

Article

## On the Emergence of Physical World from the Ultimate Reality

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### ABSTRACT

Based on the statements of several prominent scientists and the reasoning presented in the my article “On the nature of Consciousness, Space & Omnipresence of GOD” also appearing in this issue, I argue that space is not an empty - void extension of nothingness; rather, there exists an ultimately real entity which is all-pervading in space and ever-present in time. This ultimate reality may be visualized as “mutually-balanced electrostatic field”. It is suggested that matter is just a process or phenomenon of fluctuation spontaneously generated in this ultimate reality. It is then logically derived that only spherical patterns of fluctuations are sustained for longer durations, so there are a number of spherical fluctuation-patterns, which we perceive as the fundamental particles of matter. Further, a mathematical derivation is presented which supports the logic that a particle of matter is a localized spherical standing wave. This approach leads to: (i) a new insight into the wave-particle duality of fundamental particles; and (ii) a new understanding that the currently considered quantum-mechanical waves are envelop-variations or modulations of the actual more fundamental waves considered here. This understanding of the nature of particles leads us to a new understanding of gravity and an explanation for the observed relative strengths of the gravitational and electric forces.

**Key Words:** ultimate reality, physical world, fundamental particle, mutually balancing, electrostatic field, quark, quantum wave, Doppler shift.

### 1. Introduction

Robert B. Laughlin, Nobel Laureate in Physics, had this to say [1]:

It is ironic that Einstein's most creative work, the general theory of relativity, should boil down to conceptualizing space as a medium when his original premise [in special relativity] was that no such medium existed. The word 'ether' has extremely negative connotations in theoretical physics because of its past association with opposition to relativity. This is unfortunate because, stripped of these connotations, it rather nicely captures the way most physicists actually think about the vacuum. Relativity actually says nothing about the existence or nonexistence of ether pervading the universe, only that any such medium must have relativistic symmetry. It turns out that such a medium does exist. About the time relativity was becoming accepted, studies of radioactivity began showing that the empty vacuum of space had spectroscopic structure similar to that of ordinary quantum solids and fluids. Subsequent studies with large particle

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accelerators have now led us to understand that space is more like a piece of window glass than ideal Newtonian emptiness. It is filled with 'stuff' that is normally transparent but can be made visible by hitting it sufficiently hard to knock out a part. The modern concept of the vacuum of space, confirmed every day by experiment, is a 'relativistic ether'. But we do not call it this because it is taboo.

Einstein sometimes used the word '*ether*' for the gravitational field within general relativity, but this terminology never gained widespread support [2-3]:

We may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an '*ether*'. According to the general theory of relativity space without '*ether*' is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense. But this '*ether*' may not be thought of as endowed with the quality characteristic of ponderable media, as consisting of parts which may be tracked through time."

Einstein was also not happy with the probabilistic interpretation of matter waves. According to Einstein, "GOD does not play dice".

Further, Louis de Broglie stated: "any particle, even isolated, has to be imagined as in continuous "energetic contact" with a hidden medium" [4-6]. It has been suggested by Paul Dirac that: "This 'quantum vacuum' may be the equivalent in modern physics of a particulate ether" [7].

The herein author has been of the opinion that: (i) if there were chance phenomena at the sub-microscopic level, there could not be any order in the macroscopic world; an ensemble of random processes cannot have a regular wavelike shape; and (ii) if space were void extension of nothingness, curvature of space and expansion of space could not have meaning [8-9-10].

Therefore, we consider here a new approach, beginning with a postulate that: space is not a void extension of nothingness; rather, there exists a highly subtle ultimate reality which is present everywhere in the space, for all the time. This ultimate reality can be imagined as 'mutually balancing electrostatic field'; and it is free to remain steady or fluctuate or vibrate. So, there are fluctuations or perturbations spontaneously sprung in it. Particles of matter are not things; rather, a particle is a process, like the whirl pool or vortex, generated in the ultimate reality. And based on this postulate, I will attempt to derive the observed physical world and the observed relative strengths of gravitational and electric forces.

## 2. The Postulates

Space is not a void extension of nothingness; rather, there exists a highly subtle ultimate reality which is present everywhere in the space, for all the time. This ultimate reality can be imagined as 'mutually balancing electrostatic field'; and it is free to remain steady or fluctuate or vibrate; so there are fluctuations or perturbations spontaneously sprung in it. The fluctuations generated in the ultimate reality get transmitted in the manner of waves at a constant speed of light. Energy

and matter are just a process or a phenomenon of fluctuations generated in the ultimate reality; they are just a dynamic aspect of the ultimate reality. We are so far able to perceive and measure only the dynamic aspect of the ultimate reality with the help of instruments made up of energy and matter.

### 3. Steps leading to the nature of fundamental particle

(i) We can imagine the ultimate reality as a continuum - a 'soup' of electrically positive and negative points. Because of 'continuum' nature of the ultimate reality, when a small labeled part in it moves from 'a' to 'b' as shown in fig.1, it gives rise to a chain of displacements, completing a closed path; by the dot 'z' occupying the place of 'a', as shown in the fig.1 below:

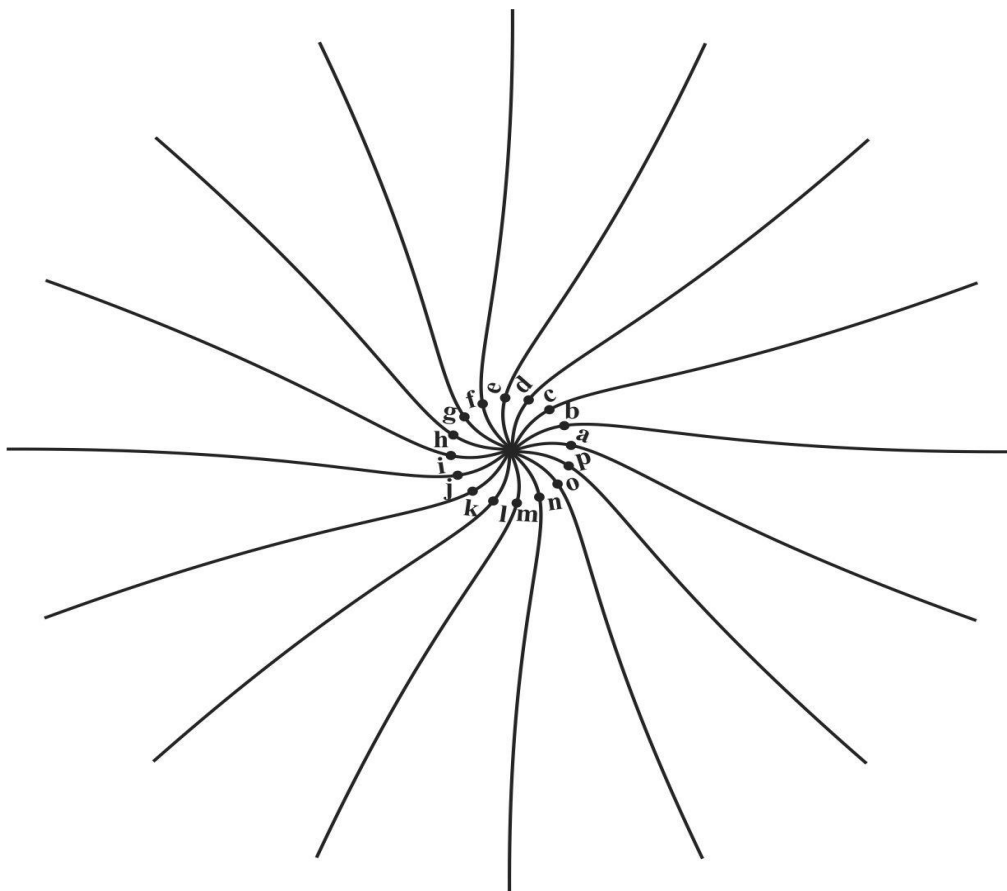


Fig.1: Because of the continuum nature of the ultimate reality, when a small labeled dot 'a' moves to 'b', 'b' moves to 'c' ....completing a closed path by 'z' shifting to 'a'.

(ii) There is no preferred axis about which these dots should complete a closed path; so they move partly about x-axis, partly about y-axis and partly about z-axis to complete the closed path. So this path can be described as a small-circle on an imaginary 'large-spherical shell' in the ultimate reality.

(iii) This process of close-loop-fluctuations of fields experiences no resistance, and so these spherical patterns of fluctuations continue for millions of years. There are integer number of such discrete fluctuation-patterns, as shown in Fig.2 below, to which we perceive as the ‘fundamental particles’ like the quarks. Fig.2 shows that the amplitude of waves increase with radial distance up to the quarter wavelength, and then start falling inversely with further increase of radial distance. These fluctuations generated in the ultimate reality get transmitted at a finite velocity, of light.

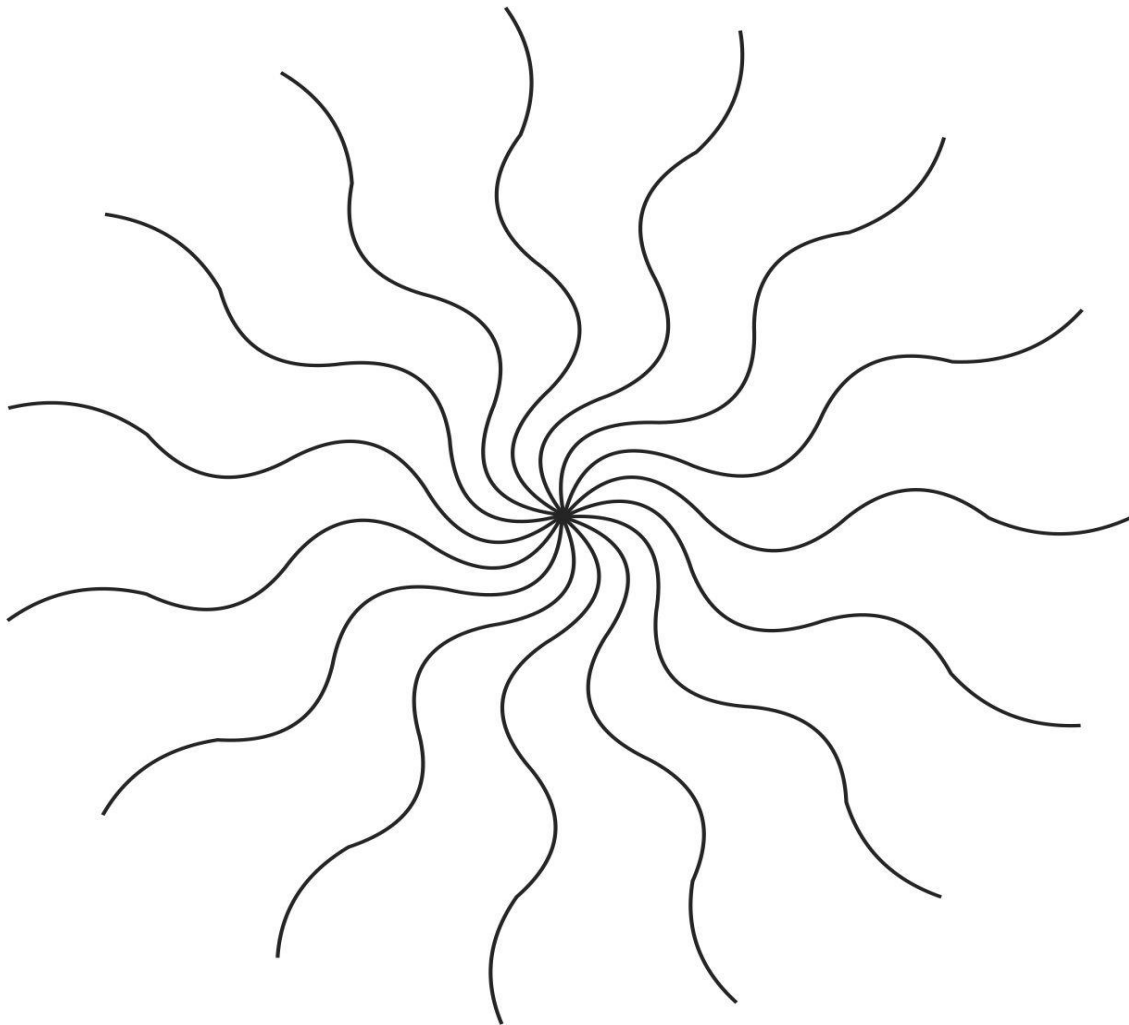


Fig.2: A “snap-shot” of wave-amplitudes of a “cross-section” of the ‘spherical-fluctuation-pattern’.

(iv) The figure below shows the peaks of wave-amplitudes of the spherical fluctuation-pattern.

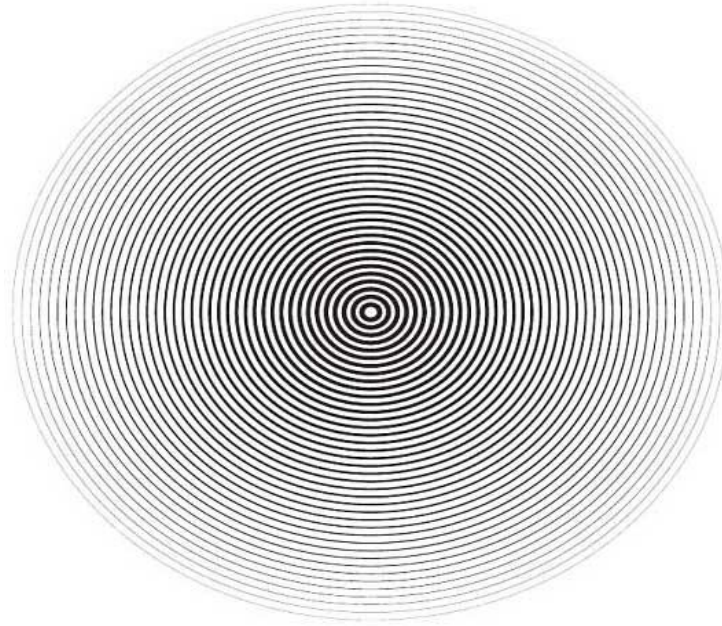


Fig.3: Concentric-circles showing peaks of wave-amplitudes of the ‘spherical-fluctuation-pattern’

When three patterns of the previous figure interfere, they give rise to radial lines of maxima and minima as shown in fig.4 below.

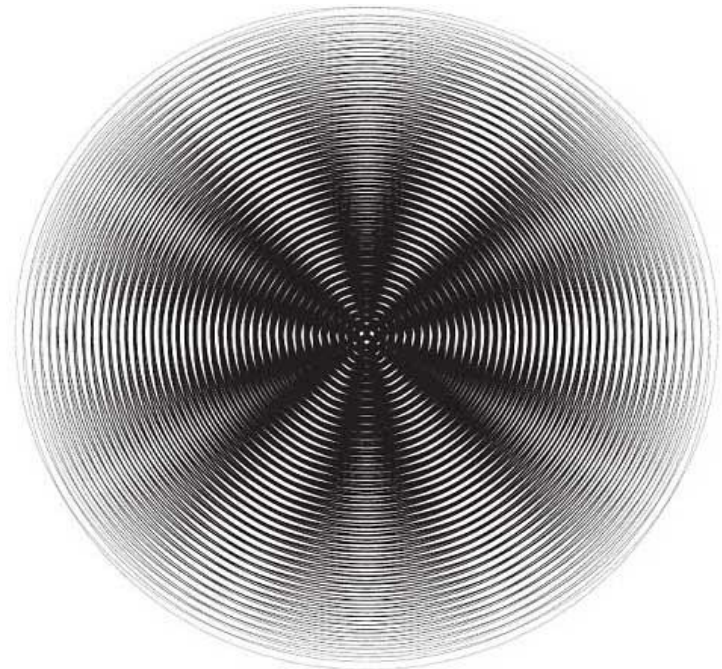


Fig.4: Interference of three spherical-fluctuation-patterns, whose maxima emerge as radial-lines.

When such radial lines, of the above figure, interfere with another set of radial lines, they give birth to a pattern very similar to the 'magnetic lines of force', as shown in fig.5 below. Thus it is the spherical fluctuation-pattern, which is the most fundamental, whose hierarchical layers of interference appear as different kinds of fields, like the 'electric-field' and the 'magnetic-field'.

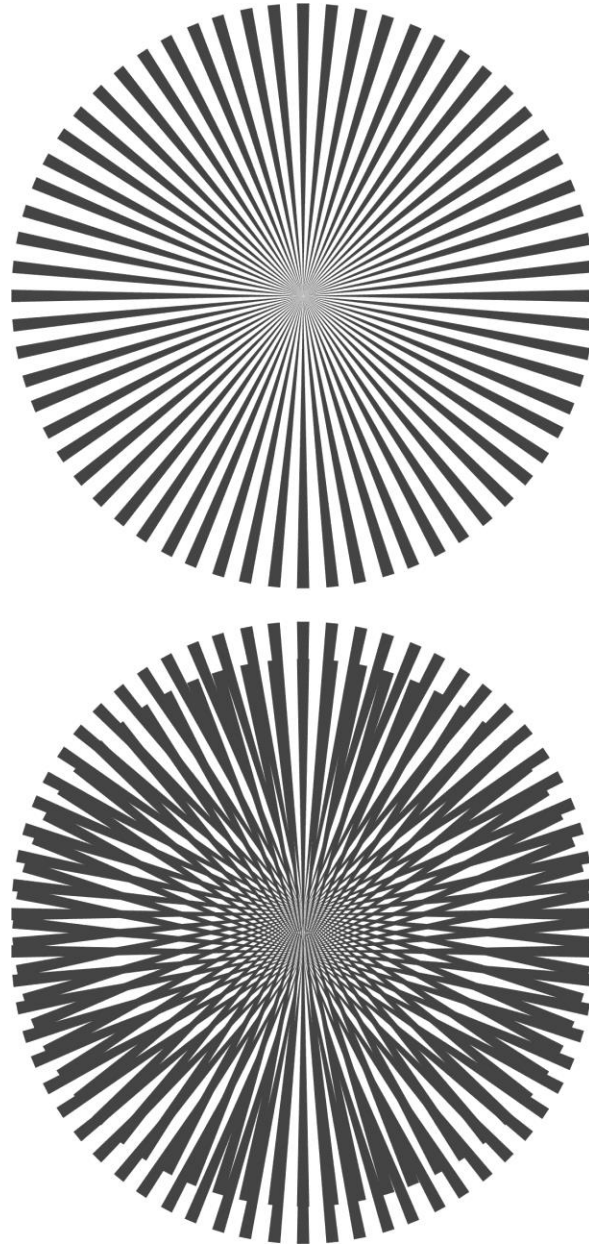


Fig:5: Radial-lines (top) representing interference-maxima of the previous figure; and second layer of interference of two such radially-outwards-lines(bottom) producing a pattern similar to the 'magnetic lines of force' around a permanent-magnet.

Because these spherical patterns shown in fig. 2, are of micro-microscopic size, they appear to us as 'point particles'; so they can be mathematically represented as 'pulse-function' in space; and it

can be Fourier transformed in to the wave-number-domain giving a wide band of wave-numbers. The pattern can also be represented in the frequency-domain, as a wide band of frequencies. Now, if the spectral components of two such spherical patterns are coherent, then they add constructively and bring the patterns closer and closer; and when they add destructively then they repel the patterns away from each other. In the case of radio-station-antennas and arrays, the amplitudes of waves get added or subtracted and the antennae remain firmly fitted in the ground; whereas in the case of interactions of the 'fundamental-particles' depending upon the constructive or destructive interference of waves, the antennae (i.e. the particles-themselves) change their positions! So, 'fundamental-particles' are like 'free-floating-antennas! The strength of interference depends on the coherence of spectral components.

#### 4. Scientific evidence in support of the standing-wave nature of the fundamental particles

The relationship among the 'energy-momentum-four-vectors' of the Special Theory of Relativity is:  $(mc^2)^2 - p^2c^2 = (m_0c^2)^2$ . We can express this relation as a right-angle-triangle of the fig. 6-a below, whose three sides are also related similarly. The three sides of the right-angle-triangle can also be viewed as vectors, as shown in the fig. 6-a. Now, we know that communications-engineers represent electric-signals like  $\text{Sin}w(t)$  and  $\text{Cos}w(t)$  as rotating 'vectors'. Similarly, we can translate the vectors of the fig. 6-a as 'signals' shown in the fig. 6-b.

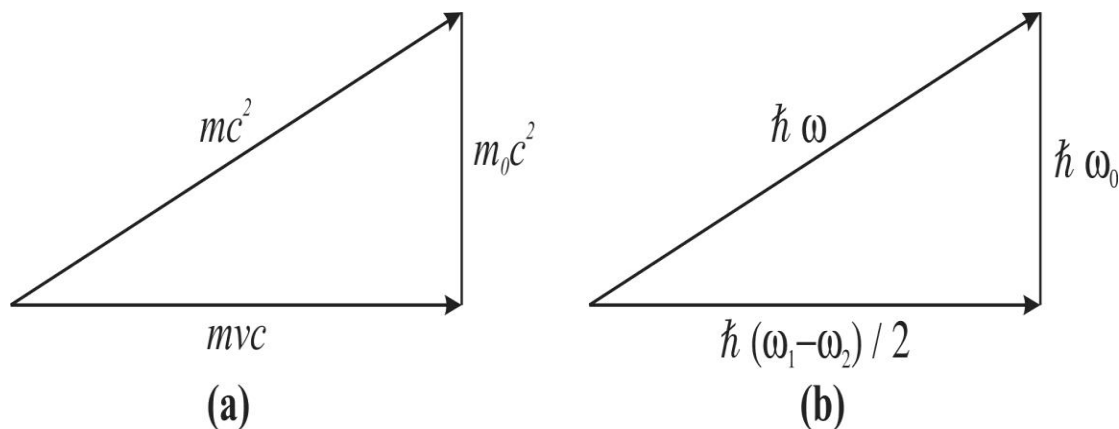


Fig.6: (a) Geometric representation of energy-momentum-four-vector of the special relativity; and (b) its wave-theoretical-translation.

In the figure: 6-a, the horizontal vector  $m v$  represents the magnitude and direction of vector-sum of three components of momentum  $m v_x, m v_y$  and  $m v_z$ .

Now, by using Planck's relation,  $E = \hbar \omega$ , and Einstein's relation,  $E = m c^2$ , we get the relations:  $m c^2 = \hbar \omega$ ; therefore,  $m c = \hbar \omega / c$ ,  $m_0 c = \hbar \omega_0 / c$ , and:

For the momentum,  $m v = m_0 v / (1 - v^2/c^2)^{1/2}$

$$\text{i.e. } m v = m_0 v c / (c^2 - v^2)^{1/2}$$

$$\text{i.e. } m v = (\hbar \omega_0 / 2 c) [ 2 v / [(c - v) (c + v)] ]^{1/2}$$

$$\text{i.e. } m v = (\hbar \omega_0 / 2 c) [ \{ (c + v) / (c - v) \}^{1/2} - \{ (c - v) / (c + v) \}^{1/2} ]$$

$$\text{i.e. } m v = [ \{ \hbar \omega_0 \{ (c + v) / (c - v) \}^{1/2} \} - \hbar \omega_0 \{ (c - v) / (c + v) \}^{1/2} ] / 2c \quad (1)$$

We can write  $\omega_1$  for the term,  $\omega_0 \{ (c + v) / (c - v) \}^{1/2}$ , and we know that  $\omega_1$  is a longitudinally Doppler-shifted frequency, when the source of light of frequency  $\omega_0$  ‘approaches’ the observer with a relative-velocity  $v$ . Similarly, we can write  $\omega_2$  for the term,  $\omega_0 \{ (c - v) / (c + v) \}^{1/2}$ , and we know that  $\omega_2$  is a longitudinally Doppler-shifted frequency, when the source of light of frequency  $\omega_0$  ‘moves away’ from the observer with a relative-velocity  $v$ . So, we can write:

$$m v = [ \hbar \omega_1 - \hbar \omega_2 ] / 2c, \text{ as shown in the figure: 6(b)} \quad (2)$$

The expression-1 can be interpreted as follows: We can consider a ‘particle’ of matter as a ‘standing-wave’ formed by a combination of two waves traveling in opposite directions with a velocity  $c$ . The wave traveling in the forward direction gets Doppler-shifted such that:

$\omega_1 = \omega_0 \{ (c + v) / (c - v) \}^{1/2}$ ; and for the wave traveling in the opposite direction, we should take  $(-c)$  for  $c$ , so the Doppler-shifted-frequency  $\omega_2 = \omega_0 \{ (c - v) / (c + v) \}^{1/2}$ . Thus we can express the momentum of a particle as  $m v = [ \hbar \omega_1 - \hbar \omega_2 ] / 2c$ . Similarly, we can express the ‘energy’ of a moving ‘particle’ as

$$E = [ \hbar \omega_1 + \hbar \omega_2 ] / 2 \quad (3)$$

This discussion leads us to physical interpretation of De-Broglie’s ‘matter-wave’ as ‘envelop-*variations*’ of the combined wave, composed of two waves traveling in opposite directions as shown in the graphs below. And ‘energy’ of a ‘moving-particle’ is the ‘*summation of energies*’ of the two constituent-waves traveling in the opposite directions and initially having half of the rest-mass-energy.

## 5. Some insight into de-Broglie’s matter waves

The wavelength of de-Broglie’s ‘matter-waves’ is conventionally expressed as:  $\lambda_B = h / m v$ .

Now, based on the expression 1:



$$\lambda_B = 2 h c / [ \hbar \omega_1 - \hbar \omega_2 ] \tag{4}$$

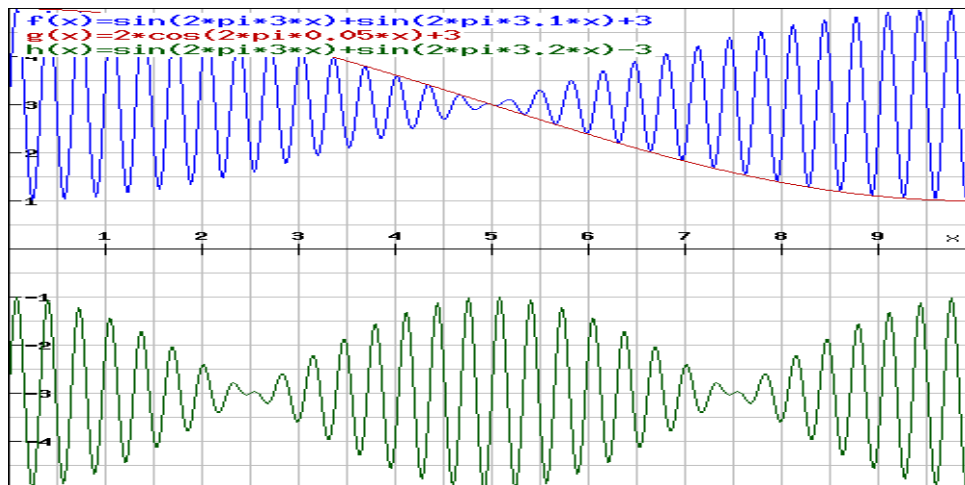
We can find the wavelengths:  $\lambda_1 = h c / \hbar \omega_1$  and  $\lambda_2 = h c / \hbar \omega_2$

Where:  $\lambda_1$  is wavelength of the Doppler-shifted-wave *approaching* the observer; and  $\lambda_2$  is wavelength of the Doppler-shifted-wave *moving-away from* the observer. From the expression-4 we find that de-Broglie-wavelength is a ‘distance between the two constructive-superimpositions of the two Doppler-shifted constituent-waves’, as shown in the fig. 7 below:

When  $\lambda_1$  and  $\lambda_2$  are equal, then the next place of constructive-superimposition can be at the infinite distance. As the difference between  $\lambda_1$  and  $\lambda_2$  gets increased, the places of their next superimpositions come closer-and-closer, reducing de-Broglie’s wavelength  $\lambda_B$ . And from the discussion of the preceding section we find that a ‘particle’ is a superimposition of the two Doppler-shifted-waves, traveling in opposite directions. So, we can expect the detection of the ‘particle’ only at a place and time where-and-when the two waves of two Doppler-shifted-wavelengths  $\lambda_1$  and  $\lambda_2$  add constructively; and not at the places where the wave of de-Broglie-wavelength add constructively; as is expected conventionally. Moreover, as we find from the Fourier-transform of the pulse-function, a ‘particle’ is a *band* of frequencies, so, we can expect ‘detection’ of the ‘particle’ at the place where the spectral-components of this whole *band* emerging from the double slits get added constructively, and not just the wave of single de-Broglie-wavelength, as is expected currently.

In the double-slit-particle-interference-experiments, the Doppler-shifted-waves of both the wavelengths pass from both the slits and wherever they add constructively, a ‘particle’ is detected. Based on this new insight it may be possible to make deterministic prediction of the place of next detection. Or, at least, with this insight we get an explanation, how difficult it is to make a deterministic-prediction, though it is possible in theory.

The graphs shown in the figure below show superimposition of the two Doppler-shifted waves; and de Broglie’s wave as per the expression-4 as envelop-variation of the combined wave:



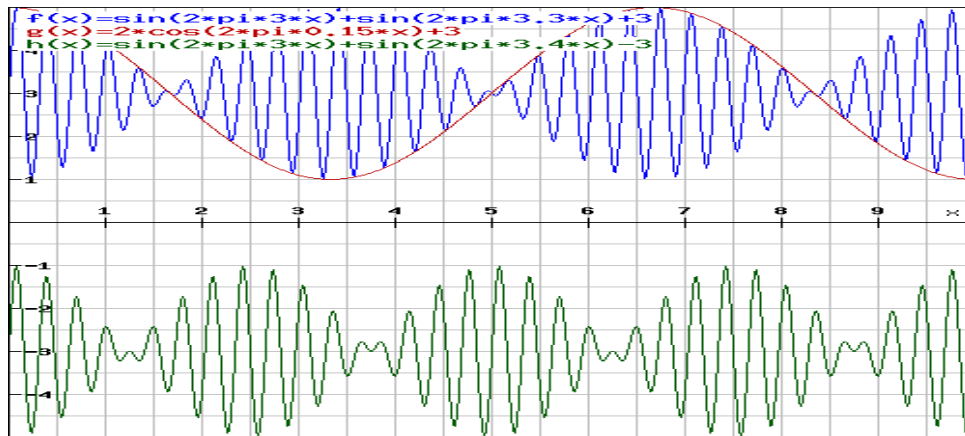


Fig.7: The waves in blue and green colors showing superimposition of two Doppler-shifted-waves; and the wave in red-color, showing envelop-variations of the superimposed-waves, which we have been knowing as the de Broglie’s ‘matter-wave’. As the difference between the two Doppler-shifted-waves increases, the de-Broglie-wavelength goes on reducing.

Thus, we are led to an insight that a stationary-particle is a ‘standing-wave’ of frequency  $w_0$  as shown in the figure-2, as was first expressed by this author in [8-9].

Annihilation of the ‘electron-positron-pair’ leaving behind a pair of ‘photons’; and the ‘photon-photon-interactions’ of two gamma-photons also provide a supportive-evidence for the ‘standing-wave-nature’ of ‘particles’ proposed here. We know from the experience of ‘directional-antennae’ and ‘arrays’ that when wave-amplitudes cancel in one direction, their energy gets added in the other direction; so the electron and the positron which were approaching, experience cancellation of one of their constituent waves in the forward direction and constructive addition of the other constituent waves, converting them to photons, and moving away from each other.

Finally, we know that a ‘particle’ of matter is actually a spherical wave-packet. So, it contains a bell-shaped ‘band’ of frequencies, instead of only one frequency  $w_0$  so far considered by us. So the Doppler-shifts discussed by us are actually the shifts of the whole ‘bands’ of the frequencies; and  $w_0, w_1$  and  $w_2$  are just ‘mean-values’ of the wide bands.

## 6. Possible New explanation for gravity

Let us assume that there are some most-fundamental-particles, and a long-range fundamental-force. We can take the mass of the ‘most-fundamental-particle’ as a unity, and think that all the massive objects are collections of the ‘most-fundamental-particles’.

Now, by a ‘particle’ we mean an entity which is localized in an extremely small space; so, a ‘particle’ can be mathematically represented in the space-domain as an impulse-function. This

impulse-function can be Fourier-transformed into the ‘wave-number-domain’. Then assuming a constant velocity of transmission of these waves, at the velocity of light, we can represent these waves in the ‘frequency-domain’ as a wide band of frequencies, as shown in the figure below.

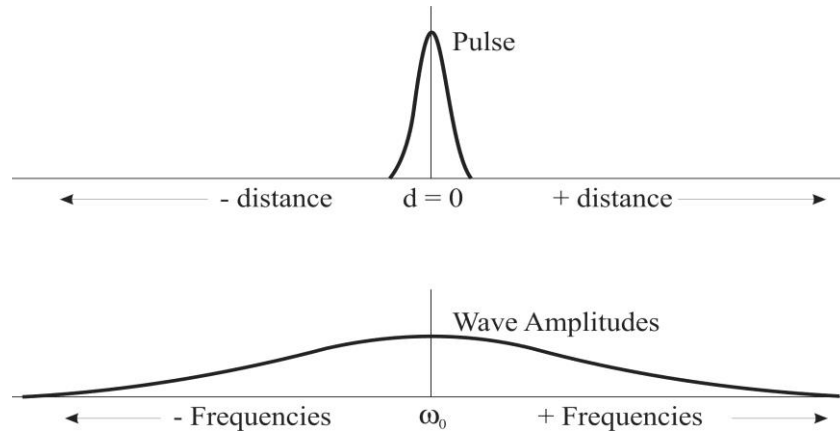
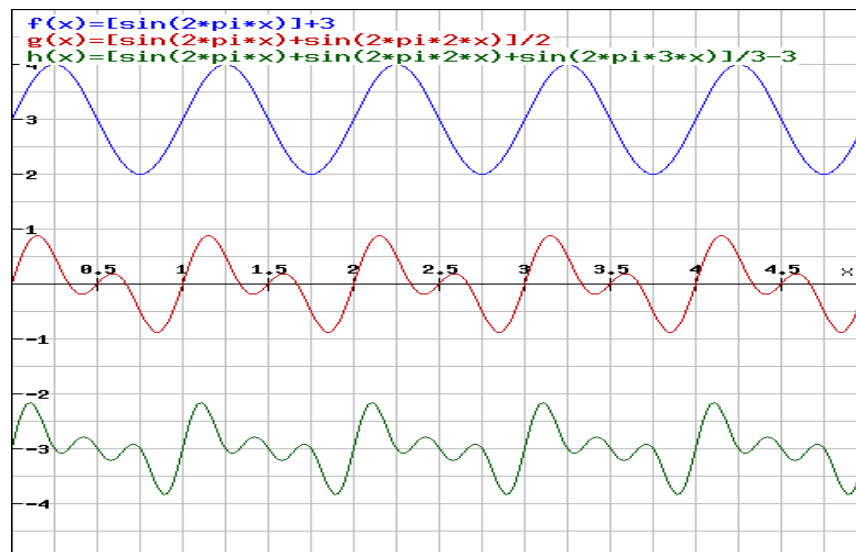


Fig.8: A ‘particle’ mathematically represented as a ‘pulse-function’(top); and its frequency-domain-representation (bottom).

A particle of matter has a wide band of frequency-spectrum and a definite phase-spectrum. When this wide band of waves travels in space, then a ‘particle’ becomes manifest only at a place and time when-and-where all the spectral-components add constructively, and have a particular, definite phase-relation, otherwise the particle remains dissolved in the un-manifest-state, as shown in the graphs below:



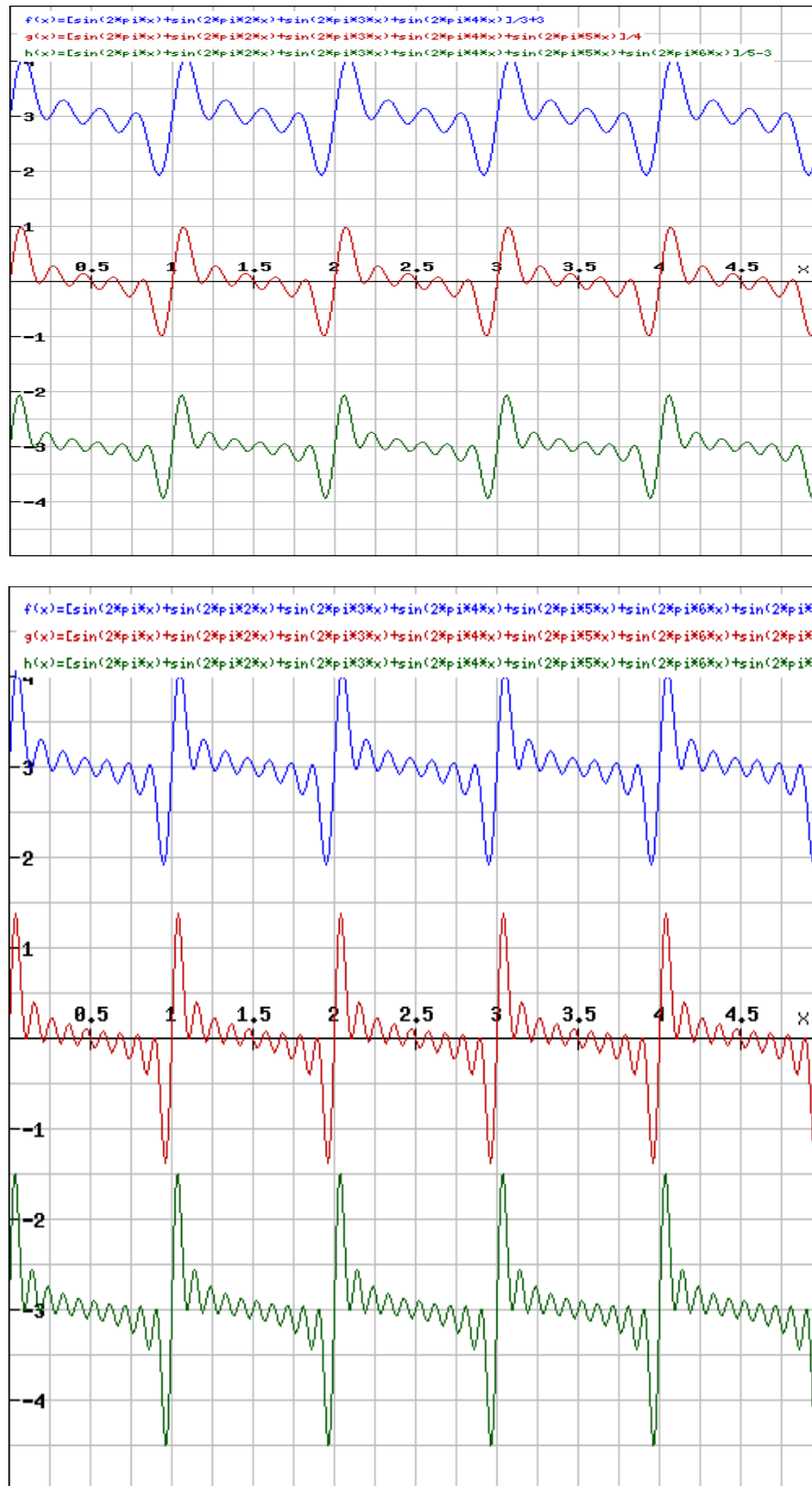


Fig.9: Figure showing ‘waves’ becoming ‘particles’: As we add more and more higher-harmonics to the fundamental-wave, they go on getting localized, like the ‘particles’.

Secondly, we cannot expect any coherence between the spectral-components of one and the other ‘particle’. That means, that when two or more such fundamental-particles come close to each other, the wide bands of their waves add like the incoherent superimposition of wideband-noise.

We know that the superimposition of  $n$  number of wide-band noise-sources of unit-amplitude is square-root-of  $n$ ; like the vector-sum of  $n$  mutually orthogonal unit-vectors. That is:

$$N(t)=[(N_1(t))^2 + (N_2(t))^2 + (N_3(t))^2 \dots + (N_n(t))^2]^{1/2} \quad (5)$$

Now, if the strength of ‘coupling-constant’ of a fundamental-force is, say,  $e^2$ , which is the strength of electric-force of the proton, then the strength of ‘coupling-constant’ of a new “fundamental-force”, which is actually due to ‘incoherent-superimposition’, within the system of  $n$  fundamental-particles will be:  $[(n^{1/2} e^2) / n]$ . Since the total-mass of the universe  $M_0$  is  $10^{80}$  proton-masses, the strength of gravitational-force between the two protons is expected to be:

$$\begin{aligned} G M_0 m_p &= \\ &(\text{Total-number of protons in the universe})^{1/2} e^2 \\ \text{i.e. } G m_p^2 &= (10^{80})^{1/2} e^2 / 10^{80} \\ \text{i.e. } G m_p^2 &= 10^{-40} e^2 \end{aligned} \quad (6)$$

[Note: This is just an order-of-magnitude-estimate]

## 7. Conclusion

The logical steps presented here lead us to a possibility that (i) space may indeed be a ‘mutually balancing electrostatic field’, a continuum, like a ‘soup’. In this continuum, spherical standing waves of fluctuations get spontaneously formed, which appear to us as fundamental-particles. The radial lines of electric field and the lines of magnetic force are patterns of ‘interference-maxima’ of fluctuations of the ultimate reality. Mathematical derivation of energy-momentum-four-vector of the special-relativity also leads to the ‘standing-wave-nature’ of fundamental particles of matter. This attempt leads to a new insight that de Broglie’s ‘matter-waves’ are ‘envelop-variations’ of the actual wave, which is a superimposition of two Doppler-shifted more-fundamental-waves. We also get an insight into the wave-particle duality, how a wave becomes a localized particle when more and more waves are added to the fundamental-wave. We also get an explanation for the observed strength-ratio of gravitational and electric forces.

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