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SECTION 3

The Behavior of Matter

The Particle "Core"

Gravitational Equivalent Frequency

Consider a small individual particle such as a proton. The gravitational action of a massive body is the collective effect of the individual action, below, in each of its such particle components.

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,

$$(3-1) \quad a_{grav} = G \cdot \left[\frac{m_{source}}{d^2} \right]$$

stating that gravitation is a property of a body's mass.

However, mass and energy are equivalent, so that a mass, m , is proportional to a frequency, f , that is characteristic of that mass. That is

$$(3-2) \quad m \cdot c^2 = h \cdot f \quad \text{or} \quad f = \left[\frac{c^2}{h} \right] \cdot m$$

so that the m_{source} of equation 3-1 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, Δv , in the velocity, v , of the attracted mass per time period, T_{source} , of the oscillation at the corresponding frequency, f_{source} , as follows.

$$(3-3) \quad a_{grav} = \Delta v / T_{source} = \Delta v \cdot f_{source}$$

Gravitation and the Planck Length

It can then be reasoned using equation 3-3 = equation 3-1 as follows .

$$(3-4) \quad a_{\text{grav}} = \Delta v \cdot f_{\text{source}} = G \cdot \left[\frac{m_{\text{source}}}{d^2} \right]$$

equation 3-5 is obtained by using that frequency is proportional to mass so that with f_p and m_p as the proton frequency and mass then $f_{\text{source}} = [m_{\text{source}} / m_p] \cdot f_p$.

$$(3-5) \quad \Delta v \cdot \left[\frac{m_{\text{source}}}{m_p} \right] \cdot f_p = G \cdot \left[\frac{m_{\text{source}}}{d^2} \right]$$

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

$$(3-6) \quad \Delta v = \frac{G \cdot m_p}{d^2 \cdot f_p} \text{ per cycle of } f_{\text{source}}.$$

Then substituting, per equation 3-2, $m_p = [h \cdot f_p] / c^2$,

$$(3-7) \quad \Delta v = \left[\frac{G}{d^2 \cdot f_p} \right] \cdot \left[\frac{h \cdot f_p}{c^2} \right]$$

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

The Planck Length, l_p , is defined as

$$(3-8) \quad l_p \equiv \left[\frac{h \cdot G}{2\pi \cdot c^3} \right]^{\frac{1}{2}} \text{ so that } G = \left[\frac{2\pi \cdot c^3 \cdot l_p^2}{h} \right]$$

Substituting G as a function of the Planck Length from equation 3-8 into G as it is in equation 3-7, the following is obtained.

$$(3-9) \quad \Delta v = \left[\frac{2\pi \cdot c^3 \cdot l_p^2}{h} \right] \cdot \left[\frac{h}{d^2 \cdot c^2} \right]$$

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

This result states that:

- the velocity change due to gravitation, Δv ,
- per cycle of the attracting mass's equivalent frequency, f_{source} ,
which quantity, $\Delta v \cdot f_{\text{source}}$, is the gravitational acceleration, a_{grav} ,
- is a specific fraction of the speed of light, c , namely the ratio of:
 - 2π 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, Δv , per cycle of that attracting mass's equivalent frequency, f_{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 3-9 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.

(3-10) The fundamental distance constant, δ

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

$$\delta = 4.051,348,7 \times 10^{-35} \text{ meters} \quad [2018 \text{ CODATA Bulletin}]$$

equation 3-9 then becomes equation 3-11.

$$(3-11) \quad \Delta v = c \cdot \frac{\delta^2}{d^2} \text{ per cycle of } f_{source}$$

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_{source} , corresponding to the attracting, source body's mass. It makes clear that an oscillation is an integral part of gravitation

The Particle "Flow"

It is difficult to conceive of the immense and complicated set of interactions, *i.e.* each individual particle paired in gravitational interaction with each other individual particle, taking place via the individual gravitational masses each "curving space" to serve its own gravitational action. The difficulty is especially so in the absence of explanation of how "space" is subject to being curved and by what mechanism the curving is effected.

There being a need for each gravitationally acting [attracting] particle to communicate to each gravitationally acting [attracted] particle the direction from the attracted particle to the attracting one and the magnitude of the attracting particle's gravitational attraction, there must be something flowing, continuously, carrying that information, spherically outward, from every gravitating particle to every other gravitating particle. That flow-communication is the gravitational field, an active process not a static state.

Furthermore, the necessity for gravitation that an oscillation and its frequency are closely involved in the effect [equations 3-11 and 3-9] and therefore in what is communicated by the flow means that the flow itself must be oscillatory.

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

Having now just determined:

- That δ sets a limit on the minimum separation distance in gravitational interactions and therefore implies 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 the outward flow,
- The only reasonable conclusion is that that reservoir is a spherical “core” of radius δ at the center of all particles, and
- That its impenetrability is due to its immense concentration [billions of years worth of flow] of the flow substance [hereinafter *medium*] in the minute [$\delta = 4.0513487 \times 10^{-35}$ meters radius per equation 3-10] center of every particle.

But, 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 it to flow, the speed of light, c .

That establishes the on-going outward flow serving the role of gravitational field as a property of every particle [the protons and electrons and their anti-particles of equation 2-6] and establishes the supply of medium supporting that flow.

Having established the supply of medium’s on-going outward flow serving the role of gravitational field as a property of every particle, 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 [the protons and electrons and their anti-particles of equation 2-6] has a need to communicate its “message” to every other such particle: the direction back from the encountered particle to the transmitting one, the magnitude of the transmitting particles’ charge, and the nature of the charge, whether positive or negative. That flow-communication is the electric field, an active process not a static state.

Furthermore, for that flow to persist and to have persisted the billions of years since the “Big Bang” there must be a supply of that which is flowing outward for it at the center of every particle. And, that “supply” must be an extremely concentrated [relative to the outward flow] reservoir of that which flows outward.

Two simultaneous such flows constituting the two fields and two supporting reservoirs supplying the flows is clearly untenable. There can only be one reservoir in

each particle’s “core” and one resulting flow producing both the gravitational field and the electric field if for no other reason than because two supply reservoirs would mutually interfere with comprehensive spherically outward flow of each.

When particles having charge, [the protons and electrons and their anti-particles of equation 2-6], are in motion at various speeds in various directions, they still exhibit their electrostatic Coulomb behavior [constant radially outward flow] at each “still” instant of their motion. And, when they are so in motion they also exhibit their magnetic Ampere behavior [outward flow modified by their motion] at each “momentary constant velocity instant” of their motion.

When the motion involves changing speed and / or changing direction the effect is a smooth continuous “stream” of the individual states exhibited at each instant of the motion, each successive state being an imprint on the otherwise radially outward flow, of the particle.

In electronic communications information is carried as variations, modulation, of the smooth, otherwise unchanging oscillation, the carrier wave. In the case of the stream of the individual states exhibited at each instant of the motion of an electric charge the “information carried” modulation of the carrier is the succession of the various forms of the particle’s outward flow. The variations in the electric charge’s outward flow are a modulation of what its outward flow would be if the electric charge were not in motion, which is the “carrier wave”.

That stream of flow modulated by a succession of the various states of motion of the source electric charges, or rather the actual modulation itself, appears to us as what we term electro-magnetic waves, of light or other. Light is a modulation, an imprint, on the propagating outward flow that also carries the gravitation.

Therefore the one single reservoir and resulting flow is a flow of gravitation and of light. Light and gravitation are the same flow.

From the “Summary and Abstract” at this book’s beginning:

There are two fundamental problems of gravitation:

- The first is that the widely accepted and dominating theory of how gravitation operates, that of Einstein’s “General Theory of Relativity”, is wrong and suffers from not being supported by any demonstrated mechanism.

That erroneous theory is that the cause of gravitation is the curving of space by the gravitational mass of physical bodies.

- The second is that the method of implementation of the original physical law of gravitation, that of Newton’s Law of Gravitation, misinterprets that law and applies that misinterpretation in all gravitational determinations.

That error of implementation is the assumption that gravitation can be treated as acting as if all of the gravitational mass of gravitating bodies were concentrated at the center of mass of each body.

It is now time to address those two problems.

