

On the Emergence of Physical-World from The Ultimate-Reality

Hasmukh K. Tank

Indian Space Research Organization

22/693 Krishna Dham-2, Vejalpur, Ahmedabad-380015 India

e-mail: tank.hasmukh@rediffmail.com, hasmukh.tank1@gmail.com

ABSTRACT

Based on the statements of Robert B. Laughlin, Albert Einstein, [Louis de Broglie](#), Paul Anderson Dirac, and the logical reasoning presented in the previous article, titled “On the nature of Consciousness, Space and the Ultimate-Reality” (Journal of Consciousness Explorations and Research, Nov. 2013, Vol.4, Issue 9), ‘space’ is not an ‘empty’ ‘void extension of nothingness’; rather, there exists an ultimately real entity (UR), which is all-pervading in space and ever-present in time. This Ultimate-Reality can be visualized as ‘Mutually-Balanced Electrostatic-Field’. It is discussed here that ‘matter’ is just a ‘process’ or a ‘phenomenon’ of ‘fluctuations’ spontaneously generated in the ultimate reality. Then it is logically derived that only spherical patterns of fluctuations are sustained for longer durations, so there are integer number of spherical fluctuation-patterns, which we perceive as the ‘fundamental particles’ of ‘matter’. Then a mathematical-derivation is presented which supports the logic, that a ‘particle’ of ‘matter’ is ‘a localized spherical standing-wave’. This attempt leads to: (i) a new insight into the ‘wave-particle-duality’ of all ‘fundamental-particles’; (ii) to 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 true nature of ‘particles’, leads us to ‘wave-theoretical-understanding’ of ‘gravity’; and an explanation for the observed ‘relative-strengths’ of ‘gravitational’ and ‘electric’ forces.

Key Words: The Ultimate-Reality, Physical-World, Fundamental-particles, Mutually-Balancing-Electrostatic-Field, Quarks, Quantum-Mechanical-Waves, Relativistic-Doppler-Shift.

1. Introduction:

[Robert B. Laughlin](#), Nobel Laureate in Physics, endowed chair in physics, Stanford University, had this to say: “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 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." [1].

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

Louis de Broglie stated: "any particle, even isolated, has to be imagined as in continuous "energetic contact" with a hidden medium"[4-5-6].

It has been suggested by Paul Dirac that: "This '[quantum vacuum](#)' may be the equivalent in modern physics of a particulate ether"[7].

Scientists like Einstein were not happy with the 'probabilistic-interpretation' of 'matter-waves'; according to him "GOD does not play dice".

This writer has been of the opinion that: (i) if there were chance-phenomena at the sub-microscopic level, then there cannot 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' then 'curvature-of-space' and 'expansion-of-space' can have no meaning [8-9-10].

So we intend to consider here a new approach, bigining with a postulate that: 'space' is not a void extension of nothingness; rather, there exists a highly subtle ultimate reality (UR) 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, it is attempted 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 UR 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 UR; they are just a dynamic aspect of the UR. We are so far able to perceive and measure only the ‘dynamic aspect of the UR’ with the help of instruments made up of ‘energy’ and ‘matter’.

3. Steps leading to the true nature of ‘fundamental particles’:

(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 (UR), 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:

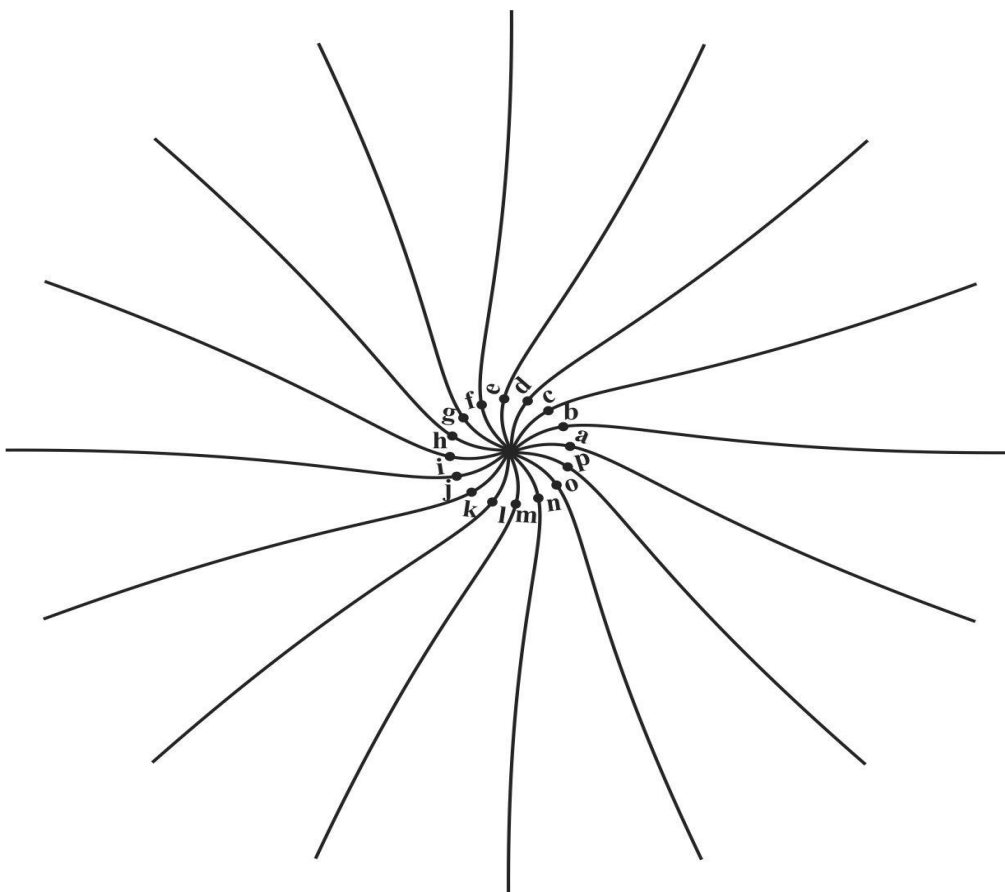


Fig.1: Because of the continuum nature of the ultimate reality, when a small labeled dot ‘a’ moves to ‘b’, ‘b’ moves to ‘c’completing a closed path by ‘z’ shifting to ‘a’.

(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 UR.

(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.

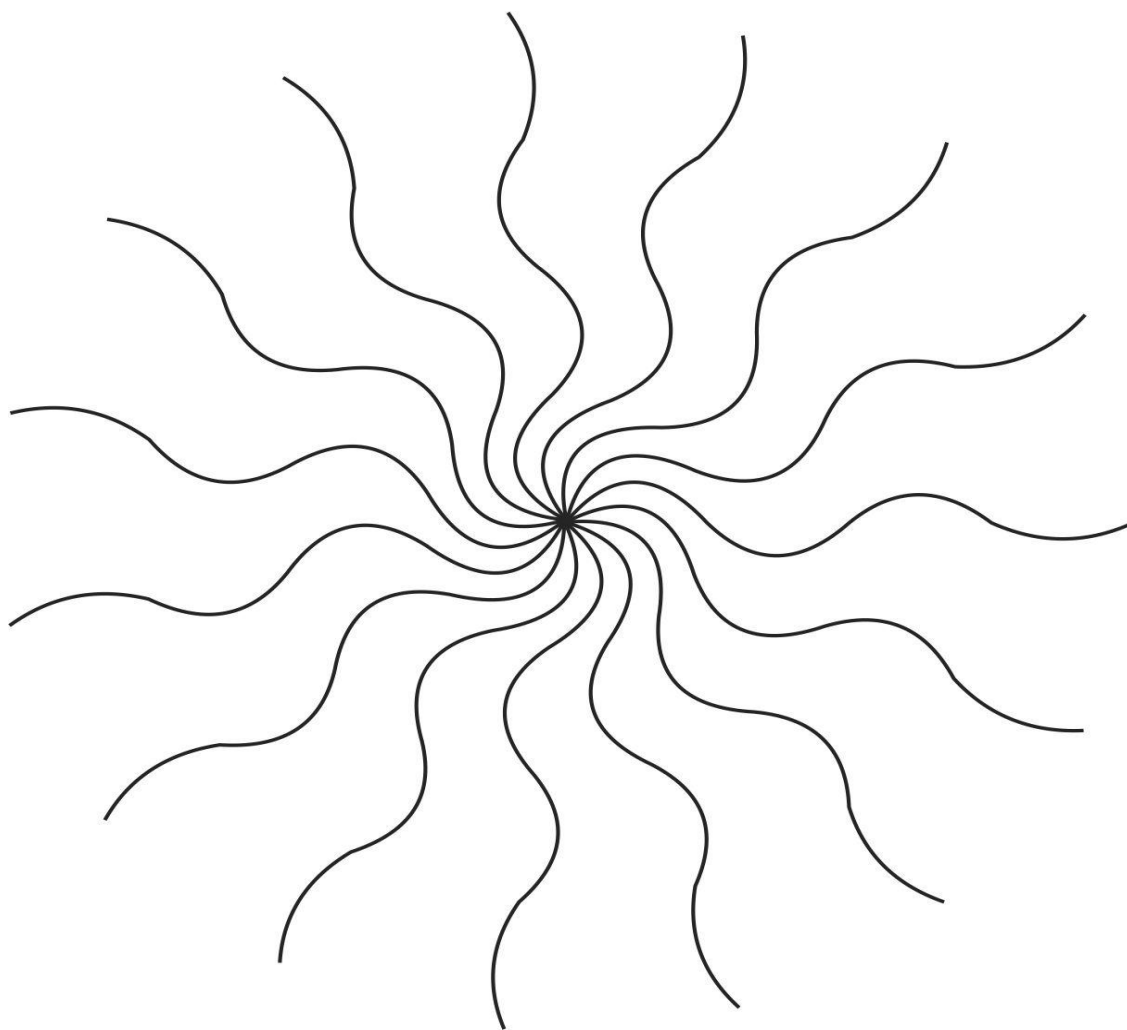


Fig.2: A “snap-shot” of wave-amplitudes of a “cross-section” of the ‘spherical-fluctuation-pattern’.

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

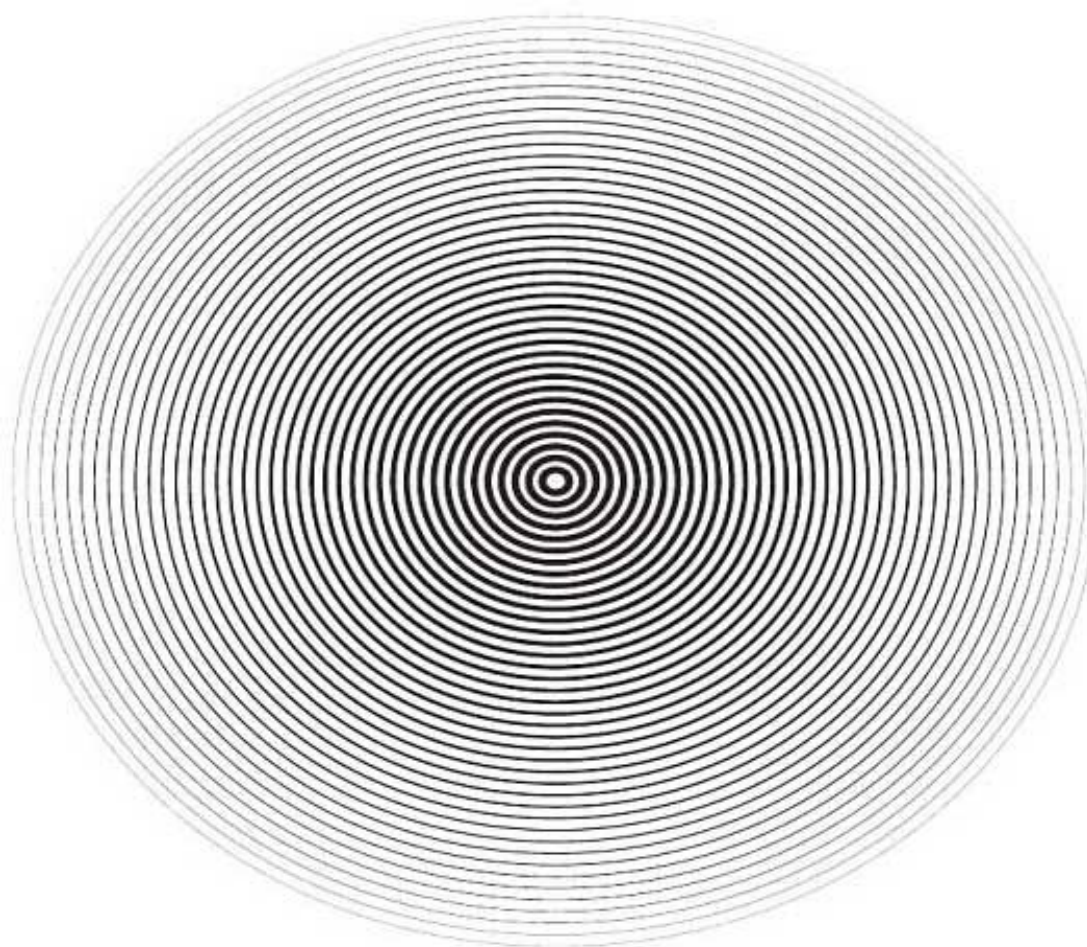


Fig.3: Concentric-circles showing peaks of wave-amplitudes of the ‘spherical-fluctuation-pattern’

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

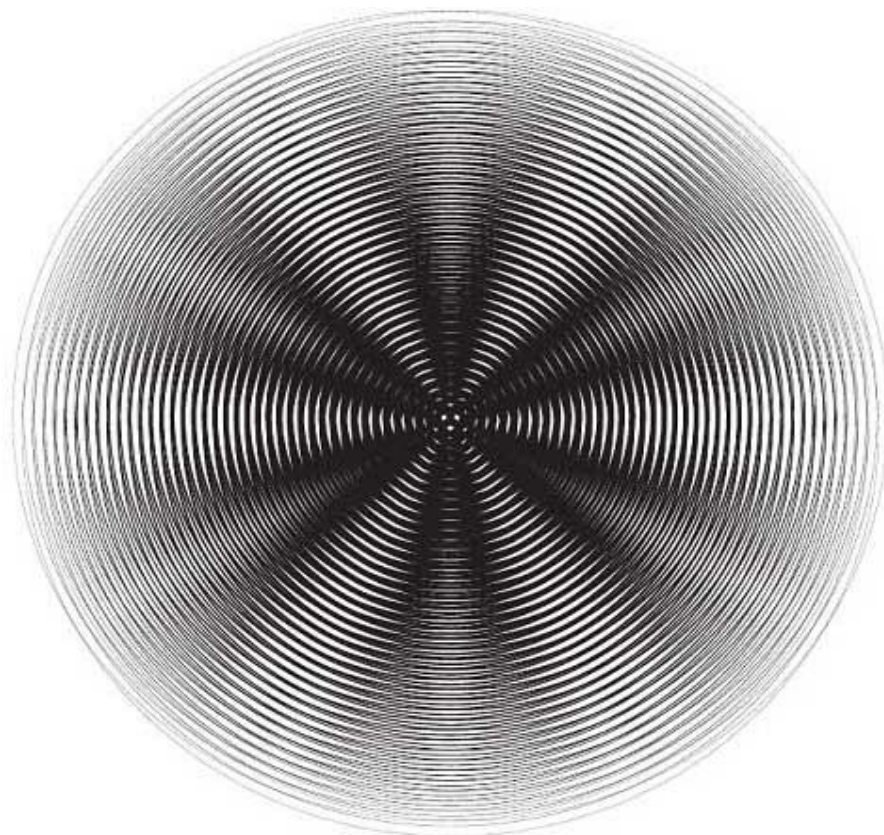


Fig.4: Interference of three spherical-fluctuation-patterns, whose maxima emerge as radial-lines.

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'.

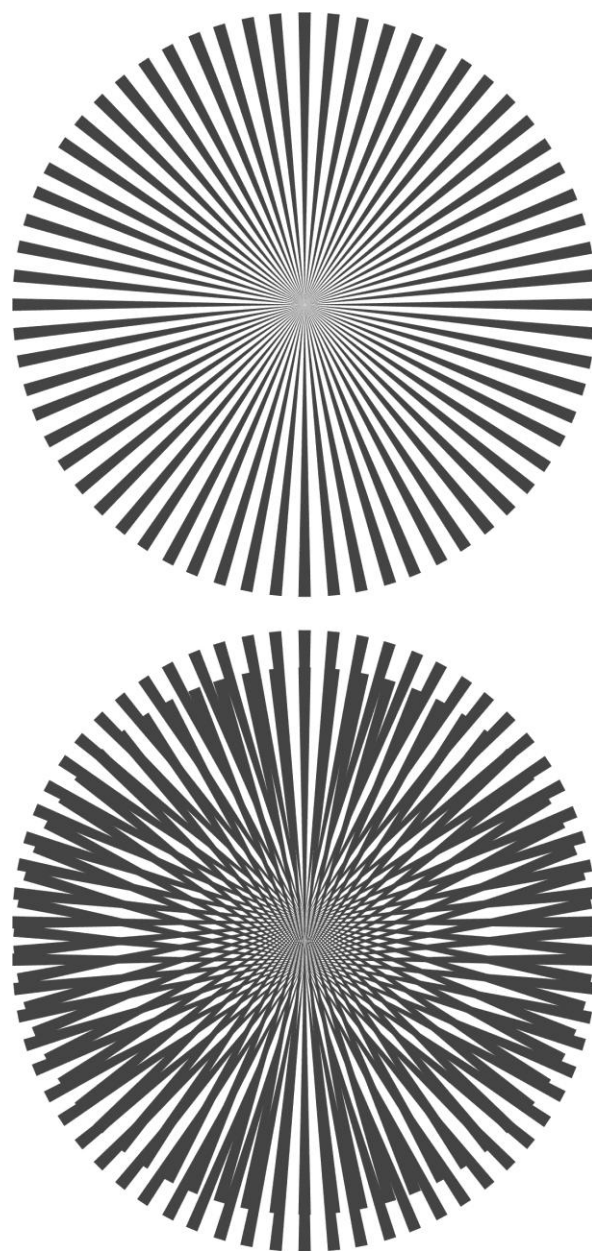


Fig:5: Radial-lines (top) representing interference-maxima of the previous figure; and second layer of interference of two such radially-outwards-lines(bottom) producing a pattern similar to the 'magnetic lines of force' around a permanent-magnet.

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. Supportive scientific-evidence for the 'standing-wave' nature of the 'fundamental-particles':

The relationship among the 'energy-momentum-four-vectors' of the Special Theory of Relativity is: $(m c^2)^2 - p^2 c^2 = (m_0 c^2)^2$. 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.

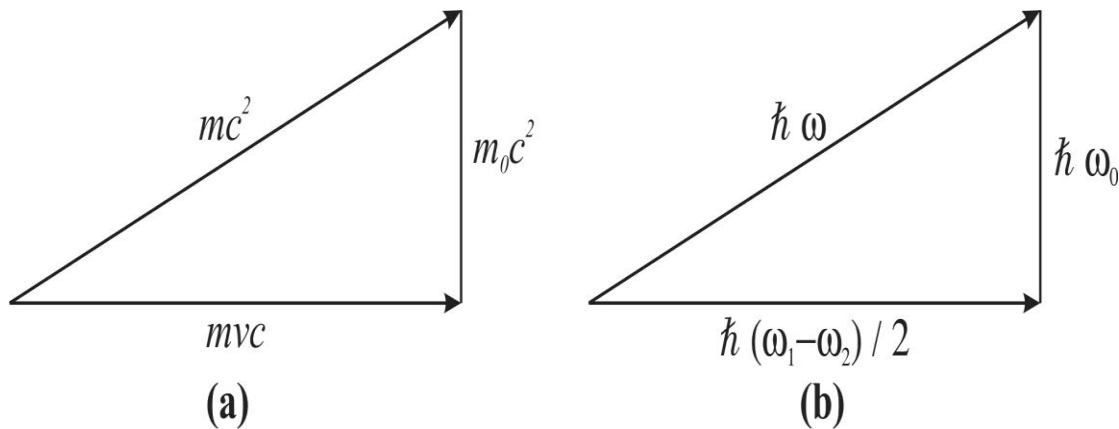


Fig.6: (a) Geometric representation of energy-momentum-four-vector of the special relativity; and (b) its wave-theoretical-translation.

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

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

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

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

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

We can write ω_1 for the term, $\omega_0 \{ (c + v) / (c - v) \}^{1/2}$, and we know that ω_1 is a longitudinally Doppler-shifted frequency, when the source of light of frequency ω_0 ‘approaches’ the observer with a relative-velocity v . Similarly, we can write ω_2 for the term, $\omega_0 \{ (c - v) / (c + v) \}^{1/2}$, and we know that ω_2 is a longitudinally Doppler-shifted frequency, when the source of light of frequency ω_0 ‘moves away’ from the observer with a relative-velocity v . So, we can write:

$m v = [\hbar \omega_1 - \hbar \omega_2] / 2c$, as shown in the figure: 6(b).....(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 $E = [\hbar \omega_1 + \hbar \omega_2] / 2$(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:

$$\lambda_B = 2 h c / [\hbar \omega_1 - \hbar \omega_2] \dots\dots\dots(4)$$

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

Where: λ_1 is wavelength of the Doppler-shifted-wave *approaching* the observer; and λ_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 λ_1 and λ_2 are equal, then the next place of constructive-superimposition can be at the infinite distance. As the difference between λ_1 and λ_2 gets increased, the places of their next superimpositions come closer-and-closer, reducing de-Broglie's wavelength λ_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 λ_1 and λ_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.

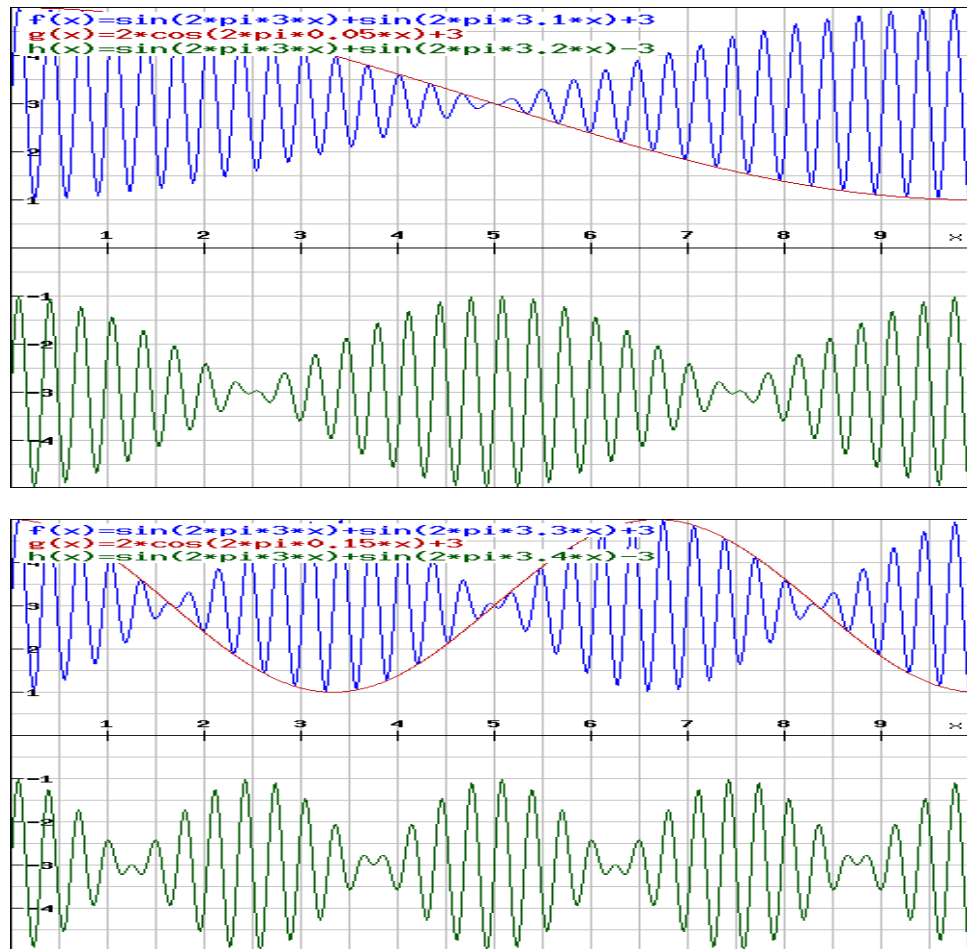


Fig.7: The waves in blue and green colors showing superimposition of two Doppler-shifted-waves; and the wave in red-color, showing envelop-variations of the superimposed-waves, which we have been knowing as the de Broglie's 'matter-wave'. As the difference between the two Doppler-shifted-waves increases, 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 ω_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 ω_0, ω_1 and ω_2 are just ‘mean-values’ of the wide bands.

6. Possible wave-theoretical 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.

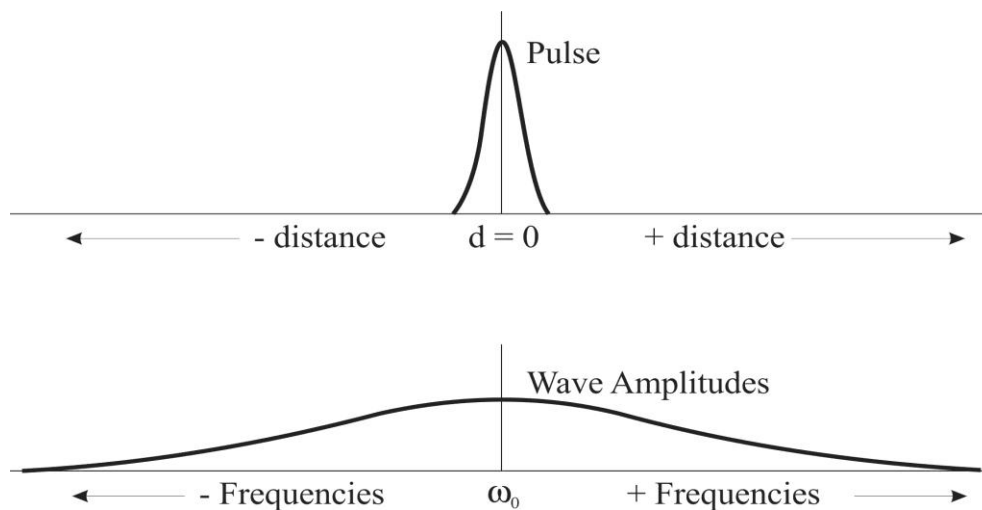
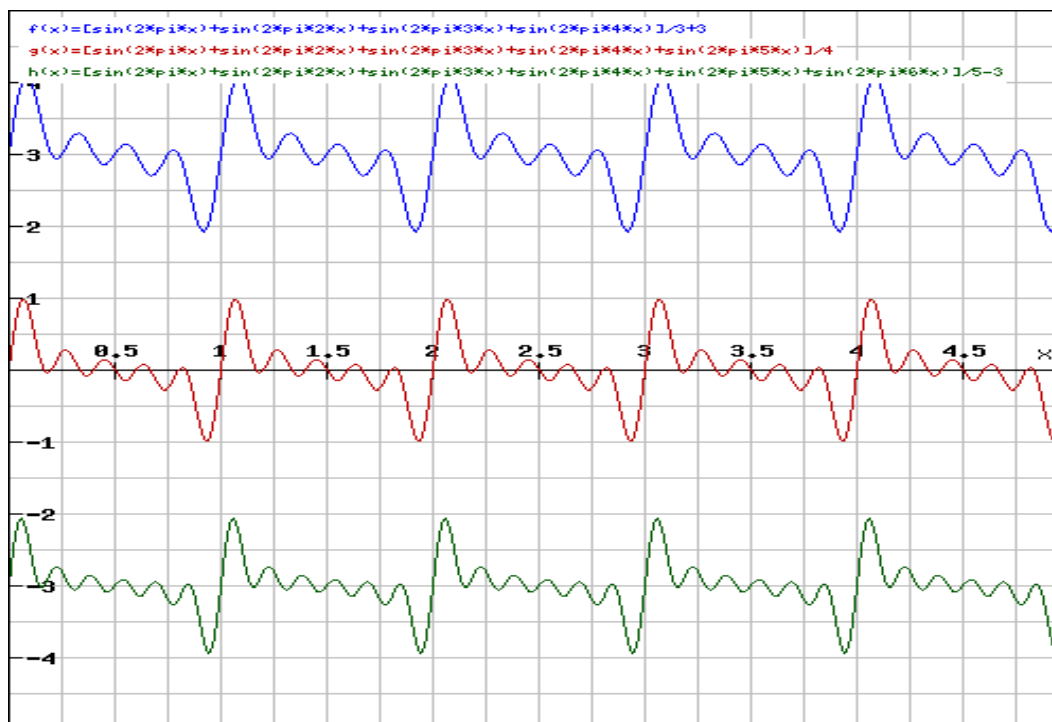
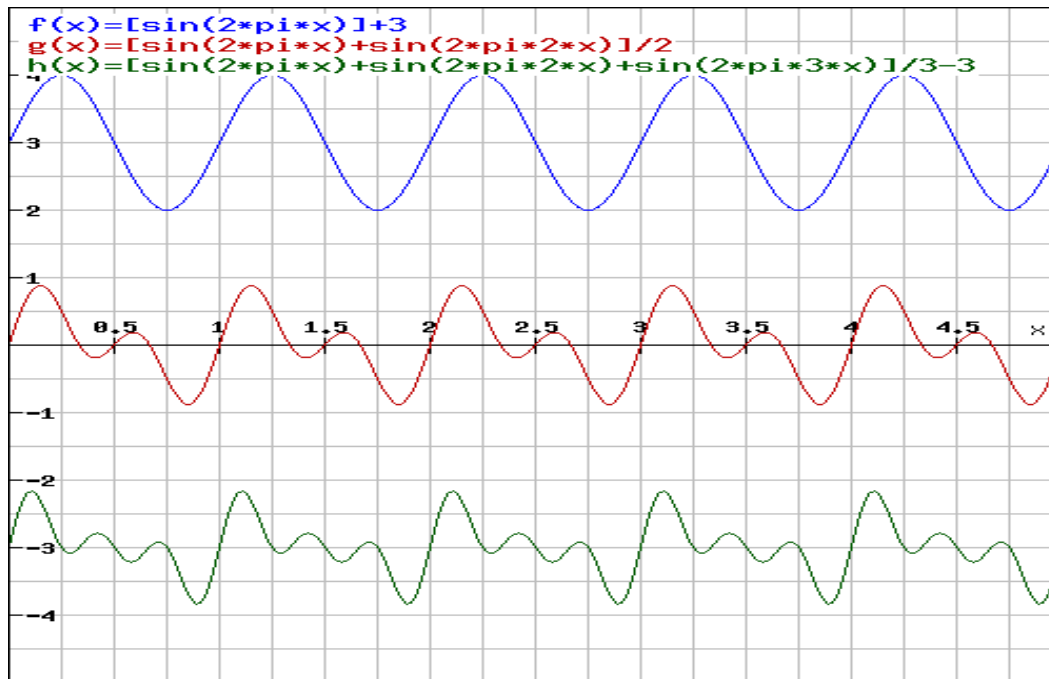


Fig.8: A ‘particle’ mathematically represented as a ‘pulse-function’ (top); and its frequency-domain-representation (bottom).

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:



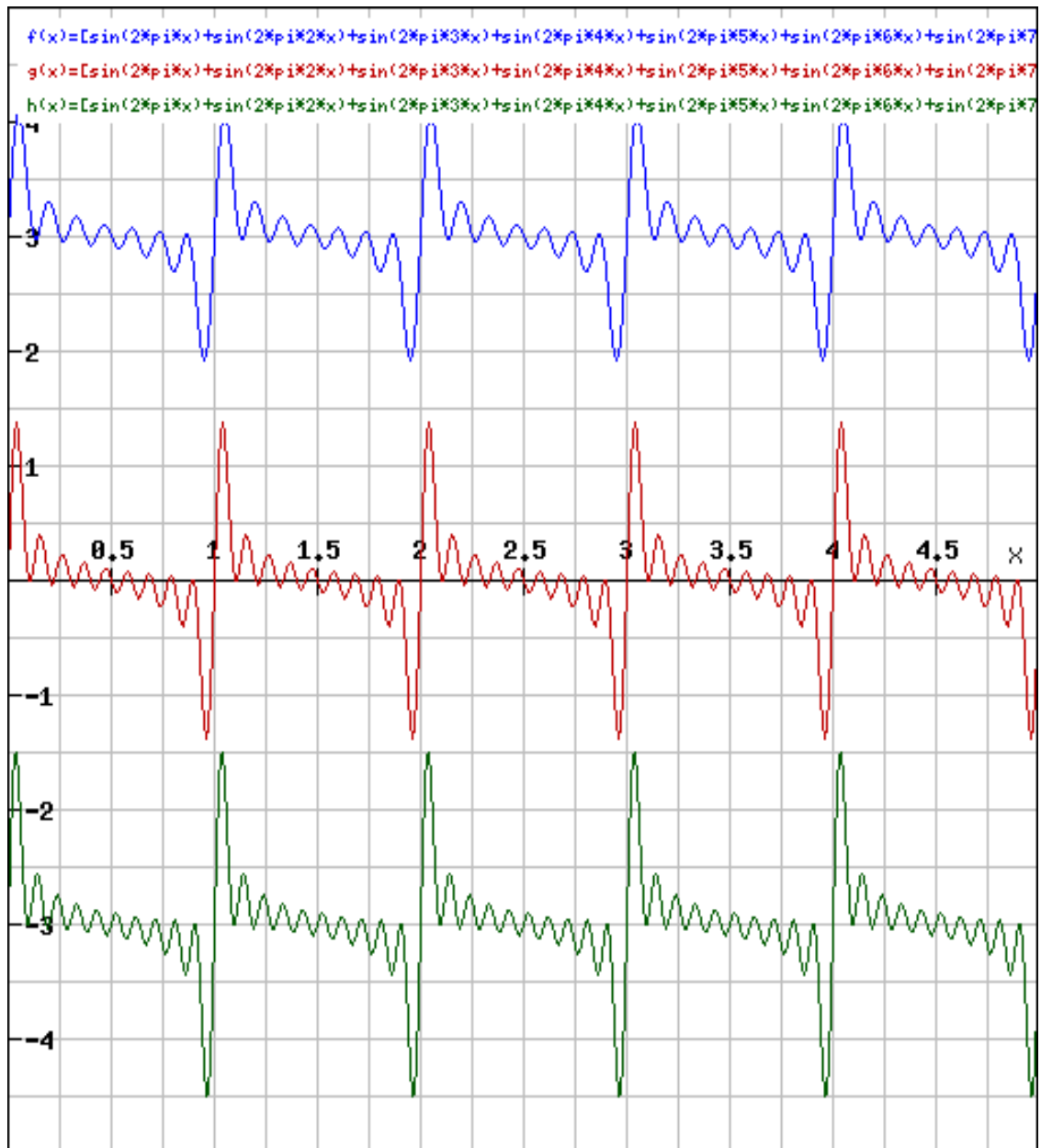


Fig.9: Figure showing ‘waves’ becoming ‘particles’: As we add more and more higher-harmonics to the fundamental-wave, they go on getting localized, like the ‘particles’.

Secondly, we can not 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:

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

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:

$$G M_0 m_p =$$

$$(\text{Total-number of protons in the universe})^{1/2} e^2$$

$$\text{i.e. } G m_p^2 = (10^{80})^{1/2} e^2 / 10^{80}$$

$$\text{i.e. } G m_p^2 = 10^{-40} e^2 \dots \dots \dots (6)$$

[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 in-deed 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 UR. 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 relative strengths of gravitational and electric forces.

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