

Reinvestigation of Heisenberg's Uncertainty Principle and a New Deduction of Schrodinger Equation - Spinvector Motion II

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Abstract A thorough investigation was conducted for the proof process of Heisenberg's famous inequality. It is apparent that any particle, no matter a classical or a quantum particle, as long as in wave motion, its dp always has an upper limit and a lower limit, which results in the product of dp and dx has both upper and lower limits. The Heisenberg's inequality is nothing to do with measurement accuracy but related to energy conservation. A new deduction method for a spinning electron revolving on an orbit around a nucleus was developed based on our recently developed theory of spin vector in motion behaving particle-wave duality. The electron's motion equation is same as Schrodinger equation while with a different energy constant j which is related to the spin vector's motion features such as the mass of the object, the spin period and revolution period, the orbit shape and size. The new deduction process of Schrodinger equation will help explain the dilemma of the quantum mechanics.

Keywords: Uncertainty Principle, Schrodinger equation, Copenhagen Interpretation, Quantum Mechanics, spinvector motion, Spinvector Mechanics

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1. Introduction

The most mysterious thing about the quantum world is that the notion of an object falls apart. Outside the world of quantum realm such as molecules, atoms, electrons and elementary particles, we have a very clear picture of an object as a thing. This applies to a person, a car, a train, an airplane, and a celestial body. But it is at the level of electrons and of distances shorter than the size of a molecular or so that the problem begins. If we keep moving to smaller and smaller distances, things become fuzzy, their shapes unclear and their boundaries uncertain. Werner Heisenberg attributed this fuzziness to an inherent property of matter he described with what he called the Uncertainty Principle [1,2] based on a mathematical inequality [3,4,5]. The principle states that we cannot measure the position, x , of an object with arbitrary precision. The more we try to ascertain where it is, the more elusive it becomes, as the uncertainty in its momentum, p , increases. Such variable pairs are known as complementary variables or canonically conjugate variables. Depending on interpretation, the uncertainty principle restricts to what extent such conjugate properties maintain their approximate meaning, as the mathematical framework of quantum physics does not provide the notion of simultaneously well-defined. The uncertainty

principle or indeterminacy suggests that in general it is not possible to predict the value of a quantity with arbitrary certainty, even if all initial conditions are provided.

Albert Einstein believed that the indeterminacy or randomness is kind of reflection of our ignorance of some fundamental property of reality, while Niels Bohr believed that the probability distributions are fundamental and irreducible and depend on which measurements we select to perform. Einstein and Bohr debated the indeterminacy for many years [6,7]. Even though many physicists are satisfied and happy with it, if we believe that science should have deeper insight into the nature of reality, we will have to know more. We will need to make sure that there is no hidden secret behind quantum mechanical probabilities. We will have to probe deeper to search the true essence of reality, hoping to find the hidden source of quantum fuzziness, the reason for this apparent loss of deterministic power in physics. That was what Einstein, Schrodinger, de Broglie, and David Bohm insisted. While Bohr, Heisenberg, Jordan, Pauli, and others were urging people to accept the mysterious nature of the quantum mechanics.

The debate between Einstein and Bohr triggered the Einstein's hidden variable assumption, EPR paradox for entangled particles [8], and David Bohm's hidden variable theory [9,10]. Then John Bell developed another inequality [11] to make it feasible to use experiment to falsify the hidden variable assumption. But up to now, no

one once investigated the deduction process of Heisenberg's inequality to verify whether we missed something, which resulted in the current interpretation.

There is another unique feature at the heart of quantum mechanics. The quantum world behaves in ways challenging our intuition. It is often said that in quantum physics an atom can be in two places at same time, which was interpreted as **superposition** of the states of the particle waves. It is as if the particle spreads as a wave when we are not looking at it. But as soon as we look again it is always there somewhere.

According to the development of quantum mechanics, Schrodinger equation is not the only way to study quantum mechanical systems. There are other formulations of quantum mechanics including matrix mechanics introduced by Werner Heisenberg, the path integral formulation developed chiefly by Richard Feynman [12]. Paul Dirac combined matrix mechanics and the Schrodinger equation into a single formulation. When these approaches are compared, the use of the Schrodinger equation is generally called wave mechanics.

The reason for the mystery is that the Schrodinger equation is different from the usual equations found in classical physics. When we calculate the path that a small ball will follow when thrown, Newton's equation will describe how the position of the ball changes in time from its initial position to its final position. We would expect that the equation for the motion of an electron would also describe how its position changes in time. But it seems it does no such thing. In fact, there is no electron in Schrodinger equation at all. There is instead the electron's wave function. This is the quantum object that introduces fuzziness. By itself it does not even have a meaning. What does have meaning is its square value, its absolute value, as it is a complicated function. This value gives the probabilities that the electron may be found in this or that position in space when it is measured. The wave function is a superposition of possibilities [13,14] developed and interpreted by Max Born.

We believe the fuzziness of Schrodinger equation resulted from its description of the electron's wave function instead of the electron's motion. It is still worth further investigating the description of the electron's actual motion and interpretation.

2. Theory Deduction

2.1. Heisenberg's Uncertainty Principle

Kennard [15] and Robertson [16] proved Heisenberg's inequality with Hilbert space technique in $\mathbb{C}^n$ with definitions:

$$\sigma_x^2 = \int_{-\infty}^{\infty} |f(x)|^2 dx = \langle f|f \rangle$$

$$\sigma_p^2 = \int_{-\infty}^{\infty} |g(x)|^2 dx = \langle g|g \rangle$$

And they proved

$$\sigma_x \sigma_p \geq \frac{\hbar}{2} \text{ or } dx dp \geq \frac{\hbar}{2}$$

Before we investigate the actual meaning of this inequality, let's review the basics about vector product operation in $\mathbb{C}^2$ first. Suppose there are two vectors A and B in a complex Cartesian coordinate with definition as below and illustrated as Figure 1. The angle spanned by vector A and B is $\theta = \beta - \alpha$.

$$A = x + iy = |A|e^{i\alpha}$$

$$B = x' + iy' = |B|e^{i\beta}$$

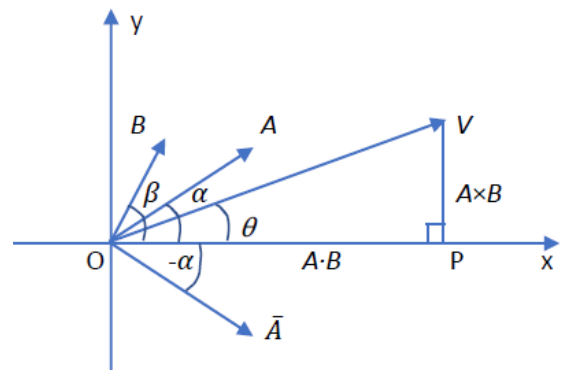


Figure 1. The product operation of vectors in complex Cartesian coordinate

And define a new vector $V = \bar{A}B$, then according to the vector product definition,

$$V = \bar{A}B = (x - iy)(x' + iy')$$

$$V = (xx' + yy') + i(xy' - x'y)$$

Because

$$\begin{pmatrix} x \\ y \end{pmatrix} \cdot \begin{pmatrix} x' \\ y' \end{pmatrix} = (xx' + yy')$$

$$\begin{pmatrix} x \\ y \end{pmatrix} \times \begin{pmatrix} x' \\ y' \end{pmatrix} = (xy' - x'y)$$

Therefore

$$V = A \cdot B + i(A \times B)$$

And

$$V = |A|e^{-i\alpha} |B|e^{i\beta}$$

$$V = |A||B|e^{i(\beta-\alpha)} = |A||B|e^{i\theta}$$

$$V = |A||B|\cos\theta + i|A||B|\sin\theta$$

In $\text{Rt}\triangle OVP$,

$$OP = A \cdot B; VP = A \times B$$

Now let's define $f(x)$ or f a function related to position, and $g(x)$ or g a function related to momentum as vectors with angle ϕ spanned by these two vectors in $\mathbb{C}^n$, and define a new vector $V = \bar{f}g$, with length of $|\sigma_x||\sigma_p|$. According to the definition of inner-product $\langle f|g \rangle$ in $\mathbb{C}^n$ Hilbert space, the result of inner-product of two vectors is a complex number. And based on Kennard's deduction result,

$$\langle f|g\rangle - \langle g|f\rangle = i\hbar$$

Therefore, let's further define Vector Z and Z^* in $\mathbb{C}^2$,

$$Z = \langle f|g\rangle = A + i\frac{\hbar}{2}$$

$$Z^* = \langle g|f\rangle = A - i\frac{\hbar}{2}$$

$$Z = |\langle f|g\rangle| e^{i\theta} = e^{i\theta} \sqrt{A^2 + \frac{\hbar^2}{4}}$$

According to the Cauchy-Schwarz Inequality,

$$|\langle f|g\rangle| \leq \sqrt{\langle f|f\rangle} \sqrt{\langle g|g\rangle}$$

While in inner-product spaces over the Reals the Cauchy-Schwarz inequality allows us to define,

$$|\langle f|g\rangle| = \sqrt{\langle f|f\rangle} \sqrt{\langle g|g\rangle} \cos\phi$$

In order to make it simple and clear, let's always take absolute values for σ_x and σ_p , and reconstruct the geometry of the vectors as Figure 2, to ensure the angle ϕ spanned by vector f and g , same as the angle between vector V and Z , $Rt\Delta OVZ$ represents the relation between $\sigma_x\sigma_p$ and $|\langle f|g\rangle|$, while $Rt\Delta OZP$ illustrates the relation between $|\langle f|g\rangle|$ and $\frac{\hbar}{2}$, and

$$OV = \sigma_x\sigma_p; OZ = |\langle f|g\rangle|$$

$$OP = A; ZP = \frac{\hbar}{2}$$

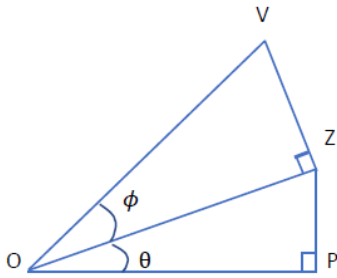


Figure 2. The geometry of vector V and Z

Even though the $Rt\Delta OVZ$ and $Rt\Delta OZP$ may not be on the same plane in $\mathbb{C}^n$ Hilbert space, according to the properties of rectangular triangles, in $Rt\Delta OVZ$ and $Rt\Delta OZP$

$$OV \geq OZ; OZ \geq ZP$$

So

$$OV \geq ZP$$

But

$$OV \leq OZ + VZ; VZ = OZ \tan\phi$$

Finally

$$ZP \leq OV \leq (1 + \tan\phi) OZ$$

$$\frac{\hbar}{2} \leq \sigma_x \sigma_p \leq (1 + \tan\phi) \sqrt{A^2 + \frac{\hbar^2}{4}}$$

Based on the above deduction, it is apparent that the product $\sigma_x\sigma_p$ has both an upper limit and a lower limit.

Now let's check the simplest wave function for a classical particle without conjugation between its position and momentum in $\mathbb{R}^n$ as below, because any object's position and momentum are over Reals in reality,

$$y = A \cos x$$

We can easily get dp according to our previous work [17],

$$dp = \frac{muA^2 \sin x \cos x dx}{\sqrt{1 + A^2 \sin^2 x}}$$

$$dp = \frac{muA^2 \sin x \cos x dx \sqrt{1 + A^2 \sin^2 x}}{1 + A^2 \sin^2 x}$$

Due to, $1 + A^2 \sin^2 x \geq 1$, and if we always take absolute values for dx and dp , so

$$dp \leq muA^2 \sqrt{1 + A^2 \sin^2 x} |\sin x \cos x dx|$$

And

$$dp \geq \frac{muA^2 |\sin x \cos x dx|}{1 + A^2 \sin^2 x}$$

Then

$$\begin{aligned} \frac{muA^2 |\sin x \cos x dx|}{1 + A^2 \sin^2 x} &\leq dp \\ &\leq muA^2 \sqrt{1 + A^2 \sin^2 x} |\sin x \cos x dx| \end{aligned}$$

Finally

$$\begin{aligned} \frac{muA^2 |\sin x dx \cos x dx|}{1 + A^2 \sin^2 x} &\leq dx dp \\ &\leq muA^2 \sqrt{1 + A^2 \sin^2 x} |\sin x dx \cos x dx| \end{aligned}$$

For the quantum particle wave equation with conjugation between its position and momentum in $\mathbb{R}^n$, if

we define $\theta = \frac{px - Et}{\hbar}$, then

$$y = \psi = \cos\theta,$$

$$\frac{\partial y}{\partial x} = -\frac{p}{\hbar} \sin\theta; \frac{\partial y}{\partial p} = -\frac{x}{\hbar} \sin\theta; \frac{\partial y}{\partial t} = \frac{E}{\hbar} \sin\theta;$$

$$dy = \frac{\partial y}{\partial x} dx + \frac{\partial y}{\partial p} dp + \frac{\partial y}{\partial t} dt;$$

$$dy = \frac{E}{\hbar} \sin\theta dt - \frac{p}{\hbar} \sin\theta dx - \frac{x}{\hbar} \sin\theta dp;$$

If we define u as the wave speed same as classical particle,

$$v_y = \frac{dy}{dt} = \frac{\sin\theta}{\hbar} (E - pu - x \frac{dp}{dt})$$

and further define

$$B = \frac{E - pu - x \frac{dp}{dt}}{\hbar}$$

then

$$v^2 = v_x^2 + v_y^2 = u^2 + B^2 \sin^2 \theta$$

$$dv = \frac{B^2 \sin\theta B \cos\theta dt - \sin^2 \theta B \left[\frac{1}{\hbar} \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right) \right]}{\sqrt{u^2 + B^2 \sin^2 \theta}}$$

$$dp = m dv$$

$$= \frac{m B \sin\theta \left[B^2 \cos\theta dt - \frac{1}{\hbar} \sin\theta \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right) \right]}{\sqrt{u^2 + B^2 \sin^2 \theta}}$$

$$dp = \frac{m B \sin\theta \left[\frac{B^2 \cos\theta dt}{-\frac{1}{\hbar} \sin\theta \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right)} \right] \sqrt{u^2 + B^2 \sin^2 \theta}}{u^2 + B^2 \sin^2 \theta}$$

If we always take absolute values for dx and dp , so

$$dp \leq \frac{m \sqrt{u^2 + B^2 \sin^2 \theta} \left[\frac{B^2 \cos\theta dt}{-\frac{1}{\hbar} \sin\theta \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right)} \right]}{|B \sin\theta|}$$

$$dp \geq \frac{mu |B \sin\theta| \left[B^2 \cos\theta dt - \frac{1}{\hbar} \sin\theta \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right) \right]}{u^2 + B^2 \sin^2 \theta}$$

then

$$dx dp \leq \frac{m \sqrt{u^2 + B^2 \sin^2 \theta} \left[\frac{B^2 \cos\theta dt}{-\frac{1}{\hbar} \sin\theta \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right)} \right] dx}{|B \sin\theta|}$$

and

$$dx dp \geq \frac{mu |B \sin\theta| \left[\frac{B^2 \cos\theta dt}{-\frac{1}{\hbar} \sin\theta \left(2u \frac{dp}{dt} + x \frac{d^2 p}{dt^2} \right)} \right] dx}{u^2 + B^2 \sin^2 \theta}$$

When we analyze the wave motion thoroughly, we all realize that any wave motion is a combination of a vibration and a uniform linear motion perpendicular to the vibration as illustrated in Figure 3.

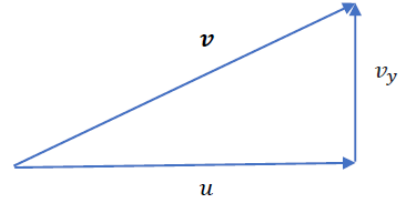


Figure 3. Wave motion---the combination of vibration and uniform linear motion

If vibration takes y axis direction, and uniform linear motion takes x axis direction, based on the property of rectangular triangles, we always have

$$v = \sqrt{u^2 + v_y^2}$$

$$v_y \leq v \leq u + v_y$$

$$dv = \frac{v_y dv_y}{\sqrt{u^2 + v_y^2}} = \frac{v_y dv_y \sqrt{u^2 + v_y^2}}{u^2 + v_y^2}$$

$$\frac{uv_y dv_y}{u^2 + v_y^2} \leq dv \leq \frac{\sqrt{u^2 + v_y^2} dv_y}{v_y}$$

And therefore

$$\frac{uv_y dp_y}{u^2 + v_y^2} \leq dp \leq \frac{\sqrt{u^2 + v_y^2} dp_y}{v_y}$$

Apparently for any particle, no matter a classical or a quantum in $\mathbb{R}^n$ space, as long as in wave motion, its dp always has both an upper limit and a lower limit. It is this intrinsic nature of wave motion that results in the product of dp and dx with both upper and lower limits, no matter in $\mathbb{R}^n$ space or in $\mathbb{C}^n$ space. These inequalities are nothing to do with the accuracy of measurement, but they are related to energy conservation during wave motion we once proved [17,18]. Therefore Heisenberg's inequality is just one of the limits of the wave motion, his uncertainty principle or interpretation is absolutely wrong.

2.2. The Schrodinger Equation

Schrodinger wave equation [19] is one of the most fundamental equations of quantum physics. It is a mathematical expression describing the energy and position of the electron in space and time, taking into account the matter wave nature of the electron inside an atom. The fundamental assumption is that an electron was treated as a structureless and point-like particle. Besides, the equation was based on other three assumptions as below as our previous paper mentioned [18]:

1. The electron's wave function is a classical plane wave equation,
2. de Broglie's hypothesis of matter wave,
3. Energy conservation,

Based on assumption 1, a cosine function was used to represent a matter wave, where λ is the matter wave length, ν is the frequency, ω is the angular frequency, u is the wave speed:

$$\psi = y = \cos\left(\frac{\omega x}{u} - \omega t\right) = \cos\left(\frac{2\pi x}{\lambda} - 2\pi \nu t\right)$$

$$\psi = y = e^{i\left(\frac{2\pi x}{\lambda} - 2\pi \nu t\right)}$$

Based on assumption 2, Planck's quantum theory was applied to state that the energy of waves are quantized, where h is Plank constant, $\hbar$ is the reduced Plank constant:

$$E = h\nu = 2\pi\nu; \lambda = \frac{h}{p} = \frac{2\pi\hbar}{p}$$

Then

$$\psi = y = e^{\frac{i}{\hbar}(px - Et)}$$

$$-\hbar^2 \frac{\partial^2 \psi}{\partial x^2} = p^2 \psi; i\hbar \frac{\partial \psi}{\partial t} = E\psi$$

Based on assumption 3, total energy is the sum of the kinetic and potential energy of the particle, the final quantum wave equation was deduced as, where m is the mass of the electron, V is the potential energy, $\hat{H}$ is the Hamiltonian operator:

$$E = KE + PE = \frac{p^2}{2m} + V$$

Finally the Schrodinger Equation is as follows:

$$E\psi = \frac{p^2 \psi}{2m} + V\psi = -\frac{\hbar^2 \partial^2 \psi}{2m \partial x^2} + V\psi$$

$$\left(-\frac{\hbar^2 \partial^2 \psi}{2m \partial x^2}\right) + V\psi = E\psi;$$

$$\hat{H}\psi = E\psi = i\hbar \frac{\partial \psi}{\partial t}.$$

2.3. Deduction from Classical Physics

Regarding the motion of an electron around a nucleus, we all know that the electron is spinning while rotating around the nucleus. Since an electron has a spin quantum number $m_s = \frac{1}{2}$, we configured it as a negative electric monopole pair or a dimetric electric vectors [20]. In order to make it simple we just take only one of the vectors into consideration, and treat it as a mechanical vector pointing from the electron center to its edge while ignoring the electric property of the vector. According to our theory that a spin vector in motion will form a wave, the vector motion is illustrated as Figure 4.

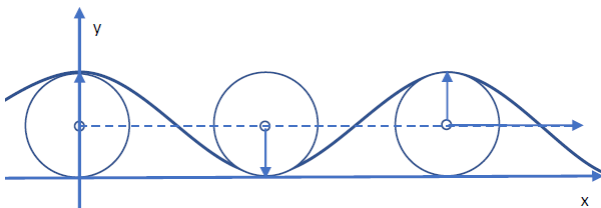


Figure 4. A Spin vector in motion

An electron's motion around a nucleus is described as Figure 5. Then the actual wave of the electron vector around the nucleus is represented as Figure 6.

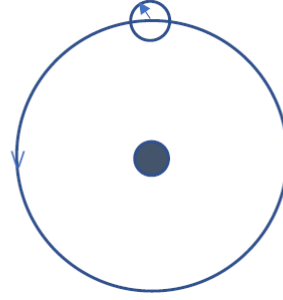


Figure 5. A Spin electron around a nucleus

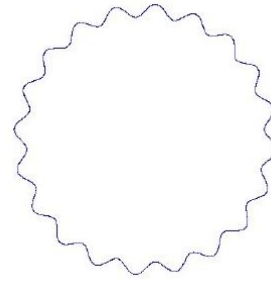


Figure 6. The trajectory of the vector head of an electron around a nucleus

If we assume that the electron, with mass m , rotates at a uniform speed v around the nucleus on the orbit with radius r , with spin period T_s and revolution period T_r , then according to the classical Newtonian physics, where λ is the wavelength of the trajectory of the vector head of the spin electron.

$$v = \frac{2\pi r}{T_r}$$

$$p = mv = \frac{2\pi r m}{T_r}$$

$$\lambda = v T_s = \frac{2\pi r T_s}{T_r}$$

$$\lambda p = \frac{4\pi^2 r^2 m T_s}{T_r^2}$$

If we define j as the energy constant of the electron,

$$j = \frac{4\pi^2 r^2 m T_s}{T_r^2}$$

because j is always a constant during the electron's spin and revolution around the nucleus, then

$$\lambda = \frac{j}{p} \quad (1)$$

And the wave equation of the spin vector of the electron will be described as below according to classical physics [21], where ψ is the wave function of the spin vector, ω is the angular frequency, u is the wave speed, ν is the frequency of the spin vector:

$$\psi = \cos\left(\frac{\omega x}{u} - \omega t\right) = \cos\left(\frac{2\pi x}{\lambda} - 2\pi \nu t\right) \quad (2)$$

If we define

$$\lambda = \frac{j}{p} = \frac{2\pi j}{p} \quad (3)$$

$$E = j\nu = 2\pi j\nu \quad (4)$$

then

$$\psi = \cos\left(\frac{px - Et}{j}\right)$$

or

$$\psi = e^{\frac{i(px - Et)}{j}} \quad (5)$$

$$-\frac{j^2 \partial^2 \psi}{\partial x^2} = p^2 \psi; \quad i j \frac{\partial \psi}{\partial t} = E \psi$$

Since the total electron energy is the sum of kinetic and potential energy of the electron, the final wave equation is deduced as Equation 6 or 7, where m is the mass of the electron, V is the potential energy, $\hat{H}$ is the Hamilton operator:

$$E = KE + PE = \frac{p^2}{2m} + V$$

$$-\frac{j^2 \partial^2 \psi}{2m \partial x^2} + V\psi = i j \frac{\partial \psi}{\partial t}; \quad \hat{H}\psi = i j \frac{\partial \psi}{\partial t} \quad (6)$$

$$-\frac{j^2 \partial^2 \psi}{2m \partial x^2} + V\psi = E\psi; \quad \hat{H}\psi = E\psi \quad (7)$$

3. Discussions

Quantum mechanics has been the core of our understanding of nature for almost a century. Without quantum physics there would literally be no modern life, technology and science. Even for all its success, it is still deeply fuzzy and mysterious. The mystery of quantum mechanics is ascribed to Copenhagen interpretation, while the root cause is attributed to Heisenberg's uncertainty principle and his indeterminacy interpretation based on the famous inequality.

Based on the deduction process, we believe Heisenberg didn't investigate thoroughly the physical setting or motion features of the quantum particle. Apparently for any classical or quantum particle, as long as in wave motion, there are always an upper limit and a lower limit for its dp , which results in the product of dp and dx with both upper and lower limits. His famous inequality is nothing to do with measurement accuracy, but it is related to energy conservation as we summarized previously.

In quantum mechanics, Bohr treated the particle-wave duality as a fundamental or metaphysical fact of nature. A given kind of quantum particle will behave sometimes as a wave, sometimes as a particle, character, in respectively different physical situations. He regarded such duality as one aspect of the concept of complementarity. He regarded renunciation of the cause-effect relation, or complementarity, of the space-time picture, as essential to the quantum mechanical account, but never gave a clear, sound explanation.

Based on our deduction of motion equation for an electron moving around a nucleus, or the earth revolving around the sun [22], we simply attribute the particle-wave duality to the unique motion of the object undergoing, the spin object in motion. No matter different masses or sizes of the objects, as long as they are in spin while in motion, they will absolutely behave the particle-wave duality.

When we review the deduction process, we realize that the energy constant, j , for a spin object in motion is relevant to the object's motion features, such as, its mass, spin period, revolution period, the orbit size and shape. Even though the final wave equations are all in the same form, Schrodinger Equation. The energy constant j shall be different with Planck constant h , it is related to its specific physical setting and motion features. Therefore it is more accurate to describe the motion of the electron around the nucleus.

We strongly believe that in quantum mechanics, the direct adoption of Planck constant h related to photon's motion nature, is just a rough estimation to describe the electron's motion around the nucleus, instead of an accurate description, maybe the Planck constant h can only be applied to the photons to describe its spin vector in motion.

And the most important feature is that the wave is the trajectory of the spin vector head in motion. Therefore, the position of the vector head is not accurate enough to describe the position of the vector itself in an object. If we take both vector heads into consideration, the actual wave feature is really a superposition of the waves of the dimetric vectors. While the electron will rotate around the nucleus as a particle. This feature of a spin vector in motion will intrinsically explain the dilemma of the quantum mechanics, the Copenhagen interpretation on Heisenberg's uncertainty principle and Born's probability rule.

4. Conclusion

Based on our deduction, we proved that there are two limits applied to any particle when it is in wave motion. Both upper and lower limit are just to ensure the energy conservation principle. Heisenberg's famous inequality is just the lower limit of the wave motion. It is nothing to do with the measurement of the particle's position or momentum.

According to EPR's criteria, *without in any way disturbing a system*, even for a quantum particle, it is still as a localized, classical, and mechanical particle but not non-local. We strongly believe that the nature follows its own philosophy and principles, and it is independent to any of our observations and measurements

Any similar interpretations introduced with measure or observation, wave function collapse, quantum particle probability, wave function superposition, were all counter intuitional and not physical interpretations. These interpretations must be wrong from physics point of view.

Based on the assumption that a spin electron revolves a nucleus on a fixed orbit, classical physics, and our new theory of a spin vector in motion, we deduced the motion equation of the electron which is same as Schrodinger equation. We can conclude that the wave equation is

applied to describe the position of the spin vector head, instead of the position of the vector itself in the electron, which will explain the dilemma of the Copenhagen's interpretation.

The energy constant j in our equation is directly linked to the physical setting or the motion features of the object undergoing. It is not a universal constant, but a constant of the object in specific motion conditions. However the equation formulation is universal for any object spinning and revolving to another object.

We are very confident that the new theory of spin vector in motion, or Spinvector Mechanics will definitely be applied to many other physical areas, especially in Quantum Mechanics, in Astronomy and Cosmology with further development in the future.

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