Unified Theory of Natural Science written on a T-shirt

Fu Yuhua

(CNOOC Research Institute, E-mail:fuyh1945@sina.com)

Abstract: The strict "unified theory" cannot exist. Referring to documents structure of public library, and applying least square method, "partial and temporary unified theory of natural science so far" including all the equations of natural science so far can be established. In this way, 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".

Key words: Unified theory, partial and temporary unified theory of natural science so far, partial and temporary unified variational principle of natural science so far, Hawking, T-shirt

Introduction

One of the reasons for 1979 Nobel Prize for physics is "for their contributions to the theory of the unified weak and electromagnetic interaction between elementary particles". While there is a conceptual mistake: the strict "unified theory" cannot exist, there is only "partial and temporary unified theory so far" (sometimes it may be simplified as "unified theory so far"). In other words, "the theory of the unified weak and electromagnetic interaction" cannot exist, and there is only "partial and temporary theory of the unified weak and electromagnetic interaction so far". In fact, not only the "unified theory" of two or more than two interactions cannot exist, but also the "unified theory" of any kind of interaction cannot exist. In other words, the "unified electromagnetic theory" cannot exist, so do the "unified gravitational theory", the "unified strong interaction theory", and the "unified weak interaction theory". However, if the "unified theory" is changed into "partial and temporary unified theory so far", then it can exist. What is the "unified theory"? In 1980, Stephen Hawking once claimed, physicists have seen the outline of "final theory", this theory of everything can express all laws of nature with a single and beautiful mathematical model, perhaps that it is so simple and can be written on a T-shirt.

In other words, for any field, the strict "unified theory" refers to that all the laws of this field can be expressed in a single mathematical model.

If following this concept to understand the strict "unified theory", we have to say, such a "unified theory" is simply cannot exist. In other words, there is only "partial and temporary unified theory so far".

Now we discuss that the strict "unified electromagnetic theory" cannot exist.

1 Why the strict "unified electromagnetic theory" cannot exist and applying least square method to establish "partial and temporary unified electromagnetic theory so far"

It might be argued that Maxwell's equations are "unified electromagnetic

theory". Facing with this argument, we ask three questions. First, whether or not all the electromagnetic laws can be included or derived by Maxwell's equations? Second, whether or not the later appeared high temperature superconductivity problem and the like can be solved by Maxwell's equations? Third, whether or not the faster-than-light （FTL） problems can be solved by Maxwell's equations? If negative answers were given to these three questions, then it should be acknowledged that Maxwell's equations are not strict "unified electromagnetic theory", but only "partial and temporary unified electromagnetic theory".

Based on the same reason, the "theory of the unified weak and electromagnetic interaction" cannot exist, and there is only "partial and temporary theory of the unified weak and electromagnetic interaction so far".

Now, referring to documents structure of public library (here it means that the public library contains various books and literatures), we establish the "partial and temporary unified electromagnetic theory so far".

First of all, for any field, applying least square method to establish this field's "partial and temporary unified theory so far" (the corresponding expression is "partial and temporary unified variational principle so far").

Supposing that for a certain domain Ω, we already establish the following general equations

$$F_i = 0 \qquad (i = 1,2 \to n) \tag{1}$$

On boundary V, the boundary conditions are as follows

$$B_j = 0 \qquad (j = 1,2 \to m) \tag{2}$$

Applying least square method, for this field and the domains and boundary conditions the "partial and temporary unified theory so far" can be expressed in the following form of "partial and temporary unified variational principle so far"

$$\Pi = \sum_{1}^{n} W_i \int_{\Omega} F_i^2 d\Omega + \sum_{1}^{m} W_j' \int_{V} B_j^2 dV = \min_0 \tag{3}$$

where: $\min_0$ **was introduced in reference [1], indicating the minimum and its value should be equal to zero.** W_i **and** W_j' **are suitable positive weighted constants; for the simplest cases, all of these weighted constants can be taken as 1. If only a certain equation is considered, we can only make its corresponding weighted constant is equal to 1 and the other weighted constants are all equal to 0.**

By using this method, we already established the "partial and temporary unified water gravity wave theory so far" and the corresponding "partial and temporary unified water gravity wave variational principle so far" in reference [2]; and established the "partial and temporary unified theory of fluid mechanics so far" and the corresponding "partial and temporary unified variational principle of fluid mechanics so far" in reference [3].

Some scholars may said, this is simply the application of least square method,

our answer is: the simplest way may be the most effective way.

It should be noted that, due to that time we cannot realize that the strict "unified theory" cannot exist, therefore in references [2] and [3], the wrong ideas that "unified water gravity wave theory", "unified water gravity wave variational principle", "unified theory of fluid mechanics" and "unified variational principle of fluid mechanics" were appeared. Now we correct these mistakes in this paper.

It should also be noted that, Eq.(2) can be included in Eq.(1), therefore we will only discuss Eq.(1), rather than discuss Eq.(2).

Now we write Maxwell's equations as follows

$F_1 = 0$, **in domain** Ω_1

where: $F_1 = \nabla \bullet D - \rho$

$F_2 = 0$, **in domain** Ω_2

where: $F_2 = \nabla \times E + \partial B / \partial t$

$F_3 = 0$, **in domain** Ω_3

where: $F_3 = \nabla \bullet B$

$F_4 = 0$, **in domain** Ω_4

where: $F_4 = \nabla \times H - j - \partial D / \partial t$

In addition, for isotropic medium, the following equations should be added

$F_5 = 0$, **in domain** Ω_5

where: $F_5 = D - \varepsilon_0 \varepsilon_r E$

$F_6 = 0$, **in domain** Ω_6

where: $F_6 = B - \mu_0 \mu_r H$

$F_7 = 0$, **in domain** Ω_7

where: $F_7 = j - \gamma E$

Besides these equations, the Coulomb's law reads

$F_8 = 0$, **in domain** Ω_8

where: $F_8 = f - \dfrac{k q_1 q_2}{r^2}$, **according to the experimental data,** k **=9.0×10^{9}N·m²/C².**

Due to limited space, other equations of electromagnetism are no longer listed. Also, a number of conservation equations (such as the equation of conservation of energy), and a number of laws (such as the law of composition of velocities), are also no longer listed. All of them will be discussed below.

In addition, some solitary equations established only for the solitary points or special cases can be written as follows

$$S_j = 0 \qquad (j = 1,2 \to m) \qquad (4)$$

For example, the scale factor in the Coulomb's law can be written as the following solitary equation

$$S_1 = 0$$

where: $S_1 = k - 9.0\times10^9 \mathrm{N\cdot m^2/C^2}$。

Another example is that, in plasma problem, the shielding distance (Debye distance) can be written as the following solitary equation

$$S_2 = 0$$

where: $S_2 = D - \sqrt{\varepsilon_0 kT / ne^2}$.

Also due to limited space, other electromagnetic solitary equations are no longer listed.

For the reason that some solitary equations cannot be run the integral process, they will be run the square sum process.

Applying least square method, "partial and temporary unified electromagnetic theory so far" can be expressed in the following form of "partial and temporary unified electromagnetic variational principle so far"

$$\Pi_{\mathrm{EM}} = \sum_1^n W_i \int_{\Omega_i} F_i^2 d\Omega_i + \sum_1^m W_j' S_j^2 = \min_0 \qquad (5)$$

where: the subscript EM denotes that the suitable scope is the electromagnetism, all of the equations $F_i = 0$ denote so far discovered (derived) all of the equations related to electromagnetism, all of the equations $S_i = 0$ denote so far discovered (derived) all of the solitary equations related to electromagnetism, and W_i and W_j' are suitable positive weighted constants.

Clearly, here n and m are all very large integers.

2 Applying least square method to establish "partial and temporary unified gravitational theory so far"

Firstly, it should be noted that, for different gravitational problems, the different

formulas or different gravitational theories should be applied. The "universal gravitational formulas or equations" actually cannot exist. For this conclusion, many scholars do not realize it. In addition, all of the different gravitational formulas can be written as the form of Eq.(1) (namely the form that the right side of the expression is equal to zero).

The first formula should be mentioned is Newton's universal gravitational formula

$$F = -\frac{GMn}{r^2} \qquad (6)$$

It can be written as the following form

$$F_1 = 0 \qquad (6')$$

where: $F_1 = F + \frac{GMm}{r^2}$

Prof. Hu Ning derived an equation according to general relativity, with the help of Hu's equation and Binet's formula, in reference [4] we derived the following improved Newton's formula of universal gravitation

$$F = -\frac{GMm}{r^2} - \frac{3G^2M^2mp}{c^2r^4} \qquad (7)$$

where: G is gravitational constant, M and m are the masses of the two objects, r is the distance between the two objects, c is the speed of light, p is the half normal chord for the object m moving around the object M along with a curve, and the value of p is given by: p = a(1-e^2) (for ellipse), p = a (e^2-1) (for hyperbola), p = y^2/2x (for parabola).

This formula can give the same results as given by general relativity for the problem of planetary advance of perihelion and the problem of gravitational defection of a photon orbit around the Sun.

It can be written as the following form

$$F_2 = 0 \qquad (7')$$

where: $F_2 = F + \frac{GMm}{r^2} + \frac{3G^2M^2mp}{c^2r^4}$

In some cases, we should also consider the following gravitational formula including three terms

$$F = -\frac{GMm}{r^2}(1 + \frac{3GMp}{c^2r^2} + \frac{wG^2M^2p^2}{c^4r^4}) \qquad (8)$$

where: w is a constant to be determined.

It can be written as the following form

$$F_3 = 0 \qquad (8')$$

where: $F_3 = F + \frac{GMm}{r^2}(1 + \frac{3GMp}{c^2 r^2} + \frac{wG^2M^2p^2}{c^4 r^4})$

But for the example that a small ball rolls along the inclined plane in the gravitational field of the Earth, all of the above mentioned formulas cannot be applied. In reference [5], we present the following gravitational formula with the variable dimension fractal form (the fractal dimension is variable, instead of constant).

$$F = -GMm/r^{2-\delta} \qquad (9)$$

where: $\delta = 1.206 \times 10^{-12} u$, u is the horizon distance that the small ball rolls.

It can be written as the following form

$$F_4 = 0 \qquad (9')$$

where: $F_4 = F + GMm / r^{2-\delta}$

In addition, the gravitational field equations of Einstein's theory of general relativity, and the gravitational formula and gravitational equations derived by other scholars, can also be written as the form of Eq.(1) (namely the form that the right side of the expression is equal to zero).

In some cases, when dealing with gravitational problem, we should also consider some principle of conservation, such as the principle of conservation of energy. Here we write the principle of conservation of energy as the form of Eq.(1) (namely the form that the right side of the expression is equal to zero). So do the other principles of conservation.

In references [5], we discussed two cases to apply the principle of conservation of energy directly and indirectly.

To apply the principle of conservation of energy directly is as follows.

Supposing that the initial total energy of a closed system is equal to $W(0)$, and for time t the total energy is equal to $W(t)$, then according to the principle of conservation of energy, it gives

$$W(0) = W(t) \qquad (10)$$

It can be written as the following form

$$F_5 = \frac{W(t)}{W(0)} - 1 = 0 \qquad (11)$$

To apply the principle of conservation of energy indirectly is as follows.

Supposing that we are interested in a special physical quantity Q, not only it can be calculated by using the principle of conservation of energy, but also can be calculated by using other gravitational formula. For distinguishing the values, let's denote the value given by other laws as Q, while denote the value given by

the principle of conservation of energy as Q', then the equation to apply the principle of conservation of energy indirectly is as follows

$$F_6 = \frac{Q}{Q'} - 1 = 0 \qquad (12)$$

Now we discuss some solitary equations established only for the solitary points or special cases.

The first one is the solitary equation about the gravitational constant.

$$S_1 = G - 6.67 \times 10^{-11}\ \mathrm{N \cdot m^2/kg^2} = 0 \qquad (13)$$

The second one is considering the deflection angle for the problem of gravitational defection of a photon orbit around the Sun.

By using general relativity or improved Newton's formula of universal gravitation (namely Eq.(7)), the deflection angle ϕ_0 reads

ϕ_0 =1.75”

However, according to the experiment, we should have ϕ =1.77±0.20, taking the average, it gives

ϕ =1.77”

According to this expression, the corresponding solitary equation is as follows

$$S_2 = \phi - 1.77'' = 0 \qquad (14)$$

Other solitary equations include: the solitary equations established by the values of planetary advance of perihelion, the solitary equations established by the unusual values of gravity at different times during total solar eclipse, and the like. Due to the limited space, they are no longer listed.

Applying least square method, "partial and temporary unified gravitational theory so far" can be expressed in the following form of "partial and temporary unified gravitational variational principle so far"

$$\Pi_{\mathrm{GRAVITY}} = \sum_1^n W_i \int_{\Omega_i} F_i^2 d\Omega_i + \sum_1^m W_j' S_j^2 = \min \qquad (15)$$

where: the subscript GRAVITY denotes that the suitable scope is the gravity, all of the equations $F_i = 0$ denote so far discovered (derived) all of the equations related to gravity, all of the equations $S_i = 0$ denote so far discovered (derived) all of the solitary equations related to gravity, and W_i and W_j' are suitable positive weighted constants.

It should be noted that, as we establish "partial and temporary unified theory so far" and the corresponding "partial and temporary unified variational principle

so far", the including phenomenon is allowed. For example, the three terms gravitational formula Eq.(8) includes Eq.(7), while Eq.(7) includes Eq.(6). But we still consider these three equations simultaneously. This is because that, in some cases Eq.(7) is more convenient; as for Eq.(6), it is enough in most cases, moreover, putting Eq.(6) at the most prominent position, express our respect to Newton who is the greatest scientist in the history. In addition, the coexisting phenomenon is also allowed. For example, the gravitational formulas of classical mechanics, the gravitational field equations of Einstein's theory of general relativity, and the equations of other gravitational theories are coexisting. For the solution that is satisfying two or more than two theories simultaneously, or solving the problems in different fields simultaneously, and the like, we will discuss them in other papers (such solutions may only be reached with the method of variational principle).

Now we discuss the applications of variational principle Eq.(15).

Example 1. Setting $W_2 = 1$ and $W_1' = 1$ in variational principle Eq.(15), and other weighted constants are all equal to 0, namely applying Eq.(7) and Eq.(13) to derive the changing rule for the gravitational coefficient G' (instead of the gravitational constant G) and make the gravitational formula in accordance with the inverse square law.

In references [6], changing Eq.(7) into the following form in accordance with the inverse square law

$$F = -\frac{G'Mm}{r^2}$$

It gives

$$-\frac{G'Mm}{r^2} = -\frac{GMm}{r^2} - \frac{3G^2M^2mp}{c^2r^4}$$

Then we have the changing rule for the gravitational coefficient G' as follows

$$G' = G(1 + \frac{3GMp}{c^2r^2}) \qquad (16)$$

For problem of Mercury's advance of perihelion, we have

$$(1 + 5.038109 \times 10^{-8})G \le G' \le (1 + 1.162308 \times 10^{-7})G$$

For problem of gravitational defection of a photon orbit around the Sun, we have

$$G \le G' \le 2.5G$$

Example 2. Setting $W_4 = 1$ and $W_6 = 1$ in variational principle Eq.(15), and other weighted constants are all equal to 0, namely applying Eq.(9) and Eq.(12) to determine the unknown δ in Eq.(9).

According to Eq.(12), variational principle Eq.(15) can be simplified into the

following form applied the law of conservation of energy indirectly

$$\Pi = \int_{x_1}^{x_2} (\frac{Q}{Q'} - 1)^2 dx = \min_0 \qquad (17)$$

The solution procedure can be found in reference [5]. For the final optimum approximate solution, the value of Π calculated by the improved universal gravitational formula and improved Newton's second law is equal to 0.1906446, it is only 0.033% of the value of Π_0 calculated by the original universal gravitational formula and original Newton's second law.

Example 3. Setting $W_3 = 1$ and $W_2' = 1$ in variational principle Eq.(15), and other weighted constants are all equal to 0, namely applying Eq.(8) and Eq.(14) to determine the unknown w in Eq.(8).

The solution procedure can be found in reference [6], the final result is as follows.

The range of value of w is as follows

$0.08571 \leq w \leq 0.42857$

Taking the average, it gives

$w = 0.25714$

For the problem of gravitational defection of a photon orbit around the Sun, the general relativity cannot give the solution that is exactly equal to the experimental value, while the method presented in this paper can do so.

It should be noted that, for variation principle Eq.(15), if there is an exact solution, then its right side can be equal to 0, here the variational principle Eq.(15) is exactly equivalent to $F_i = 0$ and $S_i = 0$ (see example 1 and example 3). If there is only an approximate solution, the right side of variational principles Eq.(15) can only be approximately equal to 0, at this moment we can apply the appropriate optimization method to seek the best approximate solution, and the effect of the solution can be judged according to the extent that the value of Π is close to 0 (see example 2).

3 Other "partial and temporary unified theory so far", especially "partial and temporary unified theory of natural science so far"

To extend the above mentioned method, we can get various "partial and temporary unified theory so far".

For unified dealing with the problems of four fundamental interactions, applying least square method, "partial and temporary unified theory of four fundamental interactions so far" can be expressed in the following form of "partial and temporary unified variational principle of four fundamental interactions so far"

$$\Pi_{G.E.S.} = \sum_1^n W_i \int_{\Omega_i} F_i^2 d\Omega_i + \sum_1^m W_j' S_j^2 = \min_0 \qquad (18)$$

where: the subscript G.E.S.W denotes that the suitable scope is the four fundamental interactions, all of the equations $F_i = 0$ denote so far discovered (derived) all of the equations related to four fundamental interactions, all of the equations $S_i = 0$ denote so far discovered (derived) all of the solitary equations related to four fundamental interactions, and W_i and W_j' are suitable positive weighted constants.

For unified dealing with the problems of natural science, applying least square method, "partial and temporary unified theory of natural science so far" can be expressed in the following form of "partial and temporary unified variational principle of natural science so far"

$$\Pi_{\mathrm{NATURE}} = \sum_{1}^{n} W_i \int_{\Omega_i} F_i^2 d\Omega_i + \sum_{1}^{m} W_j' S_j^2 = \min_0 \qquad (19)$$

where: the subscript NATURE denotes that the suitable scope is all of the problems of natural science, all of the equations $F_i = 0$ denote so far discovered (derived) all of the equations related to natural science, all of the equations $S_i = 0$ denote so far discovered (derived) all of the solitary equations related to natural science, and W_i and W_j' are suitable positive weighted constants.

It should be noted that, in variational principle (19), all equations are combined with the irregular manner, referring to documents structure of public library (here it means that in public library all books and literatures can be divided into several subsystems according to different subjects or different authors), "partial and temporary unified theory of natural science so far" can also be written as the following rugular combination.

$$\Pi_{\mathrm{NATURE}} = \sum_{1}^{n} W_i \Pi_i = \min_0 \qquad (19')$$

where: the subscript NATURE denotes that the suitable scope is all of the problems of natural science; Π_i denote all subsystems according to different subjects or different authors; for example: Π_1 may be "partial and temporary unified theory of mathematics so far", Π_2 may be "partial and temporary unified theory of physics so far", and the like; or: Π_1 may be "unified theory established by Newton's various theories", Π_2 may be "unified theory established by Einstein's various

theories", and the like; and W_i are suitable positive weighted constants.

In this way, 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".

As already noted, for "partial and temporary unified theory so far" and the corresponding "partial and temporary unified variational principle so far", the including phenomenon and coexisting phenomenon are allowed. Here we would like to point out that, besides the including process and coexisting process, the simplifying process is also allowed. For example, the first simplifying result of "partial and temporary unified theory of natural science so far" is "theory of conservation of energy", it can be expressed in the following form of "first simplifying variational principle for partial and temporary unified theory of natural science so far" (it is shorted as "variational principle of conservation of energy").

$$\Pi_{\text{NATURE}}^{\text{SIMPLE–1}} = \int_{t_1}^{t_2} (W(t)/W(0) - 1)^2 dt = \min_0 \qquad (20)$$

This "variational principle of conservation of energy" can be applied for unified dealing with many problems in physics, mechanics, astronomy, biology, engineering, and even many issues in social science. For example, in reference [7], based on "theory of conservation of energy", for some cases we derived Newton's second law, the law of universal gravitation, and the like.

Further topics are finding more simplifying processes (simplifying variational principles) and their combinations. These will make "partial and temporary unified theory of natural science so far" simpler, clearer, more perfect, and more practical.

4 Conclusions

"Partial and temporary unified variational principle of natural science so far" can be printed on a T-shirt; and in future, its contained expressions can also be increased or decreased constantly based on the actual situations.

References

1 Fu Yuhua, New solution for problem of advance of Mercury's perihelion, Acta Astronomica Sinica, No.4, 1989

2 Fu Yuhua, Unified water gravity wave theory and improved linear wave, China Ocean Engineering, 1992,Vol.6, No.1，57-64

3 Fu Yuhua, A unified variational principle of fluid mechanics and application on solitary subdomain or point, China Ocean Engineering, 1994, Vol.8, No.2

4 Fu Yuhua, Improved Newton’s formula of universal gravitation, Ziranzazhi (Nature Journal), 2001(1), 58-59

5 Fu Yuhua, Shortcomings and Applicable Scopes of Special and General Relativity. See: Unsolved Problems in Special and General Relativity. Edited by: Florentin Smarandache, Fu Yuhua and Zhao Fengjuan. Education Publishing, 2013. 81-103

6 Florentin Smarandache, V. Christianto, Fu Yuhua, R. Khrapko, J. Hutchison. Unfolding the Labyrinth: Open Problems in Physics, Mathematics, Astrophysics, and Other Areas of Science. Hexis-Phoenix, 2006, 85-95

7 Fu Yuhua, New Newton Mechanics Taking Law of Conservation of Energy as Unique Source Law, Science Journal of Physics, Volume 2015, Article ID sjp-130, 12 Pages, 2015, doi: 10.7237/sjp/130

8 Florentin Smarandache, There is No Speed Barrier in the Universe, mss., Liceul Pedagogic Rm. Valcea, Physics Prof. Elena Albu, 1972

9 Albert Einstein, Introduction to special and general relativity, Beijing: Peking University Press, 2006