





## SECTION 2

### *The Behavior of Matter: Its Form*

Section 1, *The Origin of Matter: Its Cause* resolved the origin of the matter of the universe as follows.

The universe exists. It had to come into being from a prior nothing. That had to happen while avoiding an infinity of rate of change. Conservation had to be maintained. Ergo equation 1-16.

$$(1-16) \quad U(t) = \pm U_0 \cdot [1 - \text{Cos}(2\pi \cdot f \cdot t)]$$

Thus the hypothesis is that the interruption that started our universe, the interruption of what would otherwise have been an infinite duration of the primordial absolute nothing, an interruption because an essentially infinite amount of opportunity operated on a non-zero though minute probability, was the starting of a matched pair of spherical oscillations:

- Present to us at a very high frequency,
- Of the general *[1 - Cosine]* form, and
- Together equal to the original nothing because of having matching amplitudes  $+U_0$  and  $-U_0$ .

That analysis yielded an initial event, the origin oscillations, as in Figure 2-1. [All of the unavoidably planar depictions of the spherical oscillations are of the spherical phenomenon, interpretable as a radial versus time depiction.]

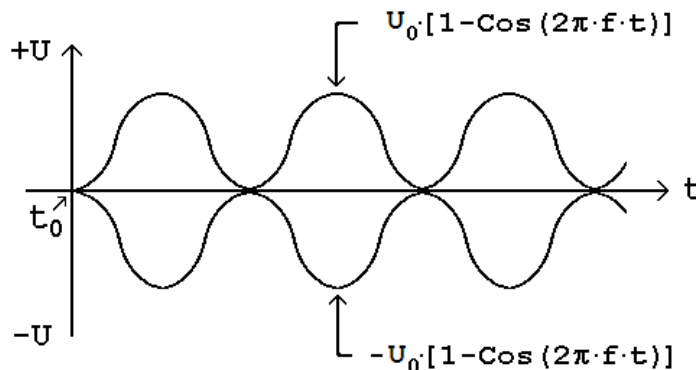


Figure 2-1

#### HOW THE ORIGINAL OSCILLATIONS BECAME THE UNIVERSE

Examination of the waveform of Figure 2-1 reveals two problems. One, that it is an immediate mutual annihilation, will be dealt with shortly below. Of concern now is that an infinite rate of change still remains; the envelope of the oscillation has an infinite rate of change at  $t=t_0$  as can be seen in Figure 2-2, below, which displays the envelope.

Viewed in a mathematical or graphical sense without any consideration of the physical reality represented, the envelope discontinuity at  $t=t_0$  is not a difficulty. The only quantity that actually exists and is varying is the overall  $U(t)$ . The envelope is merely our perception of a characteristic of the waveform. The actual varying quantity, per Figure 2-1, has no discontinuity at  $t=t_0$

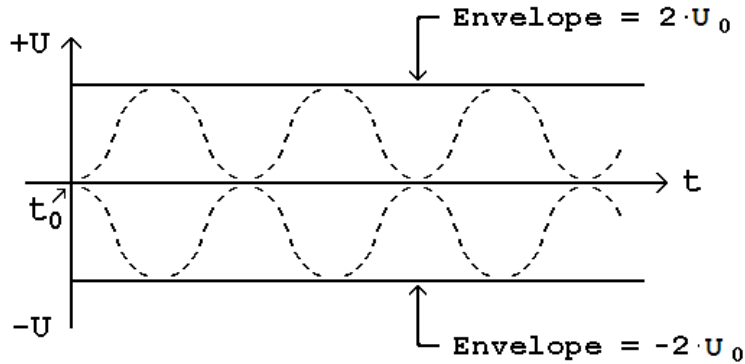


Figure 2-2

However, looking at the situation in a physical sense rather than purely mathematically, such oscillations as depicted in Figure 2-1 are all that there is to account for the effects which we call *energy*, *mass* and *charge*. Therefore, this *energy / mass / charge / oscillation* is something other than nothing. It is a physical reality that did not exist prior to the Origin. It can no more leap from zero to a finite non-zero amount than could the original  $U(t)$  so leap.

That infinite rate of change in the amount of *energy / mass / charge* at  $t=t_0$  is no more acceptable than was the infinite rate of change encountered in the original analysis of the beginning and it must be corrected by the same kind of reasoning as was then pursued: the envelope, also, had to originate as a *[1 - Cosine]* form of oscillation, which is the only form that avoids an infinite rate of change and matches the requirements of the situation.

That original envelope oscillation was at a lesser frequency than the original wave by the definition of a waveform envelope. If it were at a greater frequency then the roles (envelope and wave) would be reversed. If it were at the same frequency it would not act as an envelope and the infinity problem would remain. If we designate the envelope frequency as  $f_{env}$  and the frequency of the wave oscillation within the envelope as  $f_{wve}$  then the envelope would be of the following form.

$$(2-1) \quad U_{env} = [1 - \text{Cos}(2\pi \cdot f_{env} \cdot t)]$$

The wave is, as before, of the form

$$(2-2) \quad U_{wve} = \pm U_0 \cdot [1 - \text{Cos}(2\pi \cdot f_{wve} \cdot t)]$$

and the envelope modulating the wave is then

$$(2-3) \quad U(t) = [U_{env}] \cdot [U_{wve}] \\ = \pm U_0 \cdot [1 - \text{Cos}(2\pi \cdot f_{env} \cdot t)] \cdot [1 - \text{Cos}(2\pi \cdot f_{wve} \cdot t)].$$

That waveform appears in Figure 2-3.

However, the form of  $U(t)$  of equation 2-3 and Figure 2-3 still does not resolve the problem of an infinite rate of change at  $t_0$ . The  $[1 - \text{Cosine}]$  envelope is itself an oscillation that begins at  $t_0$  with a sudden step from zero to its full amplitude. Figure 2-3 shows the first 2 cycles of the envelope oscillation, which if only the envelope is considered, is a simple oscillation at the envelope frequency, even though visually, in the Figure, it is only the trace of the peaks of the overall complex oscillation.

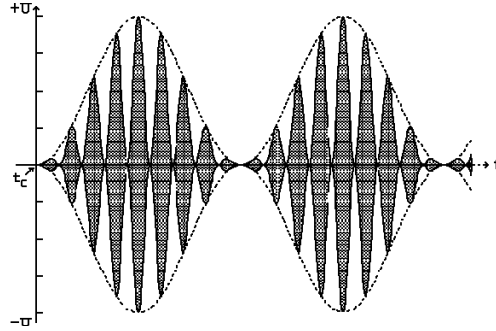


Figure 2-3

It is *energy / mass / charge* that begins suddenly in its full amount at  $t_0$  just as, in Figure 2-1, the oscillation of equation 2-1 begins at  $t_0$ . Therefore, it is again necessary to introduce an envelope of  $[1 - \text{Cosine}]$  form to prevent the infinite rate of change at  $t_0$  in the prior envelope. That correction will in turn require still another such correction and so *ad infinitum*. An (apparently at this point) infinite string of envelopes thus results as a necessity of the situation.

The resulting  $U(t)$  then is

$$(2-4) \quad U(t) = \pm U_0 \cdot \prod_{i=1}^{i=\infty} \left[ [1 - \text{Cos}(2\pi \cdot f_{\text{env}_i} \cdot t)] \right] \cdot \dots$$

$$\dots \cdot [ [1 - \text{Cos}(2\pi \cdot f_{\text{wve}} \cdot t) ] ]$$

where the  $\prod$  symbol (a large  $\pi$ , Greek "p") means the product of the indicated factors.

While an envelope frequency must be less than the frequency of the wave that it modulates so that the various  $f_{\text{env}}$  must be less than  $f_{\text{wve}}$ , each successive envelope may be at the same frequency, as the prior. The reason is as follows.

If each envelope frequency must be different then each must be at least slightly smaller than the prior. With an infinite set of envelopes and only the frequency range from slightly less than that of the wave down to slightly above zero being available each successive envelope could only be at an infinitesimally lower frequency than its predecessor in any case. Infinitesimally less is essentially the same as identical.

Then how did other than an infinite string of envelopes come about ?

Each additional envelope factor in equation 2-4 results in a higher frequency content in the overall expression. That is, as each envelope is added the expansion of the exponentiated cosines expression into a sum of individual frequency cosine terms becomes longer and acquires higher frequency terms. But, the oscillation could not have had an actual component at infinite frequency. The real universe original  $U(t)$  had an enormous set of envelopes but not an infinite set; they were "cut off" at some point.

The *Medium* of these oscillations being the only reality and, therefore, being what sets the limit on the speed of light with which we are familiar, the *Medium* also sets a limit on the highest frequency / lowest wavelength waves that can propagate. As a result the series of envelopes, of factors in equation 2-4, was limited to some finite but quite large amount. (See Appendix B, *The Limitation of the Original Envelopes*).

This yields a revised  $U(t)$ , the original oscillation, the Cosmic Egg, as equation 2-5, below.  $N_0$  is the number of envelopes, all at the same frequency,  $f_{env}$ .

$$(2-5) \quad U(t) = \pm U_0 \cdot [1 - \text{Cos}[2 \cdot \pi \cdot f_{env} \cdot t]]^{N_0} \cdot [1 - \text{Cos}[2 \cdot \pi \cdot f_{wvc} \cdot t]]$$

The waveform  $[1 - \text{Cos}(x)]^n$  converges to an increasingly narrower peak as  $n$  increases, Figure 2-4, below. For very large  $n$ , that is very large  $N_0$  of equation 2-5, the converging of the waveform into a single narrow peak proceeds to a momentary "spike" per cycle. Figure 2-5, below, shows the appearance of the waveform for extremely large  $n$ , that is for  $n = N_0$  - what the waveform of the original "Cosmic Egg", the start of our universe, "looked like". ( $N_0$  is found further below to be about  $10^{84}$ .)

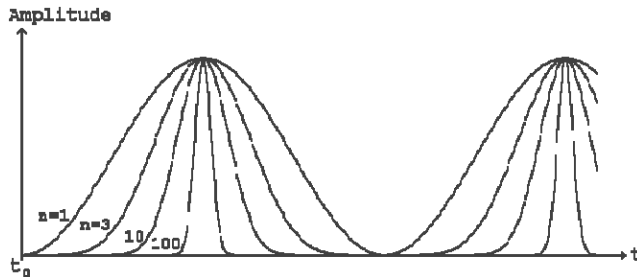


Figure 2-4  $[1 - \text{Cos}(x)]^n$  For  $n = 1, 3, 10, 100$

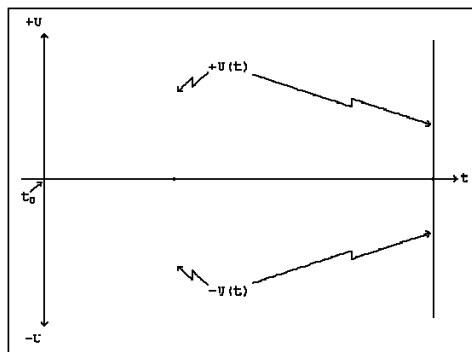


Figure 2-5  
The  $U(t)$  "Cosmic Egg" WaveForm

This discussion of  $U(t)$ , the original oscillation the start of which was the start of the universe, has dealt so far only with the problems of the Origin, the problems of the transition from nothing to something. The something was, of course, the first instant of the entire universe. As such it must have contained in itself all of the *mass / energy / positive and negative charge* of the universe.

Figures 2-1, 2-3, and 2-5 all indicate that the original pair of oscillations,  $+U$  and  $-U$ , should have immediately mutually annihilated, canceled out, reverted to the primal nothing. But, clearly that did not happen. The only explanation of that not happening is that each was unstable, so unstable that they exploded more immediately than they were able to mutually annihilate. They immediately proceeded to an immense explosion of energy and pieces of their oscillation, the event now called the "Big Bang". See Appendix C, *Why No Immediate Mutual Annihilation*.

In terms of the  $U(t)$  as depicted in Figure 2-5, the so immediate explosive decay undoubtedly occurred after only a minute portion, an infinitesimal portion, of the very first cycle had passed. It had to have been long before the first "spike". In that sense the initial event was very small, tenuous, hardly more than nothing because the instantaneous amplitude of  $U(t)$  at that moment (the height of the curve above zero at that moment long before the first "spike") was also infinitesimal. It was hardly more than, essentially zero.

In that sense, the way that the universe started at all becomes a little more comprehensible. To avoid an infinite rate of change there was essentially almost no difference between "nothing", on-going absolute nothing, and the first infinitesimal moment of the original  $U(t)$ , the original oscillation.

Yet, it contained the entire universe.

### THE FORM OF MATTER AS GENERATED BY THE "BIG BANG"

What did the "Cosmic Egg" explode into? It could only explode into pieces of what it was made of, pieces of  $[I - cosine]$  form spherical oscillations, pieces like equation 1-16, above.

Each oscillation is three-dimensional, thus spherical, because three dimensions is the minimum number that can involve space part of which is not its own boundary.

But, what did the "Cosmic Egg" explode into? It primarily exploded into what we know our universe to mainly consist of: myriad protons - Hydrogen atom nuclei, and myriad electrons - maintaining overall charge neutrality with the protons, and the antimatter forms of both, negaprotons and positrons – maintaining conservation.

[Those might also be expected to have mutually annihilated but did not. Their survival rather than annihilation is analyzed in full in Appendix C, *Why No Immediate Mutual Annihilation*. Suffice it here to observe that each product piece was initially ejected radially outward at extreme velocity and energy, on paths slightly diverging, such that initially annihilations could not occur.]

Then, what was the nature, the form of those product pieces that the "Cosmic Egg" exploded into? Because of the two frequencies of  $U(t)$ ,  $f_{wve}$  and  $f_{env}$ , and that the explosion source was of two equal but opposite polarities,  $+U_0$  and  $-U_0$ , the "Big Bang" resulted in myriad pieces of four different forms of  $[I - cosine]$  form spherical oscillations, equations 2-6.

$$\begin{aligned}
 (2-6) \quad U_{\text{Form } 1}(t) &= +U_c \cdot [1 - \text{Cos}(2\pi \cdot f_{wve} \cdot t)] && \text{the proton} \\
 U_{\text{Form } 2}(t) &= -U_c \cdot [1 - \text{Cos}(2\pi \cdot f_{env} \cdot t)] && \text{the electron} \\
 U_{\text{Form } 3}(t) &= -U_c \cdot [1 - \text{Cos}(2\pi \cdot f_{wve} \cdot t)] && \text{the anti-proton} \\
 U_{\text{Form } 4}(t) &= +U_c \cdot [1 - \text{Cos}(2\pi \cdot f_{env} \cdot t)] && \text{the anti-electron}
 \end{aligned}$$

Each of those has a specific value of its mass. Per the data provided by NIST, the National Institute of Standards and Technology those masses are:

$$\begin{aligned}
 (2-6a) \quad \blacksquare \text{ the proton and the antiproton} \quad m_p &= 1.672\,621\,898 \cdot 10^{-27} \text{ kg} \\
 \blacksquare \text{ the electron and the anti-electron} \quad m_e &= 9.109\,383\,56 \cdot 10^{-31} \text{ kg}.
 \end{aligned}$$

Using the mass-energy relationship,  $m \cdot c^2 = h \cdot f$  the frequency,  $f$ , of those particles can be calculated. Those frequencies are:

$$\begin{aligned}
 (2-6b) \quad \blacksquare \text{ the proton and anti-proton:} \quad f_{wve} &= 2.268,731,818 \cdot 10^{23} \text{ hz} \\
 \blacksquare \text{ the electron and anti-electron:} \quad f_{env} &= 1.235,589,965 \cdot 10^{20} \text{ hz}.
 \end{aligned}$$

Finally, the mass of those four fundamental particles having now been resolved, their electric charge remains. They all have the same magnitude of their oscillation,  $|U_c|$ , which by default is the magnitude of their electric charge. [ $U_c$  is the particle oscillation amplitude per equation 2-6.  $U_0$  is the original pre-explosion oscillation amplitude.] The magnitude of the oscillation is in two opposite polarities; therefore clearly, where  $q$  is the fundamental electric charge per NIST, then:

$$\begin{aligned}
 (2-7) \quad q &= 1.602,176,621 \times 10^{-19} \text{ C} \\
 +U_c &= +q \\
 -U_c &= -q
 \end{aligned}$$

Judging by its result, the ‘‘Cosmic Egg’’ was not unlike an immense atom, a very unstable immense atom [as are all of the atomic species of atomic number exceeding 83 which the cosmic egg would have immensely exceeded]. Its ‘‘Big Bang’’ was a kind of explosive nuclear radioactive decay ultimately ending in the myriad stable elements of today’s Periodic Table plus those with half lives long enough to be in detectable quantities today. Such decays follow a chain:

- From a heavy and complex composition,
- To various multiple less heavy less complex product pieces,
- . . . . .
- Until they arrive at many multiple stable forms.

The vast majority of those resulting stable forms are the protons and electrons of the material world and their anti-particles. They are of the equation 2-6 form spherical oscillation, and will be referred to as *Spherical-Centers-of-Oscillation* or as *particles*

The rates of the decays are exponential, the decay [varying from some extremely rapid to some extremely slow] is described in terms of a ‘‘half life’’, the time it takes for half of the original material’s decays to take place. Some of those ‘‘multiple less heavy less complex product pieces’’ having long half lives are present to us still today still decaying as what we term ‘‘radioactive’’ species.



The process of radioactive decay is treated in detail in Appendix A-3, *Radioactivity*. The atomic nucleus and various atomic species are treated in detail in Appendix A-2, *The Atomic Nuclei*.

The actions of the various stable atomic forms are primarily: electrostatic per Coulomb's Law, electromagnetic per Ampere's Law, and gravitational per Newton's Law. Those are treated in detail in the following sections; however, examination now of an aspect of gravitational behavior results in additional information on the behavior and form of matter as follows.

### THE FLOW FROM THE SPHERICAL-CENTERS-OF-OSCILLATION

#### The Particle "Core"

Consider a small individual particle such as a proton. Newton's law of gravitation expressed in terms of  $m_{source}$  and  $m_{acted-on}$  and with both sides of the equation divided by  $m_{acted-on}$  is, of course,

$$(2-7) \quad a_{grav} = G \cdot \left[ \frac{m_{source}}{d^2} \right]$$

However, mass and energy are equivalent, so that [using  $c$  = light speed and  $h$  = Planck's constant] a mass,  $m$ , is proportional to a frequency,  $f$ , that is characteristic of that mass. That is

$$(2-8) \quad m \cdot c^2 = h \cdot f \quad \text{or} \quad f = \left[ \frac{c^2}{h} \right] \cdot m$$

so that the  $m_{source}$  of equation 2-7 has a corresponding equivalent frequency,  $f_{source}$ .

That being the case, the gravitational acceleration,  $a_{grav}$ , can be expressed in terms of that frequency as the change,  $\Delta v$ , in the velocity,  $v$ , of the attracted mass per time period,  $T_{source}$ , of the oscillation at the corresponding frequency,  $f_{source}$ , as follows.

$$(2-9) \quad a_{grav} = \Delta v / T_{source} = \Delta v \cdot f_{source}$$

It can then be reasoned using equation 2-9 = equation 2-7 as follows .

$$(2-10) \quad a_{grav} = \Delta v \cdot f_{source} = G \cdot \left[ \frac{m_{source}}{d^2} \right]$$

Equation 2-11, below, is obtained by using that frequency is proportional to mass. With  $f_p$  and  $m_p$  as the proton frequency and mass then  $f_{source} = [m_{source} / m_p] \cdot f_p$ .

$$(2-11) \quad \Delta v \cdot \left[ \frac{m_{source}}{m_p} \right] \cdot f_p = G \cdot \left[ \frac{m_{source}}{d^2} \right]$$

Rearranging and canceling  $m_{source}$  on both sides of the equation,

$$(2-12) \quad \Delta v = \frac{G \cdot m_p}{d^2 \cdot f_p} \quad \text{per cycle of } f_{source}.$$

Then substituting, per equation 2-8,  $m_p = [h \cdot f_p] / c^2$ ,

$$(2-13) \quad \Delta v = \left[ \frac{G}{d^2 \cdot f_p} \right] \cdot \left[ \frac{h \cdot f_p}{c^2} \right]$$

$$= \frac{G \cdot h}{d^2 \cdot c^2} \text{ per cycle of } f_{\text{source}}.$$

The Planck Length,  $l_p$ , is defined as

$$(2-14) \quad l_p \equiv \left[ \frac{h \cdot G}{2\pi \cdot c^3} \right]^{\frac{1}{2}} \quad \text{so that} \quad G = \left[ \frac{2\pi \cdot c^3 \cdot l_p^2}{h} \right]$$

Substituting  $G$  as a function of the Planck Length from equation 2-14 into  $G$  as it is in equation 2-13, the following is obtained.

$$(2-15) \quad \Delta v = \left[ \frac{2\pi \cdot c^3 \cdot l_p^2}{h} \right] \cdot \left[ \frac{h}{d^2 \cdot c^2} \right]$$

$$= c \cdot \frac{2\pi \cdot l_p^2}{d^2} \text{ per cycle of } f_{\text{source}}.$$

This result states that:

- the velocity change due to gravitation,  $\Delta v$ ,
- per cycle of the attracting mass's equivalent frequency,  $f_{\text{source}}$ ,  
which quantity,  $\Delta v \cdot f_{\text{source}}$ , is the gravitational acceleration,  $a_{\text{grav}}$ ,
- is a specific fraction of the speed of light,  $c$ , namely the ratio of:
  - $2\pi$  times the Planck Length squared,  $2\pi \cdot l_p^2$ , to
  - the squared separation distance of the masses,  $d^2$ .

That squared ratio is, of course, the usual inverse square behavior.

This also means that at distance  $d = \sqrt{2\pi} \cdot l_p$  from the center of the source, attracting mass, the acceleration,  $\Delta v$ , per cycle of that attracting mass's equivalent frequency,  $f_{\text{source}}$ , is equal to the full speed of light,  $c$ , the most that it is possible to be. In other words, at that [quite close] distance from the source mass the maximum possible gravitational acceleration occurs. That is the significance, the physical meaning, of  $l_p$  or, rather, of  $\sqrt{2\pi} \cdot l_p$ .

The physical significance of  $\sqrt{2\pi} \cdot l_p$  is that it sets a limit on the minimum separation distance in gravitational interactions and it implies that a "core" of that radius is at the center of fundamental particles having rest mass. That is, equation 2-15 clearly implies that it is not possible for a particle having rest mass to be approached closer than that distance.

That physical significance of  $\sqrt{2\pi} \cdot l_p$ , is so fundamental to gravitation and apparently to particle structure, that it more truly represents a fundamental constant than does  $l_p$ . For those reasons that length should replace  $l_p$  as a fundamental constant of nature as follows.

(2-16)            The fundamental distance constant,  $\delta$   

$$\delta^2 \equiv 2\pi \cdot l_p^2$$

$$\delta = 4.051,34 \times 10^{-35} \text{ meters}$$

Equation 2-15 then becomes equation 2-17.

(2-17)             $\Delta v = c \cdot \frac{\delta^2}{d^2}$  per cycle of  $f_{\text{source}}$

a quite pure and precise statement of gravitation: that gravitation is a function of the speed of light,  $c$ , and the inverse square law, in the context of the oscillation frequency,  $f_{\text{source}}$ , corresponding to the attracting, source body's mass.

It makes clear that an oscillation is an integral part of gravitation as should be the case because gravitation is an action between particles having mass, which are the just-developed *Spherical-Centers-of-Oscillation* products, equation 2-16, of the “Big Bang”. See Section 7, *The Action of Matter - Gravitation*.

### The Particle Core's Propagated Outward Flow

Each gravitationally attracting *Spherical-Center-of-Oscillation* must tell each gravitationally attracted particle its “message”: the direction from the attracted particle to the attracting one and the magnitude of the attracting particle's gravitational attraction. That task is assigned by contemporary physics' theory to a *gravitational field*, a vector field that is an assignment of a direction of action and its magnitude to each point in a region of space.

However, that designation of the field, while facilitating the description of the action fails to explain the cause, the mechanism of the field and thus fails to explain or account for the action at issue. It also fails to account for the time delay due to the limitation of the speed of light that must exist between a change at the attracting particle and its effect at the attracted particle.

Something flowing is required, something flowing at the speed of light, continuously, carrying the direction and magnitude information, spherically outward, from every gravitating *Spherical-Center-of-Oscillation* to every other *Spherical-Center-of-Oscillation*.

Furthermore, the necessity for gravitation that an oscillation and its frequency are closely involved in the effect [equations 2-15 and 2-17] and therefore in what is communicated by the flow, means that the flow itself is oscillatory corresponding to and generated by its oscillatory source, the *Spherical-Center-of-Oscillation*.

For such a flow to persist there must be a supply of that outward flowing substance in every particle. And, for that flow to have persisted the billions of years since the “Big Bang” that “supply” must be an extremely concentrated reservoir of that which flows outward [concentrated relative to the outward flow].

Having now just determined:

- That  $\delta$  sets a limit on the minimum separation distance in gravitational interactions and therefore that a "core" of that radius is at the center of fundamental particles, and

- That an extremely concentrated reservoir supply of that which is flowing outward is required at the center of all particles to support the billions of years of their outward flow;

Therefore:

- The reservoir is the spherical “core” of radius  $\delta$  at the center of all particles;
- That it is impenetrable is because of its immense density concentration [billions of years worth of flow of the flow substance [*Medium*] in the minute ( $\delta = 4.05134 \times 10^{-35}$  meters radius spherical core) of every particle having rest mass], and.
- The *Spherical-Center-of-Oscillation* is a spherical oscillation of that immensely concentrated flow substance, *Medium*.

Then, what “contains” that core’s supply or why doesn’t it all just quickly “slosh” out and be gone ? The answer is that it is trying to do just that, to “slosh” out, as hard as it can. It cannot help propagating outward because it has no container. But it can only propagate outward at the limiting rate determined by its surface area,  $4 \cdot \pi \cdot \delta^2$  and the fastest speed possible for flow, the speed of light,  $c$ . Thus is the *Propagated Outward Flow*.

### *The Speed of the Flow – The Speed of Light*

Every oscillation that we know in nature exhibits, and the very theory of oscillations in the abstract requires, that the oscillation consist of two aspects of the substance which is oscillating [e.g. pendulum position and velocity or electric potential and current] storing and exchanging back and forth the energy of the oscillation. With one aspect varying in oscillatory fashion then when that aspect decreases there must be some "place" for its energy to go, a place in which it is stored until it reappears in that aspect when it increases again. It cannot completely disappear or be lost because the oscillation would die. That "place" is the oscillation's second aspect and it obviously must vary in a manner related to the first aspect's variation with its energy storage in opposite phase.

The matter of the universe is largely a mass of particles each a spherical [*I - Cosine*] form oscillation propagating outward.

Like electric inductance and capacitance determining the speed of propagation along a transmission line,  $\mu_0$  and  $\varepsilon_0$  determine the speed of the [*I - Cosine*] form oscillation propagation by setting the two aspects of the oscillation in which they are involved, the aspects between which the oscillation energy exchanges back and forth.

But, when the original oscillation came into existence it did so in absolute nothing. There was no “free space” with  $\mu_0$  and  $\varepsilon_0$ . There was nothing but the original oscillation. And, after the immediate explosion into all of the particles of the universe, each of those particles was sending its *Propagated Outward Flow* into nothing, into emptiness.

Where did the *Propagated Outward Flow*’s  $\mu_0$  and  $\varepsilon_0$  come from? The only thing they could have come from was the original oscillation. There is no other possible source because everything else was absolute nothing, “the zero of existence”. The  $\mu_0$  and  $\varepsilon_0$  are inherent in the substance of the oscillation, which means,  $\mu_0$  and  $\varepsilon_0$  are also inherent in

the outward propagation. Each particle's *Propagated Outward Flow* contains its own  $\mu_0$  and  $\epsilon_0$ .

Having established the supply of *Medium* [flow substance] and its on-going *Propagated Outward Flow* serving the role of gravitational field [see Section 7, *The Action of Matter: Gravitation*] as a property of every particle exhibiting rest mass, the question arises, "What of the electric field, much stronger than gravitation and co-present with gravitational field whenever the gravitating particle has electric charge?"

Just as is the case for gravitation, every particle having electric charge must tell its similar "message" to every other such particle [see Section 3, *The Action of Matter: The Electrostatic Effect - Coulomb's Law*]. That requires something flowing outward at the speed of light continuously, carrying the direction and magnitude information, spherically outward, from every electrostatic *Spherical-Center-of-Oscillation* to every other *Spherical-Center-of-Oscillation*. That flow-communication is the electric field, an active process not a static state.

The theory of an *electric field*, just as with that of a *gravitational field*, above, while facilitating the description of the action fails to explain the cause, the mechanism of the field and thus fails to explain or account for the action at issue. It also fails to account for the time delay due to the limitation of the speed of light that must exist between a change at the attracting particle and its effect at the attracted particle

Two such simultaneous flows, gravitational and electric, and two supporting reservoirs supplying the flows, is clearly untenable. There can only be one reservoir in each particle's "core" and one resulting *Propagated Outward Flow* producing both the gravitational action and the electric action if for no other reason than because two supply reservoirs would mutually interfere with a spherically outward flow of each.

The one, single, universal flow functions as follows. As developed fully in Section 3, *The Action of Matter: The Electrostatic Effect – Coulomb's Law*, that effect is due to impulses delivered by the source *Propagated Outward Flow* on the encountered *Spherical-Centers-of-Oscillation*. As developed fully in Section 7, *The Action of Matter: Gravitation*, that effect is due to the arriving flow's inverse square reduced  $\mu$  and  $\epsilon$  adding to the outgoing encountered flow's full magnitude  $\mu$  and  $\epsilon$  slowing that encountered flow.

#### SUMMARY FOR SECTION 2 – THE BEHAVIOR OF MATTER: ITS FORM

The form of matter is not that of the "particles" of classical modern physics' Standard Model. Rather the form of matter is:

- *Spherical-Centers-of-Oscillation*, spherical oscillations of [1 - Cosine] form, equation 2-6;
- Propagating spherically outward a continuous oscillatory *Propagated Outward Flow of Medium* in [1 - Cosine] form, according to its source *Spherical-Center-of-Oscillation* magnitude, sign, and frequency;
- The speed of the *Propagated Outward Flow*,  $c$ , being set by the net  $\mu$  and  $\epsilon$  in the *Medium* being propagated;

$$(2-18) \quad c = \frac{1}{\sqrt{\mu \cdot \epsilon}}$$

The *Spherical-Center-of-Oscillation* consists of a central “core”, a spherical volume of radius  $\delta = 4.051,34 \times 10^{-35}$  meters that consists entirely of a high density concentration of the oscillating *Medium*, which propagates outward at an extremely low rate determined by the surface area of the “core” and the radial outward speed of flow of the propagated *Medium*, the speed of light,  $c$ .

THE GENERAL EXPONENTIAL DECAY OF THE UNIVERSE

Since the “Big Bang” the *Propagated Outward Flows* have been gradually depleting the original supply of *medium* in each *Spherical-Center-of-Oscillation*. That process, an original quantity gradually depleted by flow away of some of the remaining quantity is an exponential decay of the form equation (2-19).

(2-19)

$$v(t) = v_0 \cdot e^{-t/\tau}$$

–  $v \equiv$  the amount of medium  
–  $\tau \equiv$  the "time parameter"

The value of  $\tau$  is

(2-20)

$$\tau = 3.57532 \cdot 10^{17} \text{ seconds}$$

$$\approx 11.3373 \cdot 10^9 \text{ years}$$

The decay is treated in detail in Appendix E, *The Universal Exponential Decay*.

