

# The Hypothesis of New Quantum and Its Applications

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## Abstract

The author puts forward the new quantum hypothesis by interpreting the existing quantum with Feynman's path integral principle, which could be regarded as the unification of real path and virtual path instead of the duality of wave-particle, and further the Hamilton Principle is employed to formulate this new quantum hypothesis. And based on the new quantum hypothesis the author preliminarily explores the radiation of the original photon, the relativity of electromagnetic field and the new interpretation of quantum.

**Keywords:** New Quantum, Hamilton Principle, Quantum Jump, Free Electron, Certainty

## 1. The hypothesis of new quantum

### 1.1 Putting forth new quantum

We all know about the debate between Newton and Huygens on the nature of light if it's a wave or a particle, and this had not been resolved until Einstein put forward the wave-particle duality of a photon, and the uncertainty resulted from this wave-particle duality has ever been deemed as the fundamental characteristics of the quantum, which is quantitatively formulated by Heisenburg's uncertainty principle, and as such a series of other principles and hypotheses have been produced accordingly that shall constitute the foundation of the existing quantum mechanics. In the meanwhile the argument on the foundation of quantum mechanics has never ceased, among them the dispute on the nature of reality conducted by Einstein and Bohr should be regarded as

the most representative one. Furthermore, the quantum mechanics and relativity theory have not been reconciled yet although both of them have many successful applications respectively. According to above it should be considered that our understanding of the photon or quantum has not yet come to an end.

The author would thus commit to conducting the further interpretation of the quantum, and in particular would seek for some interpretation of the quantum which could fundamentally supersede the wave-particle duality.

**According to Feynman's Path Integral Principle, although a particle may pass through countless possible paths from its start point to its finish point, among them just one path should really occur.** Thus it could be deduced that the particle or quantum could be assumed as the combination of real path and virtual path, and in here the real path is the one path that should really occur and the virtual path is the countless possible paths. And as such the quantum could be regarded as the unification of real path and virtual path instead of the duality of wave-particle, and the quantum so interpreted could be referred to as the New Quantum or the New Quantum Hypothesis, and likewise a photon so interpreted could be referred to as the New Photon.

## 1.2 The motion equation of new quantum

According to the new quantum hypothesis, in order to further depict the nature and motion of the new quantum the relationship between the real path and virtual paths of the new quantum needs to be formulated. The author then finds the Hamilton Principle should be able to formulate this very relationship, which represents the law of determining the real path out of the possible countless virtual paths.

According to the literature of analytical mechanics, **Hamilton Principle is the variation principle which is applicable to dynamic holonomic system, that is, in the space  $(q_1, q_2, \dots, q_N; t)$  of  $(N+1)$  dimensions, the time integral of kinetic potential  $L(q, \dot{q}, t)$  of the line linking any two points will get the stationary value in its real movement path.**

**Suppose**

$$S = \int_{t_1}^{t_2} L(q, \dot{q}, t) dt \quad (1)$$

**S** is referred to as the Hamilton action quantity, then

$$\delta S = 0 \quad (2)$$

And then its variation form is

$$\delta S = \delta \int_{t_1}^{t_2} L(\mathbf{q}, \dot{\mathbf{q}}, t) dt = \int_{t_1}^{t_2} \left( \frac{dL}{dq} \delta q + \frac{dL}{d\dot{q}} \delta \dot{q} + \frac{dL}{dt} \delta t \right) dt = 0 \quad (3)$$

And so the dynamic problem of mechanical system should come down to be a variation principle, that is, as far as the holonomic system is concerned, among all the possible movements of the system, which is conditioned by the same start and finish time, the same start and finish locations and the same constraints, the movement that enables Hamilton action quantity **S** to be the stationary value should be the one that really occurs in the system, and this is referred to as **Hamilton Principle**. Thus **Hamilton Principle** should depict the system's action quantity with the integral equation and use the variation method to calculate the motion equation of overall system.

And thus the **Hamilton Principle** should represent the law of locating the real movement from all the possible movements of the system, or the law which determines the real path out of virtual paths. Therefore, **Hamilton Principle** could be employed to formulate the relationship between the real path and virtual paths of the new quantum, and as such the system's action quantity should be able to be represented by the Hamilton action quantity.

### 1.3 Real path and virtual path of the new quantum

Further the real path and virtual path of the new quantum could be formulated respectively as follows.

According to the literature of analytical mechanics, as far as the holonomic system of **N** degree of freedom is concerned, if a system's motion is depicted by **N** generalized coordinates of  $\mathbf{q}_1, \mathbf{q}_2, \dots, \mathbf{q}_N$ , the system's motion could be equivalent to a point's motion in this space of **N** dimensions, and this space could be referred to as configuration space or coordinates space and this abstract point could be referred to as the configuration point. Thus the motion of configuration point in the configuration space should represent the whole system's motion, and the configuration point's path in the configuration space could be referred to as location path which is the system's motion path. And thus the motion position of

every moment of the system should correspond to one point of this assumed motion path. Suppose under the active force and in the period from  $t_1$  to  $t_2$  the system moves from the location of  $A(q_{j1}, t)$  to the location of  $B(q_{j2}, t)$ , the configuration point's motion path in the augmented configuration space of  $(N + 1)$  dimensions is to be the real motion path or real path. There's but one real path and its motion equation is

$$q_j = q_j(t), j = 1, 2, \dots, N \quad (4)$$

While under the conditions of same start/finish time and same start/finish locations, any one possible motion of the particles system close to the real motion as permitted by the constraints could be referred to as the possible path or virtual path. The virtual path is countless and its motion equation is

$$\tilde{q}_j = q_j(t) + \varepsilon_j \eta_j(t), j = 1, 2, \dots, N \quad (5)$$

$\varepsilon_j$  is the arbitrary micro amount,  $\eta_j(t)$  is the arbitrary function of  $t$ , and

$$\eta_j^{(t)} \Big|_{t=t_1, t=t_2} = 0.$$

Thus the real path and virtual path of the new quantum could be formulated by the equations (4) and (5) respectively.

## 2. Applications of the new quantum hypothesis

### 2.1 The interpretation of radiation of the photon

The author would at first apply the new quantum hypothesis to the interpretation of radiation of the original photon acting outside the nucleus.

According to the new quantum hypothesis, which calls for the new photon to replace the original photon, among all the possible movements of the space system outside the nucleus with the action quantity to be the new photon instead of the original photon which is originally regarded as the release by the electron transition or quantum jumps between different energy levels in an atom, only the movement which would enable Hamilton action quantity  $S$  to be the stationary value should really occur as the real path, and thus the real path so defined could be deemed to be a balanced and stable

condition of the space system outside the nucleus, which could then be referred to as the New Photon Case. Now that this balance exists between the new photon's real path and virtual paths, this Case could be referred to as the Principle of Virtual-Real Balance and the motion of the new photon in here could then be simply referred to as the Virtual-Real Motion. Thus it should be the new photon's Virtual-Real Motion that keeps the balance and stability of the space system outside the nucleus, and it is to keep the Hamilton action quantity to be the stationary value i.e.  $\delta S = 0$  that produce the real motion of the system and constitute the physical space system outside the nucleus or exactly the different energy levels outside the nucleus in the atom in which the electrons should exist. Just as Schrodinger indicated that **there should be no quantum jumps between different energy levels in an atom, but only smooth and continuous transitions from one standing wave into another with the emission of radiation being the product of some exotic resonance phenomenon**, which is in here referred to as the New Photon Case.

In a brief summary, it's the very motion which enables the Hamilton action quantity to be the stationary value that constitute the Virtual-Real Balance of the space system outside the nucleus, which in turn corresponds to the energy level distribution or the physical space itself outside the nucleus in the atom, that is, the new photon should only choose the one out of all its possible paths as the real path that would keep the system's Virtual-Real Balance, which in some previous circumstances was assumed as the radiation of the original photon or the quantum jumps between the different energy levels in the atom which should not actually exist. So the radiation of the original photon should just represent the phenomenon with the real action mechanism to be the Virtual-Real Balance that exists in the space system outside the nucleus which is the New Photon Case.

## **2.2 The relativity of electromagnetic field**

According to the new quantum hypothesis, the new photon so produced would substitute for the original photon and act as the action quantity of the physical space system outside the nucleus in the atom. Considering the original photon exists as the action quantity of electromagnetic force and it should now be replaced by the new photon, the new photon should then impact the nature and interpretation of electromagnetic force. From this perspective the electromagnetic force could be reinterpreted.

### 2.2.1 Reinterpretation of the electromagnetic force

If the system's action quantity transforms to the new photon from the original photon, the electromagnetic force as represented by the original photon should be replaced by the force that applies to the new photon, or exactly the electromagnetic force is supposed to be replaced by the force that applies to the physical space as represented by the new photon. Considering the motion of new photon could be formulated by the Hamilton Principle and further the Hamilton Principle be the necessary and sufficient condition of Lagrange equation of the holonomic system, this Lagrange equation should be able to formulate the force that applies to the physical space as represented by the new photon, and thus by replacing the electromagnetic force with the force which is represented by Lagrange equation of the holonomic system, the electromagnetic force should be so reinterpreted. Therefore the author would hereby introduce Lagrange equation of the holonomic system, which is Euler-Lagrange Equation.

According to the literature of analytical mechanics, **Euler–Lagrange Equation could be formulated as follows:**

$$\frac{\partial L}{\partial \mathbf{q}} - \frac{d}{dt} \frac{\partial L}{\partial \dot{\mathbf{q}}} = \mathbf{0} \quad (6)$$

**Among them, Lagrangian  $L(\mathbf{q}, \dot{\mathbf{q}}, t)$  is the function of time, coordinate and velocity, the generalized coordinate  $\mathbf{q} = (q_1, q_2, \dots, q_N)$  is the function of time, and the generalized velocity  $\dot{\mathbf{q}} = (\dot{q}_1, \dot{q}_2, \dots, \dot{q}_N)$  is also the function of time.**

The zero on the right side of the equation indicates that the system's generalized force is to be zero, which means that the system would not be affected by any forces but be kept in a balanced and stabilized condition, which just coincides with the New Photon Case as aforementioned. And thus the very condition of the system's generalized force being zero indicates that the electromagnetic space system outside the nucleus in an atom as represented by the original photon should have become the new physical space which is constituted by the energy distribution as represented by the new photon.

### 2.2.2 The free motion of an electron outside the nucleus

Based on the reinterpretation of the electromagnetic force outside the nucleus, the electromagnetic space outside the nucleus as represented by the original photon

should be equivalent to the new physical space which is constituted by the energy distribution as represented by the new photon, or it could be further assumed/deduced that the physical phenomena that occur in the inertial coordinate system under the action of the electromagnetic force should be identical with that of the non inertial coordinate system which is constituted by the physical space as represented by the new photon, and this assumption could be referred to as the Relativity of Electromagnetic Field. Thus the space of electromagnetic field should not be abstract but be dominated by the energy distribution of the physical space as represented by the new photon that is formulated by the Hamilton Principle.

Based on above, the picture of an electron's motion outside the nucleus could be depicted as follows.

It's generally believed that an electron would orbit the nucleus due to the effect of electromagnetic force, and the space outside the nucleus should constitute an electromagnetic field with the action quantum to be the original photon. However, according to the hypothesis of new photon, this original photon which is originally regarded as the release by the electron transition should be replaced by the new photon, or exactly there should be no quantum jumps between different energy levels in an atom but only the energy levels as represented by the new photon. And thus the electromagnetic field outside the nucleus should be replaced by the energy distribution of the physical space as formulated by the Hamilton Principle and the effect of electromagnetic force should become the characteristic of the corresponding physical space itself. So replacing the original photon with the new photon the forced motion of an electron in the electromagnetic field outside the nucleus should be able to be looked upon as the free motion that occur in an appropriate physical space. Therefore an electron outside the nucleus should conduct the free motion just as a planet might in the solar system.

### **2.3 New interpretation of quantum**

Einstein and Bohr had ever debated for a long time on the nature of quantum, and it seemed like Bohr had got the upper hand. However, should the probabilistic interpretation of quantum be complete and final in nature? The author tends to hold the same view as Einstein's and deems that the existing quantum should not be complete in nature and would thus employ the new quantum hypothesis to interpret the existing quantum, which could be further interpreted as follows.

- (1) Replacing the wave-particle duality of existing quantum with the unity of real path and virtual path of new quantum so that the new quantum should become the unity of real path and virtual path.
- (2) The motion equations of the quantum's real path and virtual path could be referred to the above equations (4) and (5) respectively.
- (3) Due to its being countless the virtual path in itself should be uncertain in nature and this should be the root cause of the existing quantum's uncertainty, and further it could be assumed that what the Uncertainty Principle depicts should just relate to the motion law of virtual path.
- (4) In the meanwhile the real path should be resulted from the virtual path as formulated by the Hamilton Principle, and thus the real path should be certain in nature as it is the one real movement path.
- (5) Assuming as the unity of real path and virtual path the new quantum should be more complete in nature, and further the new quantum should eventually be certain as its countless virtual paths produce just the one real path as formulated by the Hamilton Principle, and thus the new quantum should be not only complete but also certain, as should represent the new interpretation of quantum. This new interpretation of quantum should then substitute for Bohn's probabilistic interpretation of quantum.

In summary, the new quantum hypothesis as formulated by the Hamilton Principle should represent the quantum's new motion law which determines the quantum's real path out of its virtual paths and thus the certainty of quantum should be resumed accordingly.

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