# UNIFIED THEORY REPLACES QUANTUM THEORY & UNCERTAINTY PRINCIPLE

Rati Ram Sharma, Retired Professor & Head, Department of Biophysics & Nuclear Medicine, Postgraduate Institute of Medical Education & Research, Chandigarh, India; Residence: # 615, Sector 10, Panchkula-134113, India; Phone: 0091-172-2563949; rrjss615@gmail.com ; http://www.geocities.com/drratiram_sharma/ ; http://www.sharma-upt.com

**ABSTRACT: Heisenberg argued that wave and particle are too exclusively different in properties, making the intrinsic wave-quantum unity of light impossible to visualize and describe by the language. He invented mathematical Quantum Theory to circumvent visualization and inadequacy of language. But mathematics too is a language to supplement description. He used it to superimpose hidden concepts leading to the Uncertainty Principle. In Unified Theory the wave & particle aspects of electromagnetic radiation and moving material particle coexist blended together as wave-quantum UNITY. This is also supported by experiments. The wave-or-quantum DUALITIES of Quantum Theory appear due to experimental limitations to observe only one and not both of the two aspects simultaneously. Conservation of mass & momentum are inviolable. Matter's creation from, or dissolution into, 'nothing' is unrealistic. So the Heisenberg's Uncertainty Principle is rejected as unrealistic and new Principle of Null Action with universal applications is introduced. The Copenhagen interpretation of Quantum Theory is reappraised critically.**

This paper will bring out and rectify the unreality of Heisenberg-Bohr [1] approach and also explain from sharmon medium of the Unified Theory [2], the Wave-Quantum '**unity**' appearing as Wave-or-Quantum '**duality**', which the Quantum Theory was all about but could not explain satisfactorily. The Uncertainty Principle will be rejected as unrealistic and a new Principle of Null Action with universal applications introduced. The Copenhagen interpretation of Quantum Theory will be critically reappraised.

## 1. The objective reality exists irrespective of the observer

We observe an object through the signals, emanating or reflected from it, received by our senses and interpreted by the brain/mind. The human senses and intellect have their own limitations and the mediating signals themselves introduce some distortion or uncertainty of observation. It turns precise objective reality into imprecise subjective appearance.

Heisenberg [1] made the subjective imprecision as the very nature of things and based his Quantum Theory on the observer's imprecise view of the intrinsically precise physical reality.

But the physical objects, phenomena and events, which their theories purport to describe, do not actually need any observer for their existence and are, in fact, governed by NOT the observed but actual magnitudes of their physical parameters like energy, momentum, time, length etc. For instance, the moon or distant galaxies or invisible submicroscopic particles exist not only during the attention of the viewer but also without an observer.

In order to formulate physical laws in terms of the observed or measured magnitudes, the Quantum Theory is erroneously based on "what can be known", instead of on "what actually there is", in the objective reality. That is on the observed, and not on the actual magnitudes, putting the observer's imprecise view super-most in derogation of the inherent precision in the observed objective reality.

## 2. Wave-or-Quantum duality of matter & radiation in Quantum Theory

Heisenberg [1] noted with scientific curiosity and concern that the β-rays emitted from radioactive elements showed definite tracks in Wilson photographs like fast moving particles.

The same β-rays could also show diffraction phenomena like waves in the experiments conducted by G.P.Thomson, Davison, Germer, and others.

The X-rays and electromagnetic radiation showed the same dual behaviour in general. The X-rays when passed through a crystalline mass produce diffraction rings on photographic plates like G.P. Thomson's experiments with β-rays. However, in the Compton-Simon experiments on scattering and in the Franck-Hertz collision experiments, X-rays behaved as particles.

Einstein [3] explained the results of these experiments and those on photoelectric effects by the postulate that X-rays or any electromagnetic radiation of frequency ν and wavelength λ was propagated as quanta of energy $E = h\nu$ and momentum $p = h/\lambda$.

Thus, both material particles and electromagnetic radiations possess and manifest a duality of wave-or-quantum properties. But Heisenberg [1] argued that a thing cannot be a wave motion and a particle at the same time because the two characters are too exclusively different in nature. He further said that in reality, matter and radiation are both single entities of some yet unimaginable kinds and the observed apparent duality arises due to limitations of our language, which was invented to describe experiences of daily life involving large numbers of atoms. The present language cannot even be modified or a new one invented to describe these atomic phenomena because words can describe only things of which we can form mental pictures.

Therefore to circumvent visualization of the inherent wave-quantum **unity** and the language inadequacy a mathematical scheme - the **Quantum Theory** - was devised to treat the atomic processes. The Quantum Theory does not need or admit visualization. For visualizations, we have to content with two incomplete analogies of wave and corpuscle. Thus, one could deduce the limitations of particle concept from that of a wave and vice versa, leading to the Heisenberg's mathematical uncertainty relations.

But mathematics too is a language to support and supplement description. Heisenberg overused it to supplant and superimpose hidden physical concepts that led to the Uncertainty Principle invoking matter's unrealistic creation from, and dissolution into, nothing. Unified Theory rejects the Uncertainty Principle as unrealistic.

## 3. **Wave-quantum unity of radiation & matter in Unified Theory**

Both Einstein and Heisenberg were unclear about the wave-quantum **unity** of radiation. Einstein treated the wave aspect of electromagnetic radiation in his theory of Special Relativity and the particle aspect in the revived Corpuscular Theory [3] separately. Heisenberg's Quantum Theory split the wave-quantum **Unity** into wave-or-quantum **dualities**.

The Unified Theory instead, postulates basic **wave-quantum unity** via the sharmon medium for both radiation and matter. That is, both wave and corpuscle characters are blended together in the motion of mediator photon for electromagnetic waves and also for the motion of material particles as shown below. This basic wave-quantum **unity** appears as the wave-or-quantum **duality** *due to limitations not of the language but of experiments* to observe only one of the two coexistent characters at a time, not both simultaneously.

### 3.1. *The Wave-quantum unity for radiation in Unified Theory*

In Unified Theory, the Planck-Einstein-Lewis photon comprises multiple sharmons, which have mass. Therefore it is NOT massless but has more-than-zero mass. The 0-spin wave energy quantum, after emission from an excited electron in an atom of the source, is initially received by a sharmon in the medium, which rises to its 1-spin state to mark the effective "origin" of the electromagnetic wave. Similarly, the last 1-spin sharmon of the medium, which finally transfers the wave energy quantum as a 1-spin photon to the target and returns to the 0-spin state, marks the "terminus" of the wave. Both origin and terminus of the electromagnetic wave are situated in the sharmon medium. Since the electromagnetic light wave starts creatively at the origin in the sharmon medium its velocity is invariant to the motion of the source. Similarly, the light wave

ends vanishingly at the terminus in the sharmon medium its velocity becomes independent of the motion of the target. From the origin to the terminus, the 0-spin sharmon-packet energy quantum is propagated as a wave-quantum **unity** along a transverse electromagnetic wave in the sharmon medium contiguously via 1-spin sharmons, which do not physically move but only provide a physical carrier.

Since the spin of the emitter does not fall by 1 and that of the absorber rise by 1, only the 0-spin energy composed by 0-spin sharmons is emitted or absorbed and NOT the 1-spin photon AS A WHOLE. During transmission, only the 0-spin energy quantum is transmitted. But this energy is of the propagating 1-spin sharmons, the two together constituting the 1-spin photon, which in effect is the energized 1-spin sharmon. So after emission and before absorption at every instant and always it is a particulate energized 1-spin sharmon.

The wave quantum (photon) energy E (= $h\nu$) per unit cycle of the wave, set by the source is related to the wave frequency $\nu$, and its momentum p (= $h/\lambda$) to the wavelength $\lambda$. The wave velocity c (= $\nu\lambda$) = $(e_o.\mu_o)^{-1/2}$ is determined by the electric permittivity $e_o$ and magnetic permeability $\mu_o$ of the sharmon medium.

*Thus electromagnetic "radiation" is a wave contiguously propagating the particulate energized 1-spin sharmon bosons in the sharmon medium.*

3.1.1 *The nature of Photon and Wave-Quantum Unity*

Since the spin of an emitter does not fall by 1 and of an absorber does not rise by 1, what is emitted or absorbed is NOT the energized 1-spin sharmon as a whole but only its energy comprising 0-spin sharmons. However, the transmission, always and throughout, is of the energy of the 1-spin sharmon as a wave-quantum UNITY. The 1-spin photon or 1-spin sharmon as such is **not** emitted, propagated or absorbed.

After emission and before absorption it is always the energized 1-spin sharmon. Unified Theory gives six reasons to deny the existence of conventional 'photon'. Energized 1-spin sharmon replaces the conventional 1-spin photon but in deference to convention and for continuity is still called 1-spin "**photon**".

The Wave-Quantum unit is a 'pulse' one wavelength ($\lambda$) long, wherein 'Quantum' is not a sizeless point. A spherical wave-front or a lengthy EM wave comprises innumerable such Wave-Quantum pulses one wavelength $\lambda$ long. Approximating 'photon' as a sphere of closely packed cosminos of radius $r_c$ the photon radius becomes $r = r_c.(2hc/\lambda)^{1/3}$ .

3.2. *The Wave-quantum unity of matter in Unified Theory*

Lewis Victor de Broglie [4] was the first to work out the wave aspect of matter by associating "matter wave" with a moving material body. The frequency $\nu$ (= E/h) of the de Broglie wave is related to the kinetic energy $E = \frac{1}{2}mv^2$ and the wavelength $\lambda$ (= h/p) to its momentum p = mv. But the physical nature of the de Broglie wave has remained so unclear that Max Born [5] tried to describe it even as a probability wave. The probability, in reality, could apply to only an ensemble of large number of particles and could not be used to explain observed wave character of individual particles, moving singly.

According to Unified Theory, the material particle moves in a straight line through the sharmon medium. The kinetic energy E (= $\frac{1}{2}mv^2$) of the particle comprises 0-spin sharmons with intrinsic electric-cum-magnetic dipoles, which execute a Simple Harmonic Variation whose natural frequency $\nu$ is related to E by $\nu$ = E/h. This induces electromagnetic dipoles of the same frequency $\nu$ in the ambient sharmon medium to generate the "sharmon ripple" tightly associated and moving with the moving particle at its velocity u. Its wavelength $\lambda$ is related to the particle's momentum p by $\lambda$ = h/p.

As actually observed, the nature of this sharmon ripple is the same whether it is associated with the negative electron, positive positron/proton, or neutral neutron/atom. That is it is

independent of the electrical nature of the moving particle. Its velocity equals that of the particle and is not set by the properties of the sharmon medium. Hence it cannot be an electromagnetic or a gravitational wave in nature since they both move at light velocity c determined by physical parameters of the sharmon medium. It is found to affect the photographic plate.

Therefore it is an *energetic* mechanical ripple in the sharmon medium localized around and moving with the particle. Its frequency $\nu$ (= E/h) and wavelength $\lambda$ (= h/p) are given by the de Broglie relations. The energy E (= $\frac{1}{2}mv^2$) is the 0-spin sharmon composed kinetic energy and momentum p (=mv) is the momentum of the particle.

*Thus, the moving material particle is a particle moving through the sharmon medium and carrying the associated sharmon wave (or ripple) with itself.*

The similarity of the mathematical relations between the parameters of the particle (E, p) and wave ($\nu$, $\lambda$) aspects for radiation and matter is herein raised to the status of the identity of the physical natures of the energy quantum for being composed by 0-spin sharmons in both the cases. So in Unified Theory, both the wave and corpuscle characters, in both the radiation and moving material particle, are blended or intertwined and move together as wave-quantum '**unity**'. This unity appears as wave-or-quantum '**duality**' due to experimental limitations to observe only one of the two coexistent characters at a time, not both simultaneously.

However, Tonomura et al. [6] have observed both wave and particle aspects of low intensity light and moving electrons in one and the same experiment testifying to the existence of inherent wave-quantum unity proposed in Unified Theory. The Quantum Theory was although all about the duality of wave and corpuscle properties but could not explain it, which in Unified Theory follows naturally.

3.3. *Propagation of wave-quantum unity in matter*

A particle of matter moves in a straight line setting up a wavelet '*ripple*', in the sharmon medium. The ripple moves with the particle at its velocity v. The frequency $\nu$ (= E/h) and wavelength $\lambda$ (= h/p) of the ripple are given by the de Broglie relations, E (= $\frac{1}{2}mv^2$) being the sharmon-composed kinetic energy and p (=mv) its momentum. The relations $E = h\nu$ and $p = h/\lambda$ also apply to the radiation. This mathematical similarity is in Unified Theory, raised to the physical identity of the qualitative natures of wave energies associated with radiation and the moving material particle since both comprise the 0-spin sharmon aggregates per unit frequency cycle. The time containing wave equations

$$\nabla^2\varphi - 1/\nu^2\lambda^2 \;\partial^2\varphi/\partial t^2 = 0, \quad \nabla^2\varphi - p/\nu\lambda E \;\partial^2\varphi/\partial t^2 = 0,$$

and $$\nabla^2\varphi - p^2/E^2 \;\partial^2\varphi/\partial t^2 = 0$$

represent the wave-quantum unity for the moving particle. Here the kinetic energy $E = \frac{1}{2}mv^2$ (frequency $\nu$=E/h) and momentum p=mv (wave length $\lambda$=h/p) of the ripple wavelet depend on the velocity v of the particle as for the radiation in a dispersive medium.

A physically significant solution of an above time-containing wave equation would also satisfy the differential equation

$$\partial^2\varphi/\partial t^2 = -4\pi^2\nu^2\varphi = -4\pi^2\Delta E^2/h^2\varphi$$

for the harmonic function in time t. This gives the time-free wave equation,

$$\nabla^2\varphi + 4\pi^2 p^2/h^2\varphi = 0.$$

When the total energy E = kinetic energy T + potential energy V, $T = E-V = \frac{1}{2}mv^2$ and $p^2 = 2m(E-V)$. This leads to the famous Schrodinger wave equation

$$\nabla^2\varphi + 8\pi^2 m (E-V)/h^2 \varphi = 0.$$

As actually observed or inferred from the produced diffraction patterns, the nature of this sharmon ripple is the same whether it is associated with the negative electron, positive positron/proton, or with neutral neutron, atom or molecule i.e. independent of the electrical nature of the moving particle. Its velocity equals that of the particle and is not set at light velocity c by the physical parameters of the sharmon medium. But it affects the photographic plate.

Therefore it is an *energetic* mechanical ripple in the sharmon medium localized around and moving with the particle. In contrast, the nature of de Broglie matter waves was so unclear that Max Born described them as even mathematical probability waves.

One can now explain diffraction of energetic particles from associated sharmon wavelet ripples of wavelength $\lambda = h/mv$.

Thus, both wave and corpuscle characters, in both radiation and moving material particle, coexist and are inseparably blended to move together as a '*wave-quantum'* **unity**. Due to experimental limitation to observe only one, not both, of the two co-existent characters at a time, this **unity** appears as "*wave-or-quantum"* **duality** described by the current Quantum Theory [1].

## 4 **The Heisenberg Uncertainty Relations**

Niels Bohr and Werner Heisenberg showed that the atomic processes could be described equally in terms of waves or corpuscles. Therefore, traditional concepts of velocity, energy, momentum, position etc. to describe the mechanical behaviour of macroscopic bodies need to be suitably modified in relation to microscopic particles to develop the Quantum Theory.

The consequent realization emerged that every experiment performed to determine some numerical quantity renders the knowledge of others illusory or uncertain since the uncontrollable perturbation of the observed system alters the magnitude of previously determined quantity. As essentially basic to the Quantum Theory, it was shown [1] that energy and time (E, t) or momentum and distance (p, x) cannot be simultaneously observed less imprecisely or uncertainly than the limits set by:

$$\Delta E \,.\, \Delta t \geq h/2\pi \quad .... (1);$$
$$\Delta p \,.\, \Delta x \geq h/2\pi \quad ... (2)$$

because the measurement of E ( $ih\,\partial/\partial t$) after measuring the t or of p ($-ih\,\partial/\partial x$) after x, throws the observed system uncontrollably out of the state left at the end of t or x measurement due to $\partial/\partial t$ or $\partial/\partial x$ variation. The Heisenberg relation (1) with $\Delta t = \Delta x/c$, or the relation (2) with $\Delta p = \Delta E/c$ gives the relativistic energy-distance uncertainty relation

$$\Delta E \,.\, \Delta x \geq ch/2\pi. \quad .... (3)$$

The perceptual (not objective) relations (1), (2), and (3) were essentially deduced for the uncertainties in the magnitudes of observed parameters. The confusion arose which still continues when $\Delta E$, $\Delta t$, $\Delta p$, $\Delta x$ were misconstrued to also represent actual variations or spontaneous fluctuations in the objectively actual parameters of the observed physical object or system. The confusion got confounded when these relations were given the status of natural laws more basic than even the established laws for the conservation of energy and momentum. Violations, within the limits set by the relations (1) and (2), of otherwise inviolable conservation of energy and momentum, were thus introduced or validated which wrongly implied the unrealistic concepts of "objective indeterminism" and "non-causality".

Relations (1) and (2) led to the unrealistic concepts of the spontaneous creations and annihilations of "virtual" i.e. unreal energy quanta and particle-antiparticle pairs in Nuclear Physics and of the '*initial creations of matter out of nothing*' in the Big Bang [7] and Steady State [8] theories of expanding universe.

Relation (3) put into disarray all the classical concepts of location, boundary & trajectory, and even of the size and composition of micro particles. It led to the bizarre notion of a micro particle being constituted and bound by more massive subparticles because in confining to small $\Delta x$ the uncertainty $\Delta E$ in energy E becomes larger than E itself. A radius of Planck length $1.6 \times 10^{-33}$ cm got linked with the Planck mass $10^{-5}$ gm yielding a mass density of $10^{94}$ gm/cm$^3$. That is how the Dehmelt's cosmon, Markov's maximon, Stanyukovich's planckion, and Pati-Salam's preonic substructures of quarks and leptons became massive.

Heisenberg advocated the formulation of physical laws using only the observable or measurable parameters. But the very processes of measurement uncontrollably altered the measured magnitudes as given by (1) and (2) relations. Therefore he was against even assuming a definite value of any objective parameter. ***Unified Theory does not accept these conclusions***.

*The physical objects and objective reality exist irrespective of whether viewed by an observer or not. Any real object and its natural phenomena are governed by NOT the observed or measured but objectively actual parameters of velocity, energy, momentum, time, size, distance etc . all of which* ***objectively*** *stand simultaneously defined precisely down to any micro scale. And all these magnitudes also belong to the same eigenstate simultaneously.*

The Unified Theory scores over the Quantum Theory by explaining the wave-quantum unity and dualism of radiation and matter (not explained in Quantum Theory). It, at the same time, saves the conservation laws and the causality principle.

The Heisenberg relations (1) & (2) relate to observational uncertainties and interventional or perturbative changes, and NOT to the objectively actual parameters or to their variations, and hence do not describe the objective reality objectively or correctly. The micro particles down to any subatomic micro scale like the $10^{-33}$ cm level cosminos have precise size, mass, location etc. The composite micro particles are constituted and bound by lighter, NOT heavier, subparticles.

### 4.1. *Realistic derivation & interpretation of Heisenberg relations*

In Unified Theory "action" is a dynamic evolute of the sharmon. Hence, it is not merely a mathematical construct but a real physical entity. Its quantum is Planck constant h. During a signal mediated observer-observed interaction any and every variation $\Delta E$ in energy E or $\Delta p$ in momentum p generates the action.

$$\Delta E \,.\, \Delta t = nh \quad .... (1a)$$
$$\Delta p \,.\, \Delta x = nh. \quad .... (2a)$$

Here $\Delta E$ and $\Delta p$ are the objectively actual increases, in contrast to the subjectively observed uncertainties of Heisenberg Uncertainty Principle. However, these above relations are equivalent to the Heisenberg relations (1) and (2).

The natural conservation of energy and momentum ordains the conservation of action too. In Unified Theory [2], the relations (1a) and (2a) lead to a new Principle of Null Action which is conceptually superior to the Hamilton's Principle of Least Action as below. This is because the action realistically turns over with the variations in energy in the former but with the constant energy in the latter.

## 5. **The New Principle of Null Action**

As stated above, "action" is a dynamic evolute of the sharmon as a physical quantity. Its quantum is the Planck constant h. Any and every variation $\Delta E$ in energy E or $\Delta p$ in momentum p

is associated with a turnover $\Delta A$ of action A. An increase in energy or momentum generates the action and a decrease expends it: This leads to the relations (1a) and (2a) above.

Here $\Delta E$ and $\Delta p$ are the objectively actual variations, in contrast to the subjectively observed uncertainties of Heisenberg Uncertainty Principle given by the relations (1) and (2) above. The natural conservation of energy and momentum ordains the conservation of action too.

In Nature, the path chosen by an isolated closed system during a real physical change through a succession of intermediate states from the initial equilibrium state `a' to the final equilibrium state `b' is such that the summation or integration of action covering all variations of energy or generalized momentum is zero or null. Hence the name: "Principle of Null Action".

The summation applies to the micro phenomena wherein the quantum nature of action is revealed. In macro phenomena of gross physical changes the "graininess" of action cannot be appreciated and hence it appears as a continuous physical variable, calling for the integration.

A general case involves inter-conversions between two sets of form of energy or generalized momentum $E_x$ ($x = 1, ..., n_1$) and $E_y$ ($y = 1, ..., n_2$). The total action integral

$$A = \int (\sum \delta E_x - \sum \delta E_y) \, dt = 0,$$

or $$A = \int \delta F \, dt = 0,$$

where $$F = \sum E_x - \sum E_y.$$

Here F is a twice differentiable continuous function of n physical variables $q_k$ ($k = 1, 2, 3, \ldots, n$) of which one, say $q_m = t$, is parametric and canonically conjugate to E, and of $q_k$'s mutual derivatives $q_{kr} = dq_k/dq_r$ ($r = 1, ..., m-1, m+1, ..., n$) which in themselves are continuous functions of $q_k$. That is,

$$F = F ( q_k, q_{kr} ).$$

The above equations lead to the following "*working equations*" of this new Principle of Null Action:

$$d/dq_r ( \partial F/\partial q_{kr}) - \partial F/\partial q_k = \partial F/\partial q_r \, . \, q_{rk}$$

Their application to any specific case requires expressing F in a suitable form and then solving the resultant (n-1) differential equations.

5.1. *Hamilton's Principle of Least Action vs Principle of Null Action*

In a mechanical system, natural transformations involve inter-conversions between the kinetic energy T and potential energy V, so $F = T - V = L$, the Lagrangian. The above Equation

$$A = \int \delta F \, dt = 0,$$

transforms to

$$A = \int \delta L \, dt = 0.$$

It is operationally equivalent to Hamilton's Principle of Least Action

$$A = \int L \, dt = 0.$$

But the Unified Theory's concept of associating action turnover with the variation $\Delta E$ in energy E and hence $\Delta L$ or $\delta L$ in the Lagrangian L is more logical and realistic than with unvaried Lagrangian L of Hamilton's Principle.

5.2 *Applications of the Principle of Null Action*

The Unified Theory [2] has successfully derived the generally accepted equations for the following: Schwinger's Quantum Dynamical Principle, Klein-Gorden Field Equations, Schrodinger Wave Equation, Special and General Relativity, Euler's Equations, Lagrange's Equations, Maxwell Equations for Electromagnetic Radiation, Newton's laws of motion, Thermodynamic Equation of State, Discharge of Capacitance through Inductance & Resistance.

6. **The Copenhagen interpretation of Quantum Theory and Unified Theory**

All the unrealistic concepts of Quantum Theory can be attributed to its "Copenhagen Interpretation" [9], so called as to emphasize the influence of Niels Bohr on the Brussels (1927) conference of physicists. Its major conclusions are:

(i) *Quantum Theory is a complete theory since it works.*

Hoyle [8] used the same logic to justify the concept of continuous creation of matter out of nothing, because it works. The Unified Theory does not consider this argument as *sufficient*. The first basic necessity, which Quantum Theory does not fulfill, is realistic nature of the basic concepts. Moreover, the claim that it works is far fetched. It does not explain the wave-quantum unity in radiation and matter, which it was all about. In addition it introduces the violations of otherwise inviolable conservation of energy and momentum. ***Therefore in reality the Quantum Theory does NOT work***

(ii) *The Quantum Theory deals in what can be known about, and not in what there actually is in, the micro cosmos.*

Relativity, likewise, is also based on the observed magnitudes of governing parameters. The Unified Theory on the other hand addresses the actual reality as it is and deals in the objectively actual parameters because the real objects and physical reality exist irrespective and independently of the observer. And the physical phenomena are governed by NOT the observed/measured but actual objective parameters.

(iii) *Quantum Theory regards objective reality as a metaphysical speculation out side of Physics, hence does not recognize things as they really are.*

The Unified Theory, in contrast, proposes to develop a "realistic Physics" providing a realistic description of the objective reality as it exists and answers to the various why's and how's. See also para (ii) above.

(iv) *Since tracing of individual atoms and molecules is not feasible, Quantum Theory is contented and concerned with the statistical description of their "group behaviour".*

The Unified Theory, *in addition,* goes deeper to their individual properties as well.

(v) *In view of the intimate connection between the statistical character of Quantum Theory and the lack in precision of all perception, it may be suggested that behind the "statistical" universe of perception, there lies hidden a "real world" ruled by causality. But such speculation is useless and meaningless*.

The Unified Theory, in contrast, works on the realistic imaginations about objective reality, eliminating the perceptual distortions as far as possible.

(vi) *The wave and particle aspects of both matter and radiation are complementary. The two sets of concepts, though mutually exclusive, are nevertheless necessary for exhaustive description.*

For Unified Theory, the two aspects are not mutually exclusive but coexist blended together in the wave-quantum unity for both radiation and moving material particles.

(vii) For Niels Bohr, *isolated material particles are nothing but abstraction, as their properties can be defined and observed only because of their relations with other systems.* Heisenberg saw *the world as a complicated "tissue" of reactions, in which the breaking of a single thread affects the structure of all the rest.*

But he did not elucidate its physical bases, like Unified Theory's all composing and all pervading sharmon medium.

Not all physicists participating in the historic Brussels conference agreed with the 'Copenhagen Interpretation'. For example, Einstein wrote to Max Born about Born's statistical approach: "*The great initial success of quantum theory cannot convert me to believe in that fundamental game of dice*". To his friend Dr H. Zangger he wrote even thus: "*The more success the quantum theory has the sillier it looks*". Schrodinger said: "*Quantum theory, while extending atomism, almost without any limit, has at the same time plunged it into a crisis that is more serious than most people are prepared to admit. On the whole, the present crisis of modern science points to the necessity of revising its foundations from the basic layers up*".

This is exactly what the Unified Theory [2] does and this paper is all about.

The Unified Theory disagrees with Quantum Theory on basic issues. The objective reality, which Physics is to describe, is not a metaphysical abstraction but exists whether within or outside the view of an observer i.e. in spite and independently of the observer. The physical objects and their natural phenomena are governed by NOT the observed or knowable, but objectively actual, physical parameters of velocity, energy, momentum, size, distance etc., and these can all be simultaneously defined precisely down to any micro scale. The wave and particle aspects of both matter and radiation are not merely complementary but integral characters existing and moving together.

The Unified Theory regards Quantum Theory as a mathematically sound but unrealistic theory which deals in the observational distortions or uncertainties of the objective reality and does not describe it faithfully or correctly. The wave-or-quantum duality, of radiation and material particles which the Quantum Theory is all about but cannot explain, emerges in Unified Theory as the observational appearance of the basic wave-quantum unity due to experimental limitations to observe only one of the two (not both) characters at a time. This wave-quantum unity for both radiation and matter follows naturally from the real sharmon medium of Unified Theory [2].

## 7. **The quantum or particle nature of light**

For this the Unified Theory [2] presents explanations for the radiation emission, Compton scattering and photoelectric effect. See, for example, the explanation of Photoelectric effect in sec. 4.6 of the paper "Unified Theory Replaces Special Relativity" posted on the site for 23 August Open Debate. Explanation for Compton scattering is given below.

According to wave theory, the electric field of the electromagnetic X-rays (energy E, momentum E/c) forces the oscillation frequency of X-rays on the emitting electron, which recoils and recedes in the X-ray direction. Due to Doppler effect it therefore feels a lower frequency of X-rays. So the scattered X-rays should have a continuous range of frequencies from that of the incident X-rays downward, and the scattering process should be a gradual, not instant, process.

Both the above conclusions are against observations. Compton [11] found that 20 KeV X-rays from Molybdenum were instantly, not gradually, scattered by electrons bound to the atoms

with 10 eV energy and to have, at any particular angle, a sharply defined frequency lower than the incident X-rays.

The modern QED treats Compton scattering as a collision between two free particles: photon and electron. The emitting electron is regarded free as its binding energy 10 eV with the atom is negligible as compared to 20 KeV of the X-ray photon. Moreover, it uses the relativistic formula for the kinetic energy of the recoil electron, although the recoil velocity is not ~ c.

In Unified Theory, let $\nu$ and $\nu'$ be the frequencies of incident and scattered X-rays for the scattering angle $\theta$, and v the recoil velocity of emitting electron (mass m) inclined at an angle $\varphi$ to the incident X-rays. The conservation of energy gives

$$h\nu = h\nu' + \tfrac{1}{2}mv^2.$$

For momentum conservation, we have

$$h\nu/c = h\nu'/c \cdot \cos\theta + mv\cos\varphi$$
and $$h\nu'/c \cdot \sin\theta = mv\sin\varphi.$$

Elimination of v and $\varphi$ from these equations leads to

$$\nu' = \nu\,[((mc^2/h\nu - \cos\theta)^2 + (2mc^2/h\nu - 1))^{1/2} - (mc^2/h\nu - \cos\theta)] \quad \ldots (a)$$

But by using the relativistic kinetic energy $m' = m(1 - v^2/c^2)^{-1/2}$ for the recoil electron, we get

$$\nu' = \nu / [1 + (h\nu/mc^2)(1 - \cos\theta)] \quad \ldots. (b)$$

It is the same formula as derived from the Quantum Theory [11].

For the initial X-ray frequency $\nu = 3\times10^{18}$ Hz, at scattering angles $\theta = 0^o, 10^o, 20^o, 30^o$ the $\nu'/\nu$ comes out as 1, 0.9996, 0.9985, 0.9967 for eqn. (a) and 1, 0.9996, 0.9985, 0.9969 for eqn. (b) respectively.

With wavelength $\lambda = c/\nu$, eqn. (b) leads to

$$\Delta\lambda = \lambda' - \lambda = (h/mc)\,(1 - \cos\theta) \quad \ldots\ldots (c)$$

wherein $h/mc = r_c$ is the *Compton wavelength* of the scattering particle. It equals the increment $\Delta\lambda$ in wavelength scattered at $\theta = 90^o$ and varies inversely as the particle mass m.

*But, much against the generally accepted generalization in Quantum Theory, the concept is invalid outside scattering experiments as the particles in general do not have any corresponding wave of which* $r_c$ *is the wavelength.*

8. **The wave nature of light**

The interference and diffraction of light cannot be explained by Newton's Corpuscular theory even in its Einstein's revived form [3] or by the Quantum Theory [1]. Huygens-Fresnel Wave theory does account for them but the existence of its 'extremely more rigid than air' ether to propagate light (wrongly assumed as an elastic wave like sound) is in doubt, creating a conceptual impasse. The following Unified Theory [2] explanation for the phenomenon of interference from the realistic sharmon medium can be extended to the phenomenon of diffraction.

Let S' and S" be two small coherent sources of light separated by a small distance. The two spherical waves of frequency $\nu$ (or $w = 2\pi\nu$) and wavelength $\lambda$ (or $k = 2\pi/\lambda$) are:

$$A' = A_o \cos(wt - kr' + \phi')$$
and $$A'' = A_o \cos(wt - kr'' + \phi'')$$

where r' and r'' are the radial distances to the point P of their superposition or interference. The amplitude A stands for E, H, or $p_e$. The resultant amplitude at P is

$$A = A' + A'' = B \cos (wt + C)$$

where $B = 2A_o \cos ( k (r'' - r' )/2 + (\phi'' - \phi')/2)$
and $C = -k (r' + r'')/2 + (\phi' + \phi'')/2$.

Without losing generality we put $(\phi'' - \phi' ) = 0$. So,

$$B = 2A_o \cos k(r'' - r')/2 = 2A_o \cos \pi(r'' - r')/\lambda.$$

If the path difference $(r'' - r') = 2m.\lambda/2$,
then $\cos \pi(r'' - r')/\lambda = \cos m\pi = 1$
and $B = 2A_o$.

These are the conditions for interference maxima with an intensity
$I' = 4A_o^2 = 4 I_{o.}$

i.e. four times the intensity $I_o$ for each wave.
But when the path difference $(r'' - r') = (2m+1)\lambda/2$,
then $\cos \pi(r'' - r')/\lambda = \cos (2m+1)\pi/2 = 0$ , and B = 0.
These represent the interference minima with resultant intensity

$$I'' = B^2 = 0.$$

The above derivations from our new concept of the sharmon medium are the same as from Huygens-Fresnel Wave Theory and already stand verified experimentally.

9. **The wave and particle nature of light in one experiment**

Tonomura et al. [6], with the beams of light and electrons, have demonstrated both the wave and corpuscular characters in one and the same experiment. Further details are given in ref. [2]..

10. **Summing up remarks**

In Unified Theory [2], the electromagnetic radiation and the moving material particle are neither a wave alone nor a particle or quantum alone, and not even a simple addition or superposition of the wave and particle properties. Actually, the wave and corpuscle characters are intimately blended or intertwined to exist and travel together. This basic wave-quantum **unity** manifests as **duality** of wave and quantum properties only during or through experiments limited in their ability to observe only one of the two, not both, aspects at a time simultaneously. An ingenious experiment [6] has also demonstrated both wave and corpuscular properties of low intensity light and electron beams simultaneously supporting Unified Theory.

The Uncertainty Principle is rejected as invalid and unrealistic. The new Principle of Null Action is realistic with universal applications.

The Copenhagen interpretation of Quantum Theory is reappraised critically.

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