SECTION 5

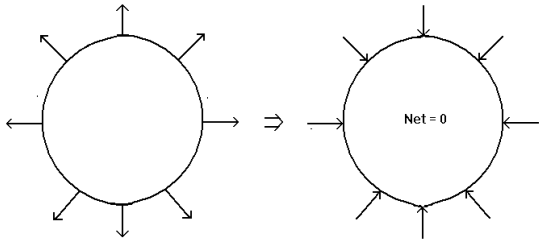
The Mechanism of Gravitation

How the Vacuum Magnetic Permeability and the Vacuum Electric Permittivity, μ_0 and ε_0, of particles' outward *Flow* produce gravitational attraction.

THE AFFECT OF THE OUTWARD FLOW ON ITS PROPAGATING SOURCE

The oscillating substance in the core of each of the myriad particles is its mass. There is no other place or thing to be the mass of those particles. Therefore the propagating outward *Flow* has momentum, the effect of the product of mass, inherent in the substance of the *Flow*, and that substance *Flow*'s velocity.

The *[1 – cosine]* oscillatory form of the propagated wave is, in effect, a stream of pulses. In the absence of other effects the outward *Flow* is naturally radially outward. While the radially outward *Flow* of the particle's core source of the *Flow* effectively transmits pulses of momentum outward in its *[1 - cosine]* oscillation, that core source of that *Flow* simultaneously experiences radially inward equal but opposite pulses of reaction momentum in accordance with Newton's third law of motion, to every action there is an equal but opposite reaction. In effect the core source is under radial reaction compression. Because that effect is usually radially uniform it produces no net affect on the particle. Figure 5-1.



Outward *Flow* Pulses Cause Equal but Opposite Reaction Pulses Inward to no Net Effect on the Particle's Motion

Figure 5-1

A PARTICLE'S FLOW ENCOUNTERING ANOTHER PARTICLE

In a universe of the myriad particles resulting from the Big Bang, each of those particles propagating its own outward *Flow* radially in all directions, there are many instances of the *Flow* from one particle [the "source" particle] encountering, running into, the outward *Flow* of another particle [the "encountered" particle]. Because the *Flow*s are spherically outward *Flow*s from spherically oscillating sources, such "source" particle *Flow*s are oscillatory and inverse square reduced in magnitude the farther that their wave front has traveled from its source.

The *Flow* behavior is analogous to that of an electric transmission line where the rate of travel of an oscillation down the line is determined by the time it takes to build up the electric current for each oscillation cycle through each infinitesimal increment of the line's distributed series inductance [L_p] and to build up the electric potential for each oscillation cycle on each infinitesimal increment [C_p] of the line's distributed shunt capacitance. The transmission line speed of *Flow* is determined by the well-established relationship equation (5-1).

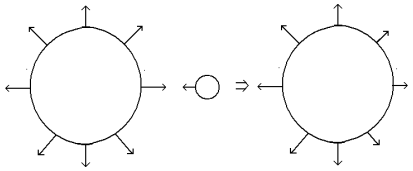
(5-1) $$\text{Speed}_{\text{Transmission Line}} = \frac{1}{\sqrt{L_p \cdot C_p}}$$

As presented in the preceding Section 5, the μ_0 and ε_0 are inherent in the substance of the oscillation, which means, μ_0 and ε_0 are also inherent in the outward propagation. Each particle's *Propagated Outward Flow* contains and carries its own μ_0 and ε_0.

For particles' propagating oscillating *Flow* the factor determining its speed of propagation is the time required to build up the *Flow* amount for each oscillation cycle through each infinitesimal increment of the *Flow*'s μ_0 and the *Flow*'s potential for each oscillation cycle on each infinitesimal increment of the *Flow*'s ε_0. But, in radially outward propagating particle's *Flow*, the *Flow* amount is inverse square spread out and the potential likewise both in exactly the same proportion as its μ_0 and ε_0. The ratio of the *Flow* amount to its μ_0 and of its *Flow* potential to its ε_0 remains constant, and so likewise the speed, radially outward, of its propagation, *c*.

Upon encountering another particle that arriving *Flow*'s then μ_0 and ε_0 (scalar quantities not vector and much inverse square reduced) combine with the (full magnitude as in the *Flow* as originated at the "source") μ_0 and ε_0 in the new outgoing propagation of the "encountered" center, the combined μ_0 sum and the combined ε_0 sum each being larger values than in the "encountered" particle's originating *Flow*. The result is that that "encountered" particle's new outward *Flow* is slowed relative to its natural otherwise speed. That is, its speed of *Flow* is determined by a combination of the parameters μ_0 and ε_0 larger than its *Flow*'s otherwise natural values. The speed of *Flow* is determined by the well-established relationship:

(5-2) $$\text{Speed} = \frac{1}{\sqrt{\mu_0 \cdot \varepsilon_0}}$$



PRE-ENCOUNTER FLOW EFFECT OF THE ENCOUNTER

Incoming Flow from a Distant Source Slows the Encountered Outward Flow
By Locally Increasing the Amounts of μ_0 and ε_0 Acting There

Figure 5-2

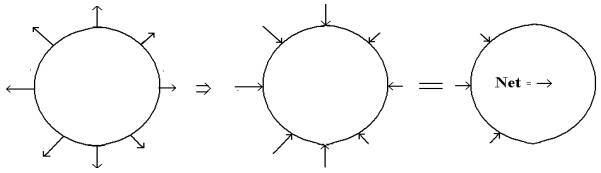
GRAVITATION IS THE MOMENTUM REACTION TO OUTWARD FLOW SLOWING.

The incoming *Flow* from a distant "source" particle having the effect of slowing the speed of the "encountered" particle's outward propagated *Flow* causes that "encountered" particle's outward *Flow* to have less momentum than if it were not slowed, again momentum being the product of mass and velocity.

Therefore the Newton's Third Law reaction to that reduced outward *Flow* momentum, that is the reaction back on the "encountered" particle, is smaller than otherwise. That effect takes place on the side of the "encountered particle" facing toward the "source" particle from which the slowing - causing *Flow* came.

But, on the opposite side of the "encountered" particle no such slowing of its outward propagated *Flow* is present so that the outward *Flow* there has the full natural momentum and the Newton's Third Law reaction on the particle on that side is the full natural amount. Consequently, the "encountered" particle experiencing its usual full momentum reaction back on itself on its side opposite that facing the incoming *Flow* from the "source" but experiencing reduced reaction back on itself on its side facing the incoming *Flow* from the "source", experiences a net momentum reaction toward the "source" particle from which the slowing-causing *Flow* came.

Thus the particle experiences $[1 - Cosine]$ pulses of momentum increase toward the "source" gravitationally attracting particle which is gravitational acceleration.



PARTIAL REDUCED FLOW CAUSES
PARTIAL LESS REACTION AND
NET MOMENTUM TOWARD SOURCE

Incoming Flow from a Distant Source Slows Part of the Encountered Outward Flow,
Which Reduces Part of the Reaction Momentum there,
Which Results in a Net Momentum Toward the Gravitational Source

Figure 5-3

As noted earlier the *[1 – cosine]* oscillatory form of the propagated wave is, in effect, a stream of pulses. The action of Figure 5-3 is of pulses of momentum toward the "source" gravitationally attracting particle at a repetition rate of the incoming pulses of *Flow* from that source, which is gravitational acceleration.

That is, the mass that is the "encountered" particle experiences *[1 – Cosine]* pulses of momentum increase toward the "source" gravitationally attracting particle. The "encountered" particle's mass is fixed; the momentum increases are velocity increases, an increment of velocity for each "pulse" in the stream of *Flow*. Those increments occur at the frequency of the pulses, their repetition rate as generated and propagated by the "source". That stream of velocity increments constitutes the gravitational acceleration.

DERIVATION OF NEWTON'S LAW OF GRAVITATION

In Section 4 a statement of the derived gravitational acceleration was obtained as equation 2*–17*, repeated below.

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

a quite pure, precise and direct statement of the operation of gravitation. It states that gravitation is a function of the speed of light, *c*, and the inverse square law, in the context of the oscillation frequency, f_S, corresponding to the attracting, source body's mass. It should be noted that equation *4–17* is exact without involving a constant of proportionality such as *G*.

The equation *2–17* result can also be obtained directly from consideration of solely how slowing is caused by μ and ε, which demonstrates that the cause of gravitation is the slowing of wave propagation presented just above. That is as follows.

For the *Medium* of the *Propagated Outward Flow* at the instant of its propagation from its source center responding to its own μ_0 and ε_0, the value of those two are constant at what we term their free space values. Those values are inverse square reduced as the medium carrying them propagates outward from their source center-of-oscillation. (The speed of wave propagation remains the same because the waves are also inverse square reduced in amplitude.)

(5–3) (1) At distance δ from the center of the source center, the first place where the propagated medium appears and where its concentration is greatest, the values of μ and ε are the free space values:

$$\mu = \mu_0 \qquad \text{and} \qquad \varepsilon = \varepsilon_0$$

(2) Per the inverse square law, the values at distance *"d"* from the center of the source center are:

$$\mu(d) = \mu_0 \cdot \frac{\delta^2}{d^2} \qquad \text{and} \qquad \varepsilon(d) = \varepsilon_0 \cdot \frac{\delta^2}{d^2}$$

Then, the overall net effective values when *Flow*ing medium from a distant center passes through the outward propagation of an encountered center are

(5-4)
$$\mu_{net} = \left[\mu_0 + \mu_0 \cdot \frac{\delta^2}{d^2}\right] = \mu_0 \cdot \left[1 + \frac{\delta^2}{d^2}\right]$$

$$\varepsilon_{net} = \left[\varepsilon_0 + \varepsilon_0 \cdot \frac{\delta^2}{d^2}\right] = \varepsilon_0 \cdot \left[1 + \frac{\delta^2}{d^2}\right]$$

The resulting net speed of propagation is, then

(5-5)
$$c_{net} = \frac{1}{\left[\mu_{net} \cdot \varepsilon_{net}\right]^{½}} = \frac{1}{\left[1 + \frac{\delta^2}{d^2}\right] \cdot \left[\mu_0 \cdot \varepsilon_0\right]^{½}}$$

$$= \frac{c}{\left[1 + \frac{\delta^2}{d^2}\right]} = \frac{d^2}{d^2 + \delta^2} \cdot c$$

and the amount of the slowing is

(5-6)
$$\Delta c = c - c_{net}$$

$$= c \cdot \left[1 - \frac{d^2}{d^2 + \delta^2}\right]$$

$$= c \cdot \frac{\delta^2}{d^2 + \delta^2}$$

$$= c \cdot \frac{\delta^2}{d^2}$$ [d^2 is much greater than δ^2]

so that

(5-7)
$$\Delta v = c \cdot \frac{\delta^2}{d^2}$$ [the slowing, Δc, equals the velocity change, Δv]

which is identical to equation *2-17*, above.

Equation *(2-17)*, above, gives the gravitationally caused velocity change per cycle of the incoming gravitational wave field. The time rate of those velocity change increments, i.e. the gravitational acceleration, a_g, is Δv times the incoming wave's frequency, which is the source center's frequency, f_s.

(7-8)
$$a_g = \Delta v \cdot f_s$$

$$= c \cdot \frac{\delta^2}{d^2} \cdot f_s$$

$$= c \cdot \frac{\delta^2}{d^2} \cdot \frac{m_s \cdot c^2}{h}$$ [m_s = the source center's mass;

$$= G \cdot \frac{m_s}{d^2}$$ [substituting G per equation *2-14* re the definition of the Planck Length and equation 2-16 re definition of δ]

(7-9) $F_g = a_g \cdot m_e$

$$= G \cdot \frac{m_s . m_s}{d^2}$$ [m_e is the encountered center's mass.]

which is Newton's Law of Gravitation.

There is a streaming outward *Flow* of pulses of momentum from every particle and one of the effects of that stream upon its encountering another particle is to force a net acceleration of the "encountered" particle back toward the "source" particle, the effect that we call "gravitational attraction". The effect results from the "source" *Flow* combining its μ_o and ε_o with those of the "encountered" *Flow* causing slowing its speed of propagation.

Modification of that *Flow* before it can act on the "encountered" particle
is the means to control of gravitation.

Such modification uses the same effect as does the cause of gravitation – the μ_o and ε_o of particles' *Flow*s combining to slow the *Flow*s.

Analysis and development of the means to such modification of that *Flow* is presented in the following Sections.