ponderous* and *radiant*.("Plasma" may possibly be considered a third state of matter. There is also the question as to whether the interior of stars may not be considered plasma.)

There is a precedence in ponderous matter for this classification of states, namely, "solid", "liquid", and "vapor". The molecule H_2O exists as the constituent of all three states. This is analogous to the quantum being the constituent of ponderous matter and radiation.

THE PROTON

Given the mass of the proton (m_p) as 1.6726485 x 10^-24 gr, then

$$\frac{m_p}{m_q} = n_p = 2.268909 \times 10^{23}$$

$$n_p \text{ cor nu} = \frac{m_p c^2}{h} = \frac{(n_p m_q)c^2}{h} = \frac{n_p(m_q c^2)}{h} = \frac{n_p h_0}{h} = \frac{n_p}{t} = \frac{n_p}{sec}$$

= 2.268909 x 10^ 23/sec

INTERNAL (REST) ENERGY

$$E_i = n_p h_0 = n_p(m_q c^2) = (n_p m_q)c^2 = m_p c^2$$

$$= h \nu_p = 1.503302 \times 10{-}3 \text{ erg}$$

(These are of the form n h_0, m c^2, and h nu)

DIAMETER

$$\frac{LS}{n_p} = 1.321307 \times 10{-}13 \text{ cm}$$

RADIUS $r = 6.606535 \times 10^{-}14$ cm

RESONANCE CAVITY RADIUS $a = 5.068050 \times 10^{-}14$ cm

THE NEUTRON

We may think of the neutron as a hybrid composed of a proton and and an electron plus approximately one and one-half electron mass of quanta as a binding force. Although this view has been discarded it is the author's belief there is such verification herein that the structure should be reinstated.

We note that in the free state the neutron is unstable and has a half-life of 12.8 minutes. Located in the nucleus, in combination with protons, the stability is permanent -- except in heavy nuclei where there is a surplus of neutrons. There the neutron's tendency to decay begins to assert itself and "radioactive" decay takes place, although we do note the products and half-lives are different.

Given the mass of the neutron as 1.6749543 x 10^-24 gr we may write

$$\frac{m_N}{m_q} = n_N = 2.272037 \times 10^{23}$$

(cor = corresponds to)

$$n_N \text{ cor } \nu = \frac{m_N c^2}{\text{-------}} = \frac{(n_N m_q)c^2}{\text{----------}} = \frac{n_N h_0}{\text{--------}} = \frac{n_N}{\text{----}} = \frac{n_N}{\text{---}}$$

$$\frac{h}{t} \cdot \frac{h}{sec} \cdot \frac{h}{}$$

$$= 2.272037 \times 10^{23}/sec$$

INTERNAL (REST) ENERGY

$$E_i = n_N h_0 = n_N(m_q c^2) = (n_N m_q)c^2 = m_N c^2$$

$$= h \nu_N = 1.505375 \times 10^{-3} \text{ erg}$$

(These are of the form $n h_0$, $m c^2$, and $h \nu$)

DIAMETER

$$\frac{LS}{n_N} = 1.319488 \times 10^{-13} \text{ cm}$$

$$r = 6.597440 \times 10^{-14} \text{ cm}$$

$$a = 5.061073 \times 10^{-14} \text{ cm}$$

NEUTRON DECAY

We determine the difference in mass between the neutron and proton to be

$$m_N - m_p = 2.305800 \times 10^{-27} \text{ gr} .$$

When a neutron decays by emitting an electron and antineutrino it becomes a proton concurrently emitting the 2.3058×10^{-27} gr.

Of this 9.108953×10^{-28} gr is the electron, leaving a balance of 1.394905×10^{-27} gr, or approximately 1.5 electron mass to comprise the antineutrino.

The rest energy (internal energy) of the antineutrino is

$$mc^2 = nm_q c^2 = nh_0 = 1.253678 \times 10^{-6} \text{ erg} = .783 \text{ MeV}.$$

This is the theoretical energy of beta decay.

We represent the decay thus:

$$N \rightarrow p^+ + e^- + 1.5 \text{ electron mass}$$

The 1.5 electron mass does not create a particle because it is non-coherent

being the manifestation of the binding energy. Part of this energy (and mass) is released as the energy accelerating the proton and electron, the rest forms a quasi particle consisting of quanta traveling through space *clustered* in close proximity. This "particle" is known as the antineutrino.

The "size" of the antineutrino is in question (but may be deduced) because the .783 MeV is utilized in accelerating the proton, electron, and the antineutrino itself. Knowing the energy of the proton and electron establishes the energy of the antineutrino. The velocity must be that of light or nearly so. The antineutrino is not mass-less. The energy not utilized by the electron and proton divided by c^2 should be the mass.

As individual quanta the constituents of the neutrino/antineutrino possess spatial orientation in many directions. This nullifies the electric and magnetic moment. The intrinsic spin, however, persists and serves to conserve the whole.

charge	+ -		+		-	0
	N	-->	p	+ e	+	q
spin	1/2		1/2	1/2		1/2

To whatever extent neutrinos permeate the cosmos, they are a factor in the total mass (or mass density in a steady state universe of unknown boundaries).

As a result of the above description of beta decay, we perceive the neutron *not* to be a true elementary particle but a composite of a proton and an electron. Thus the neutron is electrically neutral because it contains both charges.

This concept of the neutron is further enhanced by noting that the *free* neutron is unstable, which in turn suggests there are certain interactions within the atomic nuclei that keep nucleonic neutrinos stable.

An attractive hypothesis would be that the pre-neutrino not only binds the electron and the proton to form the neutron but in the atomic nucleus is at least a part of the binding process of protons to neutrons which varies the neucleonic forces thus resulting in isotopes and radioactive decay. It is noted that in a general way the larger the proportions of neutrons in the nuclei, the greater the instability, viz., nuclei with an excess of neutrons have a problem similar to that of the individual neutron, stability. This interrelation of forces might also explain the excess of nucleonic neutrons per se, which raises a question, why are there not an exact equal quantity of protons and neutrons in atomic nuclei?

In furtherance of this concept of the neutron we take a closer look which will display a slightly different and more accurate picture.

Bombarding beryllium-9 with high energy photons yields beryllium-8 plus a neutron. In other words adding the high energy photon to a proton creates a neutron.

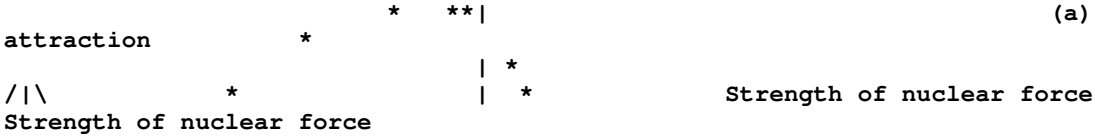
Thus we perceive a photon -- consisting of one-half RH spin and one-half LH spin -- entering a proton of RH spin, the RH quanta of the photon being added to the proton.

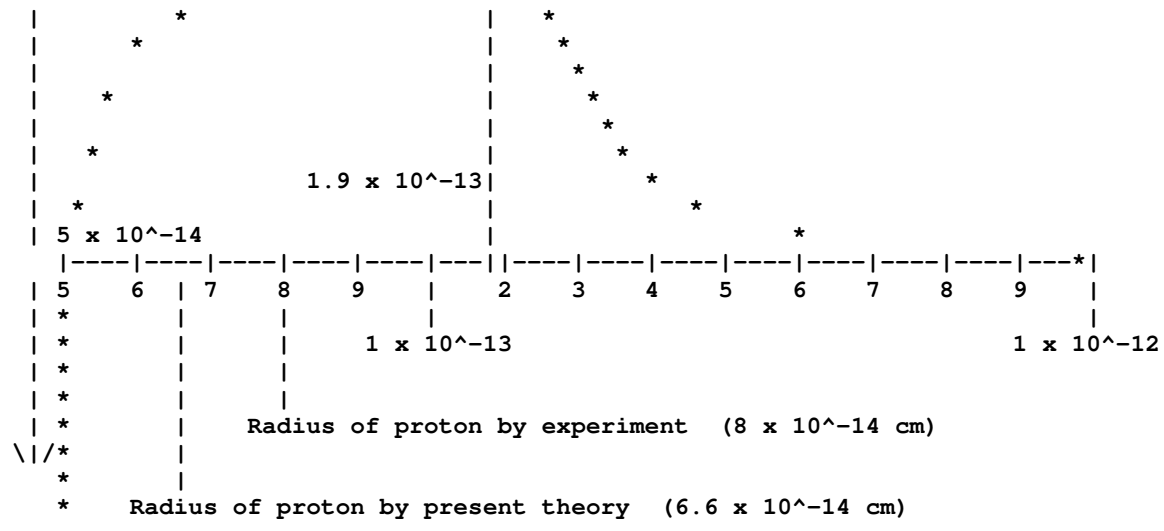
The LH quanta become essentially an electron the core of which is in close

proximity to the core of the proton but encasing it due to the electron's larger radius and maintaining the close proximity by virtue of the merger attraction displayed earlier. The Zone 1 region is predominant and the attraction strong. While in this state the particle is known as a neutron for the electric moments are opposite and thus canceled.

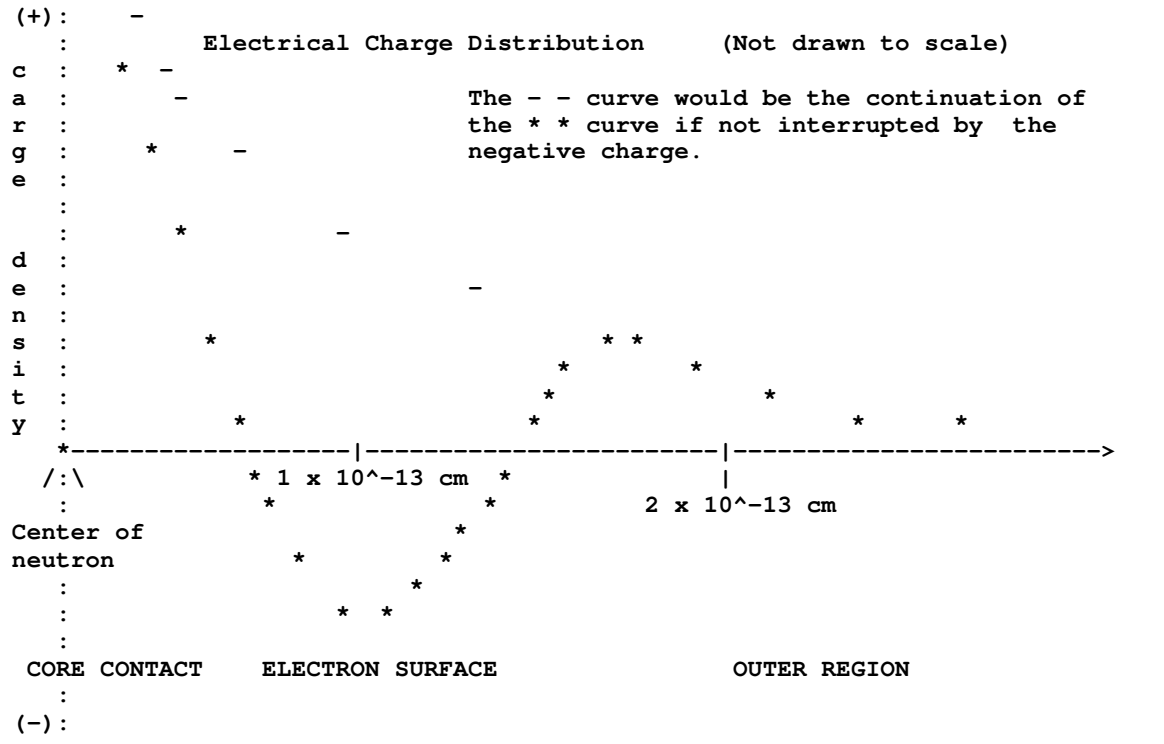
However, other than the attractive force there are other forces at work, one is the Pauli exclusion principle where the proton density is overburdened by the presence of the additional RH quanta. In addition the proton core and the electron core are in close proximity in a union that is mostly Zone 2. Within that zone the repulsive force comes into play, therefore the LH quanta of the photon/electron are ejected also to become an electron and a constituent of the antineutrino.
The RH quanta overpopulating the proton are also ejected as a constituent of the antineutrino.
Let us now visualize the dimensions of the neutron. Recalling the curve for the strong force we consider in conjunction with it the curve for the electrical charge distribution of the neutrino.

(See next page)





(b)



Source of (b): THE PHYSICAL SCIENCES: A CONTEMPORARY APPROACH, Edward F. Neuzel, Bogden & Quigley, N.Y., 1972, p 199

The data displayed confirms in dimensional form the hypothesis of the neutron structure.

The effective neutron radius is LS/2n_N = 6.6 x 10^-14 cm. We now seek the effective radius of the "encasing electron" , i.e., the concentric LH quanta before emission. To do this we refer to the above curves (a and b) and note on curve (a) that, as determined earlier, the nuclear force dramatically becomes negatively asymptotic just below 10^-13 cm indicating that this is

the surface *region* of the nucleon, the *region* of nucleonic contact. Just above 10^-13 cm we perceive the nuclear force at its maximum -- and at 10^-13 it changes from the positive direction to negative. Thus 10^-13 is a critical region.

Observing curve (b) we see that this same region is the location of the maximum *negative* charge surrounding the core. In short, the regions of the proton "surface" and the encasing electron coincide.

We also note from curve (b) that there is a *positive* electric moment above the negative, i.e., outward.

Bearing in mind that our composite particle has an actual diameter of one light second we form the following picture:

Commencing from the outer extremity (1/2 LS) we experience a charge-neutral zone. As we approach the core of the neutron we register the positive (RH) quanta which far outnumber the LH by a ratio greater than 1836 to 1. As we reach 2 x 10^-13 cm [curve (b)] the positive charge commences to accelerate its increase. At approximately 1.36 x 10^-13 cm the curve is downward, *changing from positive to negative*. That means we have encountered the electron casing. We see on curve (a) that this is the same locale as the change in the nucleonic force from the positive direction to the negative. Thus we deduce that the negative (LH)quanta have their essential location, i.e., essential radius at 10^-13 cm from the center. In other words the essential radius of the electron envelope surrounds -- almost touching -- the essential surface of the proton at 6.6 x 10^-14 cm.

Normally the essential surface of the electron would be 1.2 x 10^-10 cm, a difference by a factor of approximately 1,200. Thus the electron core can be considered buried quite deeply within the proton and this would explain the violent ejection which prevents the electron from orbiting the proton and forming a hydrogen atom.

We note on curve (b) that after inwardly passing the negative (electron) shell at 10^-13 cm the curve rises rapidly toward the positive indicating we are entering the proton core. Concurrently, at that same location on curve (a), the strong force is nullified and the (+) repulsion force becomes asymptotic -- again indicating we are entering the proton core.

In short, by overview, we see that approaching from the extremity of what is essentially a proton the positive charge commences to rise but is interrupted by the negative (electron) envelope and then commences to rise once again, rapidly, as we enter the interior of the proton core.

In confirmation we note that the magnetic moment of the neutron is given as -1.9135 mu_n (nuclear magnaton). The negative sign refers to the condition of the angular momentum *vector* being in the *opposite direction* of the magnetic moment. We note the electron envelope spins in the *opposite direction* of the proton. This apparently accounts for the phenomenon.

NEUTRON DENSITY

The neutron density is confirmed by estimates of the density of neutron stars.

$$\text{Neutron density} = n^4 D_1 = \left| \frac{m_N}{m_q} \right|^4 \quad D_1 = 1.392477 \times 10^{15} \text{ gr/cc.}$$

$$D_1 \text{ (primary density)} = \frac{m_q}{4\backslash 3\ \pi\ r_q^3} = 5.225484 \times 10^{-79} \text{ gr/cc}$$

$(r_q = 1/2\ LS)$

UNCERTAINTY

We now examine the Heisenberg uncertainty relations.

$$/\backslash x \ . \ /\backslash P_x > = h$$

$$/\backslash y \ . \ /\backslash P_y > = h$$

$$/\backslash z \ . \ /\backslash P_z > = h$$

$$/\backslash t \ . \ /\backslash W > = h$$

We analyze the first expression (which applies to the others as well):

The cross product of /\ x and /\ P_x is *equal to* or greater than h.

We assume the *minimum* condition as "equal to" h.

We then set /\ P_x to the absolute minimum, P_1. In that case m = m_q and /\ x = 1 LS.

Therefore, *as a minimum*, we have 1 LS * m_q c = h.

Thus we have the momentum (m_q c) of *one* quantum across the diameter (1 LS) equal to h.

We have seen this elsewhere. It holds here as further verification of the physical quantum concept.

The same holds true for /\ y and /\ z as the quantum is spherical.

Let us consider the last expression, where /\ W = kinetic energy.

$$/\backslash W_{min} = \frac{h}{/\backslash t}$$

As the maximum diameter of one quantum is 1 LS, it will require one second for transit. (velocity of free quanta is c)

Therefore, we have

$$/\backslash W_{min} = \frac{6.625661 \times 10^{-27}}{1 \text{ sec}} = h_0$$

Thus the minimum kinetic energy is h_0. The present theory gives the kinetic energy of one quantum as $m_q c^2$ which is 6.62566×10^{-27} erg or h_0.

The expression states the cross products are equal to or greater than h. We assumed the minimals as equal to h. If we assume other than that it is evident from other experiences that only multiples of h can occur.

It is readily conceivable that if the entities measured are small enough it is the act of measuring that introduces the uncertainty. Therefore, we conclude that uncertainty is not an intrinsic or inherent characteristic of the universe -- and that we should consequently dispense with all the flights of fancy that have resulted from this assumption.

THE HEISENBERG PHOTON

A photon is composed of an aggregate of n quanta, the effective diameter (wavelength)

$$\text{of which is } \frac{1 \text{ LS}}{n} .$$

Since photons are linearly grouped quanta and always in motion they have no *exact* location, their best approximated locations being the clustered quanta cores.

Therefore, the /\ x, /\ y, /\ z of Heisenberg is the *effective* size of the aggregate. That is to say whereas the individual quantum has a diameter of 1 LS , an aggregate of quanta has a very small core the density of which creates an effective diameter of 1LS/n. However, the group as a whole attenuates outward to a one light second diameter. The effective diameter is the wavelength which can be written

$$\lambda = \frac{\text{LS}}{n}$$

Dividing both parameters by one second

$$\lambda = \frac{\frac{\text{LS}}{\text{sec}}}{n} = \frac{c}{\nu}$$

$$\frac{\text{----}}{\text{sec}}$$

Thus we have an extremely mobile entity which is essentially a group wave embodying measurable mass as well as measurable electromagnetic characteristics requiring two distinct type of detectors (material and electromagnetic) and having no clearly discernable boundaries.

THE HEISENBERG PHOTON/PARTICLE TRANSITION

The photon conditions continue into the realm of particles -- but with modifications.

- **(a) The linear wave pattern is exchanged for an oscillating, concentric standing group wave having resonance.**
- **(b) The group wave core becomes more definite as n increases.**
- **(c) Also, as n increases the mass characteristics become more predominant, and Newtonian/Galilean mechanics begins to emerge.**
- **(d) The 90 degree orientation and balanced coexistence of electric and magnetic manifestations that existed in photons is altered, manifesting as electric charge and magnetic torque or moment -- still orthogonal one to the other.**
- **(e) Spin is also separated. Whereas photons tolerate right and left hand spin quanta, in the condensed concentric mode of particles, reverse spins become mutually exclusive as matter and antimatter.**

In regard to (e) we see this phenomenon manifest in pair production where a photon of sufficient mass (energy) is converted to an electron and a positron.

There is no experiment known to this author where a circularly polarized high energy photon of *singular spin* is used to attempt pair production. The result should be two electrons or two positrons depending on which photon is used, i.e., RR or LL.

MATHEMATICAL AGENDA

An area to be more exactly defined (mathematically) is the wave composition of the photon as a secondary wave in a standing group wave.

Another, and most essential requirement, is a showing of the wave mechanics of the electron and proton. The question to be answered is, why are there two -- and only two -- quantities of concentric oscillating quanta that are stable? As a corollary, we ask what is the nature of this stability? How does a set of free standing concentric oscillating waves set up a resonance where there is apparently nothing with which to be in resonance?

One supposition might be that in order to have a resonance there must be two boundaries. In the instance of a tube and driven air column there is the open end of the tube and its closed end. Analogously, in the case of the particle it would be the outer limit of expansion and the inner limit of the

repulsing density of the core.

There should be a showing that quantities of quanta other than the stable two exist briefly in a semi resonant state (exhibiting charge, spin, etc.) quickly attaining a resonant state of a lesser configuration. Thus we experience the phenomenon of "elementary " particles and their "decay" to stable particles, electron, proton, photon, and nuclei neutrons.

And as a cap to these questions: What is the wave nature of the proton electron union forming the neutron -- and the mechanics of the interaction between that union and the other protons and neutrons in the nucleus?

There remains much to be done.

GRAVITY

We are faced with the question, what is the mechanics of action at a distance? In other words if space is truly empty, how can one body exert a force on another - especially at great distances?

The standard model proposes "virtual" particles which, in the case of gravity is given a name (graviton) and not much more. In the case of the electromagnetic force the virtual particle is the photon, for the strong force it's the pi meson.

The present theory has a different view. The electromagnetic force is a symbiotic one consisting of two components, electric force and magnetic force.

It is the negative electric force that binds the electrons to the positive nucleus and the positive electric force that repels the nucleons from each other.

If we were to peer at an electron or proton from the *polar* perspective, we would see the inner core quanta rotating faster than the outer. These same rotating core quanta are sequentially expanding and contracting, supplying two forces -- a magnetic force sweeping circularly and transverse to the polar axis, and an electric force parallel to the polar axis.

Peering at a particle from the equatorial view one would perceive the equatorial "wind" and as one came closer to the core they would also perceive the circular velocity as being constant, though increasingly dense. This is the magnetic force -- and much weaker than the electric.

The electron and proton having opposite charges attract, drawing their nuclei into close proximity where the polar electric forces cancel each other leaving the composite atom neutral charge-wise and dynamically stable. In conjunction with these two forces is the merger dynamics illustrated above.

Two protons or two electrons having parallel spins the merger dynamics repels, the like polar electric forces also repel maintaining their identity, i.e., the composite maintains its negative or positive electric charge.

We here discuss the gravity force. It will be found to be related to the strong force inasmuch as the vortex force of fermions comes into play. There is a major difference. Whereas in the case of the strong force the vortex force draws in whole particles, in the case of gravity it draws individual quanta. But we are getting ahead of ourselves.

*** * ***

consider the hypothesis that not all quanta in a material body are confined, and that some escape to be free, radiating outward in all directions at the speed of light.

We may consider this as analogous to the sublimation of solids such as ice.

It is yet to be determined whether this process is affected quantitatively by extremes of temperature. Beyond that we may assume that all matter, regardless of physical or chemical composition, emanates individual quanta at the same rate, viz., the emanation is a function of fermion particles regardless of how they are grouped. Further, the rate of emanation as a certain percentage of the total mass, is constant. [Be aware that this is an *assumption*. It may well turn out that there are conditions of state of matter, temperature or massiveness, that alter this rate -- and in turn alter the force of gravity. However, for the present, we proceed on this assumption.]

In summation we assume that a portion of a given mass is radiated in all directions as solitary "gravity quanta" and that the portion is constant. Collaterally we also assume that all grouped quanta (atoms) in a body simultaneously absorb all available free quanta arriving in their vicinity. (Recall that free quanta have a diameter of one light second.)

We now consider the absorptive process. "Absorption" is not a wholly accurate term because by the present hypothesis the free gravity quanta are not absorbed so much as they are *drawn* into the body with such great rapidity as to *also draw the absorbing body toward the quanta*, which is the same direction as the emitting body. Since this process is mutual, there appears what is interpreted as a "*mutual attraction*" and "*action at a distance*".

The question arises, what is the nature of this drawing force? In the case of the strong force it was demonstrated that due to their spin protons and neutrons developed a vortex force that mutually drew neighboring nuclei together. It is this same vortex force that draws ambient quanta into the nuclei. One observes this centrally directed force in a cyclone. As all nuclei draw simultaneously the more nuclei present the faster ambient quanta are ingested.

Let us now quantify the gravitational process.
(temporarily setting general relativity aside)

STANDARD CONDITIONS

(Two one-gram masses one centimeter apart)

$$F = G = 6.672 \times 10^{-8} \text{ dyne}$$

The assumed mechanism will be shown to be commensurate with the usual mathematical expression for gravity interaction:

$$F = \frac{G\,(m_1 \times m_2)}{d^2}$$

We now quantify the sublimation of matter. To do this we discuss

gravitational force in terms of energy under standard conditions. It is evident that F x 1 cm = E_k. Thereby, a body having a force F exerted on it, will possess a kinetic energy of the same coefficient as the force when it moves 1 cm. By designating the quantity as dyne-centimeters, we keep this relationship constantly in mind.

Since potential and kinetic energy are interchangeable and conserved in a closed system, it matters not whether we consider the energy associated with the bodies under consideration as potential or kinetic, what is essential is that we consider the *energy* and *recognize that it is created by the force G*.

Having ascertained the energy existent between two bodies under standard conditions, we can immediately determine the *equivalent mass* from the familiar m = E/c^2. [This is of the same genre as radiation where E = mc^2.] In the standard case we assert *that* mass to be the *mass equivalent of G*.

(1) Contemplating the standard condition,

$$F = \frac{G \ \ 1 \times 1}{1^2} = 6.672 \times 10^{-8} \text{ dyne}$$

m = mass = 1 gr G = gravity constant

d = distance between the masses = 1 cm

(2) If the force applied travels 1 cm, we have

F x 1cm = E = 6.672 x 10^-8 dyne centimeter (erg)

and $\frac{E}{c^2} = m$

therefore, the mass equivalent of G is

$$S = \frac{6.672 \times 10^{-8}}{c^2} = 7.423597 \times 10^{-29} \text{ gr} .$$

Thus we conclude that the mass of the energy between the weights is 7.423597 x 10^-29 gr *and is the quantity sublimated each second from 1 gr*. And so we term this sublimated mass, S.

The reason for taking S as the sublimation of *one* gram instead of two is that the force resulting from S is *common to both*. That means each weight draws that amount from the other, which in turn means each one gram mass sublimates S (7.423597 x 10^-29 gr per sec) to be absorbed by the other.

The correctness of this is displayed in the worked example at the end of this section.

Since S is stated for *one* gram then we can say that it represents the *portion* of mass sublimated for *any* mass. Thus (in grams) m x S is the

total mass sublimated from any body. We designate that m_S is "mass sublimated from a body".

Next we note that by $n = \frac{m}{m_q} = \frac{E}{h_0}$ **we can ascertain the number of quanta comprising the 6.672 x 10^-8 erg (or 7.423597 x 10^-29 gr).**

This turns to be 1.006994 x 10^19 quanta.

We now ask, if 1.006994 x 10^19 quanta produce 6.672 x 10 ^-8 erg, then what part of an erg would *one* quantum produce? That is to say, how much potential energy exists between one quantum one centimeter from one gram? (*This is equivalent to being an ambient quantum the surface of which is in contact with the drawing mass*.) We write

$$\frac{1.006994 \times 10^{19} \text{ quanta}}{6.672 \times 10^{-8} \text{ erg}} :: \frac{1}{x \text{ erg}}$$

and we see $x = h_0$. **(h_0 is 6.626 x 10^-27 erg)**

Thus we show that a 1 gr mass will attract one ambient quanta (1q , or Q) with h_0 energy or |h|dyne of force at one centimeter. Thus, G is quantized, that is to say gravity is quantized.

Note:- Henceforward we will refer to sublimated quanta as "gravity quanta", "free quanta", or "ambient quanta" and assign them the symbol, Q. "Ambient quanta" are specifically gravity quanta that are in proximity to an absorbing body and subject to absorption.

Note that

$1.006994 \times 10^{19} \; h_0 = |G|\text{erg}$ **. and**

$$\frac{|G|\text{erg}}{1 \text{ cm}} = |G| \text{ dyne} .$$

It will be noticed there is a plethora of familiar constants in which the coefficient of the constant appears but has mismatched dimensions. This arrangement is practically incestuous.

We will display these quantities in their symbolic form but bracket the mismatched coefficient symbol; thus we remain aware of the tight interrelation of a relatively few basic quantities and at the same time emphasize the simplicity, rhythm, and beauty of the universe. It is this simplicity and rhythm that forms a fractal-like construction of the universe.

In reiteration, 1.006994 x 10^19 ambient quanta correspond to G dyne or 6.672 x 10^-8 dyne .

Therefore, 1 quantum cor |h|dyne. That is, one ambient quantum will produce |h| (6.625661 x 10^-27) dyne *per gram* absorbing it.

It is assumed that bodies radiate individual quanta, i.e., gravity quanta at the same velocity as any other radiation -- c.

The mass loss would also be the same: E/c^2.

The acceleration of ambient quanta drawn into proximate bodies *is tremendously high*. (For all practical purposes the acceleration is pseudo, the velocity of absorption can be considered attained instantaneously.)

(where nQ = m x S/m_q)
(recall S = sublimated mass per gram.)
(m_q = mass of the quantum, 7.37203854 x 10^-48 gr.)

F_Q = force of gravity quantum per gram of absorbing body = G/nQ =

|h| gr cm/sec^2 = |h|dyne.

MINIMAL CONDITIONS

The minimal condition, signified by the subscript 1, is a function of the natural, i.e., *uninfluenced emission* of quanta. It is a result of the internal (potential) energy of the quantum solely

$$\text{Action} = h = m\,a\,d\,t = m_q \frac{LS}{sec^2} LS\ 1\ sec$$

$$a_1 = \frac{c}{sec} = \frac{LS}{sec^2} = \frac{h}{m_q\ LS\ sec} = \frac{m\,a\,d\,t}{m\ d\,t}$$

$$t_1 = 1\ sec = \frac{h}{\frac{m_q\ LS}{sec^2}\ LS} = \frac{m\,a\,d\,t}{m\,a\,d} = \frac{h}{h_0}$$

$$P_1 = m_q\,c = \frac{h}{LS} = \frac{m\,a\,d\,t}{LS} = 2.210082 \times 10^{-37}\ gr\ cm/sec$$

$$F_1 = \frac{/\backslash\ P_1}{sec} = m_q\,a_1 = 2.210082 \times 10^{-37}\ gr\ cm/sec2$$

$$E_1 = F_1\ d_1 = F_1\ LS = h_0 \qquad (d_1 = \text{diameter of quantum})$$

$$v_1 = a_1 \; t_1 = \; c = \frac{h}{m_q \, LS} = \frac{m \; a \; d \; t}{m \quad d}$$

$$d_1 = \frac{LS}{1} = LS = \frac{h}{m_q \, c} = \frac{m \; a \; d \; t}{m \quad c}$$

The parameters h, F_1, P_1, and E_1 (or h_0) are *absolute* minimums found in nature.

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Before proceeding it may be well to display a few key shorthand notations.

Q = 1 nascent or gravity quantum.

S = 7.423597 x 10^-29 gr = portion of mass sublimated per gram per sec.

mS = sublimated mass, i.e., portion of body sublimated per second (grams).

NQ = mS/m_q = number of Q per second sublimated by a body of mass m.

n_q = m/m_q = number of quanta comprising a body. Usually given as n when the mass is known and used frequently.

nm_q = mass of a body

$$nQ = \frac{mS}{m_q \; d^2} \text{ or } \frac{NQ}{d^2} =$$ number of Q emitted/sec by a mass that are available at a distance from that mass. (ambient quanta)

N_q = n_q * nQ = total *interacting* quanta. Represents the number of quanta in an absorbing body (n_q) multiplied by the number of ambient quanta, nQ.

==========

A WORKED EXAMPLE

We shall concern ourselves with the gravitational attraction of the moon (M) and earth (E) for which some of the parameters are known. There is one disadvantage which is that these parameters are approximate (at least as given here). However, for purposes of illustration, they shall suffice.

(where m = mass, d = distance, r = radius, a = acceleration (at Earth's surface 45 degrees from the equator).

mass of earth $m_E = 5.98 \times 10^{27}$ gr

mass of moon $m_M = 7.36 \times 10^{25}$ gr

distance earth-moon $d_{E-M} = 3.8 \times 10^{10}$ cm_ _

radius of earth $r_E = 6.37 \times 10^8$ cm

acceleration at earth surface $a_{E\_sur} = 980.665$ cm/sec^2

Step (1)

We ascertain by *standard form* the gravitational attraction between E and M , which we write F_E-M.

Gravity can be expressed either as a force or in terms of acceleration.

By the standard equation,

$$F = \frac{G\ m_E\ m_M}{d_{E-M}\ ^2} = 2.033611 \times 10^{25} \text{ dynes}$$

From $a = \frac{F}{m}$ **we obtain**

$a_E = 3.400687 \times 10{-}3$ cm/sec^2 **(acceleration of E toward M)**

$a_M = 2.763058 \times 10^{-1}$ cm/sec^2 **(acceleration of M toward E)**

(We set aside the counteracting conditions as not germane to the example.)

We note that whereas F is common to both bodies, the acceleration of each is different being inversely proportional to its mass.

Next, we note the condition of emitted gravity quanta spreading along the expanding surface of an imaginary sphere; thus quanta available for absorption diminish in numbers inversely proportional to d^2. Quanta available for absorption are called ambient quanta.

Step (2)

We calculate nQ, the number of nascent quanta from the moon that *are in the vicinity of Earth*, i.e., *ambient* quanta

$$nQ = \frac{\frac{m_M}{m_q} S}{d^2} = 5.132600 \times 10^{23}\ Q$$

Step (3)

Next we recall that one gram matter attracts one Q with |h|dyne of force.

So m_E x |h|dyne x nQ = total attraction force = 2.033611 dynes.

We see that this is the same as given by the standard equation.

We now calculate the acceleration of a body at the surface of the Earth:

$$NQ = \frac{m_E\ S}{m_q} = 6.02 \times 10^{46}\ Q$$

$$\frac{6.02 \times 10^{46}\ Q}{(r_E^2)\quad (6.37 \times 10^8)^2} = nQ \text{ at the surface.}$$

So the force exerted on bodies at the surface is

|h|dyne nQ = 983.3 gr cm/sec^2

which is the number of dynes *per gram.* We can write acceleration as

$$a = \frac{F}{m}$$

where F (|h|dyne nQ) is multiplied by the number of grams of the body.

Since m is the same number of grams, the two cancel leaving

a = |h|dyne nQ = 983.3 cm/sec at the surface.

Given: a = 980.665 cm/sec^2 (at latitude 45 deg.)

THE QUANTIZATION OF GRAVITY

Gravitational action is not customarily thought of in magnitudes on the order of c because the response of ponderous bodies results in velocities extremely small compared to that of light, nor is it thought of in terms of typical quantum magnitudes because it is such a weak force that determinations of micro proportion are difficult or considered insignificant.

However, the concept here is that the mechanics of gravity in its *initiating* form employs free quanta traveling at c, and the dimensions of which are on the order of c. Absorption velocity must necessarily be of *much greater* magnitudes.

Thus we see gravitational action as initiating on the quantum mass level but altered by the factors nQ and nq to magnitudes we usually associate with gravity.

Whereas one usually thinks of quantum magnitudes as being very small, in gravitational mechanics we are dealing with a broad spectrum commencing with

the large dimensions of *individual* quanta having micro mass which are modified by large numbers of quanta and great velocities to evolve into what appears as a mechanics of macro proportions only.

QUESTIONS

We persue some inevitable questions regarding the sublimation of mass. We propose here that all bodies radiate gravitational quanta which represent

7.423597 x 10^-29 or one part in 1.347056 x 10^28 per second.

The question arises, is this loss detectable? Probably not because (a) it is so miniscule, and (b) each body also receives ambient quanta from other bodies which compensates for the loss. Thus the individual quanta may be thought of as the "virtual" or exchange particle of gravity (although the mechanics is different).

Other questions: Is the sublimation rate variable for any reason? For example, would near absolute zero temperatures affect the rate? If not, what would? And, is any of this detectable with present day technology?

Collaterally, would extremely high temperatures affect S?

Also, might a body of great mass (ten suns or more) affect sublimation?

In summary, in regard to the basic questions of gravity the present theory has ascertained or explained quantitatively *and* qualitatively

(a) action at a distance -- and its corollary

(b) mutual attraction

(c) the gravity "virtual" particle or "gravity wave"

(d) the force engendered

(e) portion of mass radiated as gravitational quanta.

What we are in need of is a more exact picture of the mechanism of absorption.

At this juncture we picture a continuum of free quanta approaching a body at c and being drawn in at an increased velocity proportional to the number of particles comprising the body. Thus the conclusion is that *all* particles of the body simultaneously draw on each and every ambient quantum, the more particles (mass) comprising the body, the faster the draw and consequently the greater the force.

As a given quantum is drawn in it must, being indivisible, be eventually pulled away from other absorbing quanta and become an integral part of a single fermion.

But what is the cause or mechanism of absorption, and how do we quantify it?

At base we believe the mechanism must be the vortex action described for the strong force. This is the most logical prospect.

However, taking the vortex force as 8.455122 x 10^-22 dyne as given at the full radius of a single proton, and applying it to an ambient quantum, the resultant

-- by rough estimate -- is found to be too great, i.e., greater than gravity by twenty eight orders of ten.

Of course there are differences. The strong force operates between two nuclei extremely close to their centers whereas the gravity situation has many fermions spread over a wide range absorbing inactive ambient quanta. In addition these quanta are impacting at c. This c has to be to be absorbed and then surpassed before a force can be exerted in the direction from which the quanta are arriving.

In addition, in the final stage the absorbed quantum is drawn in many different directions and, because it is indivisible, finally absorbed by only *one* fermion. All these conditions must result in a reduction of force. However, it is extremely difficult to quantitatively assess them.

REGARDING CURVED SPACE AND THE PRESENT THEORY OF GRAVITY

Apparently the universe is comprised of a cluster of galaxy clusters.

We know that galaxies rotate -- and so do virtually all things in cosmology and on the quantum particle level.

Thereby, we ask: Does the universe rotate?

If so, we ask

(a) What is the effect of rotation as to centrifugal force?

(b) How would rotation affect Doppler readings?

(c) Does light from distant sources undergo the Coriolis effect?

(d) Do gravity quanta suffer the coriolis effect?

(e) If so would that not create the illusion that space is curved?

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End