Errors in Nobel Prize for Physics (6)

—Improper Heisenberg Uncertainty Principle

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Abstract: One of the reasons for 1932 Nobel Prize for physics is “for the creation of quantum mechanics”. As well-known, the most famous contribution of Heisenberg is uncertainty principle, therefore one of the most importment reasons for Heisenberg was awarded the Nobel Prize is the creation of uncertainty principle. While, this paper points out that the original uncertainty principle is improper. Considering all the possible situations (including the case that people can create laws), the author presents "certainty-uncertainty principles" with general form and variable dimension fractal form. According to the classification of Neutrosophy, "certainty-uncertainty principles" can be divided into three principles in different conditions: "certainty principle", namely a particle’s position and momentum can be known simultaneously; "uncertainty principle", namely a particle’s position and momentum cannot be known simultaneously; and neutral (fuzzy) "indeterminacy principle", namely whether or not a particle’s position and momentum can be known simultaneously is undetermined. The special cases of "certainty-uncertainty principles" include the original uncertainty principle and Ozawa inequality. In addition, in accordance with the original uncertainty principle, discussing high-speed particle’s speed and track with Newton mechanics is unreasonable; but according to "certainty-uncertainty principles", Newton mechanics can be used to discuss the problem of gravitational defection of a photon orbit around the Sun (it gives the same result of deflection angle as given by general relativity). Finally, for the reason that in physics the principles, laws and the like that are regardless of the principle (law) of conservation of energy may be invalid; therefore "certainty-uncertainty principles" should be restricted (or constrained) by principle (law) of conservation of energy, and thus it can satisfy the principle (law) of conservation of energy.

Key words: Uncertainty principle, certainty-uncertainty principles, fractal, variable dimension fractal, Ozawa inequality, principle (law) of conservation of energy

Introduction

In quantum mechanics, the uncertainty principle refers to the position and momentum of a particle cannot be determined simultaneously, the uncertainty of position (Δx) and uncertainty of momentum (Δp) obey the following inequality

$$\Delta x \Delta p \geq h / 4\pi \qquad (1)$$

where, h is the Planck constant.

One of the reason for 1932 Nobel Prize for physics is “for the creation of quantum mechanics”. As well-known, the most famous contribution of Heisenberg is uncertainty principle, therefore one of the most importment reasons for Heisenberg was awarded the Nobel Prize is the creation of uncertainty principle. While, this paper points out that the original uncertainty principle is improper.

1 Heisenberg inequality, Ozawa inequality and their forms of equality

Heisenberg inequality (Eq.1) can be changed into the following form of equality

$$\Delta x \Delta p = kh/4\pi \qquad (2)$$

where, k is a real number and $k \geq 1$.

Ozawa inequality [1] can be written as follows

$$\Delta Q \Delta P + \Delta Q \sigma(P) + \sigma(Q) \Delta P \geq h/4\pi \qquad (3)$$

It can be changed into the following form of equality

$$\Delta Q \Delta P + \Delta Q \sigma(P) + \sigma(Q) \Delta P = kh/4\pi \qquad (4)$$

where, k is a real number and $k \geq 1$.

2 "Certainty-uncertainty principles" with general form

Neutrosophy is proposed by Prof. Florentin Smarandache in 1995.

Neutrosophy is a new branch of philosophy that studies the origin, nature, and scope of neutralities, as well as their interactions with different ideational spectra.

This theory considers every notion or idea <A> together with its opposite or negation <Anti-A> and the spectrum of "neutralities" <Neut-A> (i.e. notions or ideas located between the two extremes, supporting neither <A> nor <Anti-A>). The <Neut-A> and <Anti-A> ideas together are referred to as <Non-A>.

Neutrosophy is the base of neutrosophic logic, neutrosophic set, neutrosophic probability and statistics used in engineering applications (especially for software and information fusion), medicine, military, cybernetics, and physics.

Neutrosophic Logic is a general framework for unification of many existing logics, such as fuzzy logic (especially intuitionistic fuzzy logic), paraconsistent logic, intuitionistic logic, etc. The main idea of NL is to characterize each logical statement in a 3D Neutrosophic Space, where each dimension of the space represents respectively the truth (T), the falsehood (F), and the indeterminacy (I) of the statement under consideration, where T, I, F are standard or non-standard real subsets of]-0, 1+[without necessarily connection between them.

More information about Neutrosophy may be found in references [2, 3].

According to Neutrosophy, the original uncertainty principle can be extended into the following "certainty-uncertainty principles" with general form

$$\Delta x \Delta p = Kh \qquad (5)$$

where, K is a real number and $K > 0$.

Eq.(5) can be divided into three principles:

The first one is the “uncertainty principle” ($K \geq K_1$): a particle’s position and momentum cannot be known simultaneously.

Obviously, if $K_1 = 1/4\pi$, then it is the original uncertainty principle.

The second one is the "certainty principle" ($K \leq K_2$): a particle's position and momentum can be known simultaneously.

The third one is the neutral (fuzzy) "indeterminacy principle" ($K_2 < K < K_1$): whether or not a particle's position and momentum can be known simultaneously is undetermined.

Similarly, the original Ozawa inequality can be extended into the following Ozawa type's "certainty-uncertainty principles" with general form

$$\Delta Q \Delta P + \Delta Q \sigma(P) + \sigma(Q) \Delta P = Kh \qquad (6)$$

where, K is a real number and $K > 0$.

Eq.(6) can be divided into three principles:

The first one is the "certainty principle" ($K \geq K_1$): a particle's position and momentum can be known (namely can be measured with zero-error) simultaneously (here σ(*P*) or σ(*Q*) is equal to infinity).

Obviously, if $K_1 = 1/4\pi$, then it is the original Ozawa inequality (with equality form).

It should be noted that here the first one is not the uncertainty principle, but certainty principle.

The second one is the "uncertainty principle" ($K \leq K_2$): a particle's position and momentum cannot be known simultaneously.

The third one is the neutral (fuzzy) "indeterminacy principle" ($K_2 < K < K_1$): whether or not a particle's position and momentum can be known simultaneously is undetermined.

3 "Certainty-uncertainty principles" with variable dimension fractal form

In order to process Eq. (5) and Eq.(6), as well as other equalities and inequalities that may arise in the future with unified manner, we will discuss the "certainty-uncertainty principles" with variable dimension fractal form.

The general form of variable dimension fractal is as follows

$$N = \frac{C}{r^D} \qquad (7)$$

where, $D = f(r)$, instead of a constant.

For the sake of convenience, we only discuss the situation of $C = 1$, that is

$$N = \frac{1}{r^D} \qquad (8)$$

Thus, Eq.(5) can be written as the following variable dimension fractal form

$$\Delta x \Delta p = \frac{1}{h^D} \qquad (9)$$

Solving this equation, it gives

$$D = -\frac{\ln(Kh)}{\ln h} \qquad (10)$$

Then, the values of D_1 and D_2 corresponding to K_1 and K_2 can be calculated by Eq.(10), for example

$$D_1 = -\frac{\ln(K_1 h)}{\ln h} \qquad (11)$$

Similarly, Eq.(6) can be written as the following variable dimension fractal form

$$\Delta Q \Delta P = \frac{1}{h^D} \qquad (12)$$

Solving this equation, it gives

$$D = -\frac{\ln(Kh - \Delta Q \sigma(P) - \sigma(Q)\Delta P)}{\ln h} \qquad (13)$$

Then, the values of D_1 and D_2 corresponding to K_1 and K_2 can be calculated by Eq.(13), for example

$$D_1 = -\frac{\ln(K_1 h - \Delta Q \sigma(P) - \sigma(Q)\Delta P)}{\ln h} \qquad (14)$$

4 Solving the problem of light speed with Newton mechanics

In accordance with the original uncertainty principle, discussing high-speed particle's speed and track with Newton mechanics is unreasonable; but according to "certainty-uncertainty principles", Newton mechanics can be used to discuss the problem of gravitational defection of a photon orbit around the Sun (it presents the same result of deflection angle as given by general relativity). The solving method can be found in reference [4]; in which, for problem of gravitational defection of a photon orbit around the Sun, the improved formula of gravitation between Sun and photon is as follows:

$$F = -\frac{GMm}{r^2} - \frac{1.5GMmr_0^2}{r^4} \qquad (15)$$

where: r_0 is the shortest distance between the light and the Sun, if the light and the Sun are tangent, it is equal to the radius of the Sun.

The funny thing is that, for this problem, the maximum gravitational force given by the improved formula is 2.5 times of that given by the original Newton's law of gravity.

5 To be restricted (or constrained) by principle (law) of conservation of energy

For the reason that in physics the principles, laws and the like that are regardless of the principle (law) of conservation of energy may be invalid; therefore "certainty-uncertainty principles" should be restricted (or constrained) by principle (law) of conservation of energy, and thus it can satisfy the principle (law) of conservation of energy.

The general form of the principle (law) of conservation of energy is as follows

$$E(t) = E(0) = const$$

or

$$1 - \frac{E(t)}{E(0)} = 0$$

Thus, referring to reference [3] for applying least square method to establish "partial and temporary unified theory of natural science so far" including all the equations of natural science so far (in which, the theory of everything to express all of natural laws, described by Hawking that a single equation could be written on a T-shirt, is partially and temporarily realized in the form of "partial and temporary unified variational principle of natural science so far"), Eq.(5) (one kind of "certainty-uncertainty principles" with general form) can be restricted (or constrained) by principle (law) of conservation of energy as follows

$$(\Delta x \Delta p - Kh)^2 + w(1 - \frac{E(t)}{E(0)})^2 = 0 \qquad (16)$$

where, K is a real number and $K > 0$, w is a suitable positive weighted number.

Similarly, Eq.(6) (one kind of Ozawa type's "certainty-uncertainty principles" with general form) can be restricted (or constrained) by principle (law) of conservation of energy as follows

$$(\Delta Q \Delta P + \Delta Q \sigma(P) + \sigma(Q) \Delta P - Kh)^2 + w(1 - \frac{E(t)}{E(0)})^2 = 0 \qquad (17)$$

For Eq.(9) (the variable dimension fractal form of Eq.(5)), it can be restricted (or constrained) by principle (law) of conservation of energy as follows

$$(\Delta x \Delta p - \frac{1}{h^D})^2 + w(1 - \frac{E(t)}{E(0)})^2 = 0 \qquad (18)$$

For Eq.(12) (the variable dimension fractal form of Eq.(6)), it can be restricted (or constrained) by principle (law) of conservation of energy as follows

$$(\Delta Q \Delta P - \frac{1}{h^D})^2 + w(1 - \frac{E(t)}{E(0)})^2 = 0 \qquad (19)$$

As the cases that "certainty-uncertainty principles" should be restricted (or constrained) by other principles (laws) and the like, similar method can be used.

6 Conclusions

The original uncertainty principle is improper. Considering all the possible situations (including the case that people can create laws), the author presents "certainty-uncertainty principles" with general form and variable dimension fractal form. According to the classification of Neutrosophy, "certainty-uncertainty principles" can be divided into three principles in different conditions: "certainty principle", namely a particle's position and momentum can be known simultaneously; "uncertainty principle", namely a particle's position and momentum cannot be known simultaneously; and neutral (fuzzy) "indeterminacy principle", namely whether or not a particle's position and momentum can be known simultaneously is undetermined.

Referring to the "certainty-uncertainty principles" for a particle's position and momentum, the "certainty-uncertainty principles" for other physical quantities can also be presented with the similar method.

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