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# TRIAD PHILOSOPHY AND TRIAD SCIENCE BASED ON TRIAD LOGIC

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**Abstract:** Based on a new ternary logic(triad logic), triad philosophy and triad science are introduced. In triad philosophy, triad ontology, triad methodology and triad epistemology have been developed. In triad science, The concept of quantity coordinate is introduced and that the idea of quantity-space-time cannot be separated is established. Einstein gravitational field, Maxwell electromagnetic field and Yang-Mills gauge field have been unified in form with a unified action. Eleven dimension field and vacuum are interpreted by the unified theory. A new triad cosmos model and the idea of substance generation have been proposed. With triad methodology, a new unified philosophical and scientific system has been established for combining all human knowledge together as a whole.

**Key words:** triad philosophy, triad science, ternary logic, methodology, unified field theory, cosmology
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## INTRODUCTION

In past philosophy and science, dual philosophy or dichotomy was emphasized. And when I systematize the triad thoughts, I can introduce triad philosophy and triad science based on triad logic. Triad philosophy and triad science are contemporary developments that penetrate Western, Chinese and Eastern thoughts. With the triad method, some scientific posers such as unified field theory and quantum cosmology can be solved.

As language logic constructs the foundation of philosophy and mathematical logic constitutes the base of science, all the ideas of triad philosophy and triad science begin at triad logic.

## TRIAD LOGIC

In triad logic, there exist triad operators ( $+$, $*$, $R$ ) and three values ( $1, 0, -1$ ). Their value table fits an extended Lukasiewicz $L_3$ (Lukasiewicz, 1930) system shown as follows.

| + | 1 | 0 | -1 |
|---|---|---|---|
| 1 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 |
| -1 | 1 | 0 | -1 |

| * | 1 | 0 | -1 |
|---|---|---|---|
| 1 | 1 | 0 | -1 |
| 0 | 0 | 0 | -1 |
| -1 | -1 | -1 | -1 |

| R | 1 | 0 | -1 |
|---|---|---|---|
| 1 | -1 | -1 | 0 |
| 0 | -1 | 0 | 1 |
| -1 | 0 | 1 | 1 |

This is a non-symmetric ternary logic.

Based on the above value table, I can prove following laws.

### 1. The exchange law

$$A + B = B + A \quad A * B = B * A \quad ARB = BRA$$

Demonst. : ∵

| $A$ | $B$ | $A+B$ | $B+A$ | $A*B$ | $B*A$ | $ARB$ | $BRA$ |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | -1 | -1 |
| 1 | 0 | 1 | 1 | 0 | 0 | -1 | -1 |
| 1 | -1 | 1 | 1 | -1 | -1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 | 0 | -1 | -1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | -1 | 1 | 1 | -1 | -1 | 1 | 1 |
| -1 | 1 | 0 | 0 | -1 | -1 | 0 | 0 |
| -1 | 0 | -1 | -1 | -1 | -1 | 1 | 1 |
| -1 | -1 | -1 | -1 | -1 | -1 | 1 | 1 |

∴ $A + B = B + A \quad A * B = B * A \quad ARB = BRA$ [Q.E.D.]

### 2. The combination law

$$(A + B) + C = A + (B + C) \quad (A * B) * C = A * (B * C)$$

Demonst. : ∵

| $A$ | $B$ | $C$ | $(A+B)+C$ | $A+(B+C)$ | $(A*B)*C$ | $A*(B*C)$ | $(ARB)RC$ | $AR(BRC)$ |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1 | -1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | -1 |
| 1 | -1 | 0 | 1 | 1 | -1 | -1 | 0 | -1 |
| 1 | 1 | -1 | 1 | 1 | -1 | -1 | 1 | -1 |
| 1 | 0 | -1 | 1 | 1 | -1 | -1 | 1 | -1 |
| 1 | -1 | -1 | 1 | 1 | -1 | -1 | 1 | -1 |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | -1 | 1 |
| 0 | -1 | 1 | 1 | 1 | -1 | -1 | -1 | 0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | -1 | 0 | 0 | 0 | -1 | -1 | -1 | -1 |
| 0 | 1 | -1 | 1 | 1 | -1 | -1 | 1 | 0 |
| 0 | 0 | -1 | 0 | 0 | -1 | -1 | 1 | -1 |
| 0 | -1 | -1 | 0 | 0 | -1 | -1 | 0 | -1 |
| -1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | 1 |
| -1 | 0 | 1 | 1 | 1 | -1 | -1 | -1 | 1 |
| -1 | -1 | 1 | 1 | 1 | -1 | -1 | -1 | 1 |
| -1 | 1 | 0 | 1 | 1 | -1 | -1 | 0 | 1 |
| -1 | 0 | 0 | 0 | 0 | -1 | -1 | -1 | 1 |
| -1 | -1 | 0 | 0 | 0 | -1 | -1 | -1 | 0 |
| -1 | 1 | -1 | 1 | 1 | -1 | -1 | 1 | 1 |
| -1 | 0 | -1 | 0 | 0 | -1 | -1 | 0 | 0 |
| -1 | -1 | -1 | -1 | -1 | -1 | -1 | 0 | 0 |

$\therefore \quad (A+B)+C = A+(B+C) \quad (A*B)*C = A*(B*C)$ [Q.E.D.]

### 3. The distribution law

$$A*(B+C) = (A*B)+(A*C) \quad AR(B+C) = (ARB)*(ARC) \quad AR(B*C) = (ARB)+(ARC)$$

Demonst. : $\because$

| $A$ | $B$ | $C$ | $A*(B+C)$ | $(A*B)+(A*C)$ | $A*(BRC)$ | $(A*B)R(A*C)$ | $AR(B+C)$ | $(ARB)+(ARC)$ | $AR(B*C)$ | $(ARB)*(ARC)$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 |
| 1 | 0 | 1 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 |
| 1 | -1 | 1 | 1 | 1 | 0 | 0 | -1 | 0 | 0 | -1 |
| 1 | 1 | 0 | 1 | 1 | -1 | -1 | -1 | -1 | -1 | -1 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | -1 | -1 | -1 | -1 |
| 1 | -1 | 0 | 0 | 0 | 1 | 1 | -1 | 0 | 0 | -1 |
| 1 | 1 | -1 | 1 | 1 | 0 | 0 | -1 | 0 | 0 | -1 |
| 1 | 0 | -1 | 0 | 0 | 1 | 1 | -1 | 0 | 0 | -1 |
| 1 | -1 | -1 | -1 | -1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | -1 | -1 | -1 | -1 |
| 0 | 0 | 1 | 0 | 0 | -1 | 0 | -1 | 0 | 0 | -1 |
| 0 | -1 | 1 | 0 | 0 | 0 | 1 | -1 | 1 | 1 | -1 |
| 0 | 1 | 0 | 0 | 0 | -1 | 0 | -1 | 0 | 0 | -1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | -1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 1 | -1 | 0 | 0 | 0 | 1 | -1 | 1 | 1 | -1 |
| 0 | 0 | -1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | -1 | -1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 |
| -1 | 1 | 1 | -1 | -1 | -1 | 1 | 0 | 0 | 0 | 0 |
| -1 | 0 | 1 | -1 | -1 | -1 | 1 | 0 | 1 | 1 | 0 |
| -1 | -1 | 1 | -1 | -1 | -1 | 1 | 0 | 1 | 1 | 0 |
| -1 | 1 | 0 | -1 | -1 | -1 | 1 | 0 | 1 | 1 | 0 |
| -1 | 0 | 0 | -1 | -1 | -1 | 1 | 1 | 1 | 1 | 1 |
| -1 | -1 | 0 | -1 | -1 | -1 | 1 | 1 | 1 | 1 | 1 |
| -1 | 1 | -1 | -1 | -1 | -1 | 1 | 0 | 1 | 1 | 0 |
| -1 | 0 | -1 | -1 | -1 | -1 | 1 | 1 | 1 | 1 | 1 |
| -1 | -1 | -1 | -1 | -1 | -1 | 1 | 1 | 1 | 1 | 1 |

$\therefore \quad A*(B+C) = (A*B)+(A*C) \quad AR(B+C) = (ARB)*(ARC) \quad AR(B*C) = (ARB)+(ARC)$ [Q.E.D.]

Certainly, we can also introduce symmetric ternary logic. For example,

| + | 1 | 0 | -1 |
|---|---|---|---|
| 1 | 1 | 1 | 0 |
| 0 | 1 | 0 | -1 |
| -1 | 0 | -1 | -1 |

| * | 1 | 0 | -1 |
|---|---|---|---|
| 1 | 1 | 0 | -1 |
| 0 | 0 | 0 | 0 |
| -1 | -1 | 0 | 1 |

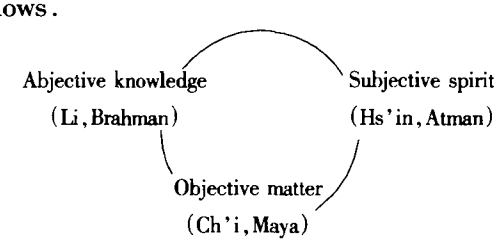
| R | 1 | 0 | -1 |
|---|---|---|---|
| 1 | -1 | -1 | 0 |
| 0 | -1 | 0 | 1 |
| -1 | 0 | 1 | 1 |

but we will lose the combination law of + and compatibility with dual system.

Based on the logic system, sentences will be classified as positive sentences (true value, 1), indefinite sentences (no value, 0) and negative sentences (false value, -1) in language; and a new pair operator R and я will be developed in mathematics. Triad logic will provide more rich logic meanings than past dual logic and can introduce a lot of applications. Triad philosophy will be developed based on triad language logic and triad science on triad mathematical logic.

## TRIAD ONTOLOGY AND TRIAD HERMENEUTICS

Synthesizing the ideas of Li (rightness), Ch'i (vapors), Hs'in (mind) in Chinese philosophy, the ideas of Brahman, Maya, Atman in Indian Philosophy, and Popper's ideas(Popper, 1972) of objective matter(World 1), subjective spirit(World 2), objective knowledge (World 3) in Western Philosophy, I set up triad ontology as follows.

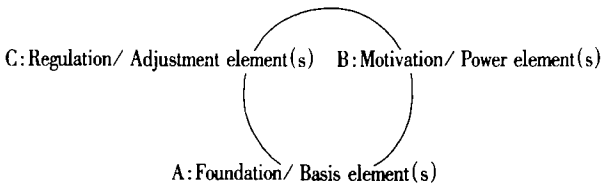



According to Prof. Chung-ying Cheng's onto-hermeneutics(Cheng, 1996), Li in Chinese Philosoply and Brahman in Indian philosophy is interpreted as objective knowledge in Western philosophy, so are Ch'i and Maya as objective matter and Hs'in and Atman as subjective spirit.

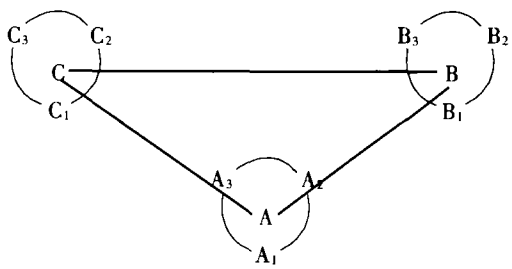
In Wittgenstein's Tractatus Logico-philosophicus(Wittgenstein, 1929), basic philosophic problem is relation of said and shown. And in Triad philosophy, it is triad relation.

## TRIAD METHODOLOGY AND TRIAD EPISTEMOLOGY

The methodological view of triad philosophy is a system view. The triad method is generalized as follows in a system.

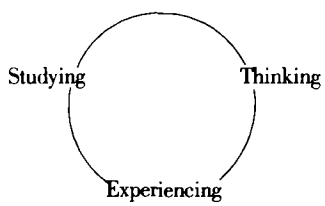



Every system and subsystem may be dominated by three main elements. When a system is controlled by three elements $A$, $B$, $C$, the system may be called one order triad system. And when $A$ is divided as $A_1$, $A_2$, $A_3$, $B$ as $B_1$, $B_2$, $B_3$ and $C$ as $C_1$, $C_2$, $C_3$, the system that contains nine elements may be called two order triad system.




Generally, a system which consists of $m$ elements may be called $(n-1)+\frac{m}{3^n}$ order triad system. When $m \in [1,3]$, $n = 1$; when $m \in [4,9]$, $n = 2$; and when $m \in [10,27]$, $n = 3$.

The generation and development of knowledge must be a process: at the beginning, the knowledge came from experiencing. After a man concluded some principles or rules from experiences, he could think based on the principles or rules and got knowledge. When knowledge was accumulated to large quantity and organized as a system, human could get knowledge through learning or studying. Thus, there are three sources of knowledge:




Considering Kant's philosophy (Kant, Schmidt Ed., 1927), experiencing, thinking

and studying all may undergo "perception→understanding→reason". I combine Kant's epistemological line with Chinese "nine squares" as a "cognition frame"(Fig.1)

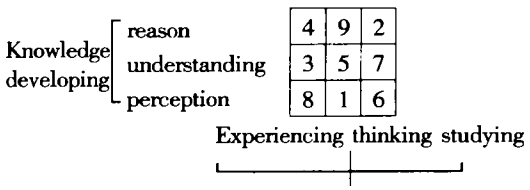
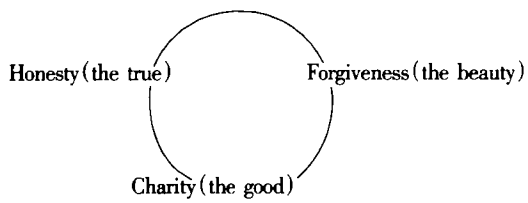



**Fig.1 Cognition frame**

The numbers express the importance order (the larger the number is, the more important is the kind of knowledge.) contributing to modern knowledge.

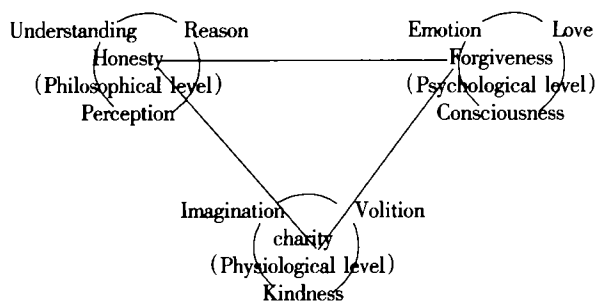
## TRIAD ETHICS AND TRIAD VIEW OF LIFE

In ethics, triad relation is




Triad ethics means that we should generally be charitable to everyone under the condition of maintaining the basic ecological balance and human living, should forgive other persons, and should be sincere in society.

So, an ideal humanity or personality is the unity of charity, forgiveness and honesty. I think that humanity has complex multi – level inner structure, which contains physiological, psychological and philosophical levels. It is a two order triad system:




In the system, charity(the good) is the dynamic source of kindness, volition and imagination. So are forgiveness (the beauty) of consciousness, love, emotion and honesty(the true) of perception, reason, understanding. The triad ethics derives from the humanity structure.

Logic, science and law result from reason. Courage, willpower and war are caused by volition. And joy, anger, anxiety, fear(terror) and arts come from emotion. In physiological level, volition is main; in psychological level, love is main; and in philosophical level, reason is main. Humanity may mainly be a Trinity of volition, love and reason. Certainly, we cannot ignore other natures, for example, there will be no hope without imagination.

Paying attention to kindness and developing reason are necessary paths for training ideal personality.

I think that the moral level will adapt to the social civilization and economic level. In future, everyone can choose a suitable ethics based on his conditions. There are three standards for choice:

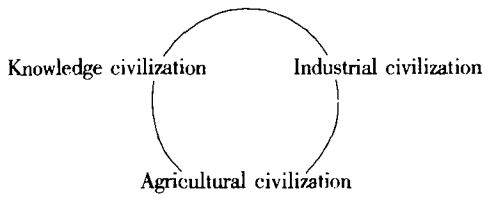
1 High standard(The sage view of life): Charity for everything and forgiveness for everyone. He is glad to help others and to act for society. He will say: "I like to be charitable to the world, forgiveness for all the people and honesty in the society."

2 Middle standard(The gentleman view of life): Keep goodness in mind and be upright in action. He is peaceful and modest. He will say: "I will keep charity and forgiveness for good people, and honesty in society."

3 Low standard(The masses view of life): Do not destroy social safety. He dislikes to help others. But he does not hurt others either. He will say: "I am charitable only to myself, forgiveness only for my friends; but I am honesty in society."

If most people can get middle standard in a society, the social morality will be good. Even low standard will lead to peace and quietness. The base is to keep "honesty in society".

I think that agricultural civilization, industrial civilization and knowledge (post-industrial) civilization will meantime exist in the future world. The triad civilization (society) will need triad ethic regulation.




Triad Ontology, triad epistemology and triad ethics construct the main frame of triad philosophy.

## THE FOUNDATION OF TRIAD MATHEMATICS AND PHYSICS

In triad mathematical system, + and −, × and ÷, $R$ and $\mathcal{R}$ become triad operators. Many new mathematical results may be introduced based on $R$ and $\mathcal{R}$.

We need new definition of rotation $R$ and anti-rotation $\mathcal{R}$ in mathematics. The general definition should be studied.

When we apply triad scientific idea to physical system, we need a new coordinate or dimension corresponding to space and time. What is the new coordinate? This is a lost basic coordinate in past physics. I find it based on the thinking of relationship between number and quantity. We do measure anytime and everything cannot be separated from measure in the world. But we ignored the basis of measure. There must be a measure coordinate which is the basic dimension of the world. We need the coordinate for measure. That is quantity coordinate. Quantity is like space and time. Only when there is quantity, space and time can be measured. Thus, quantity-space-time cannot be divided each other. Space-time-quantity constructs the cosmos coordinate system. And number relates them together as a whole.

The basic triad physical frame, after quantity coordinate is introduced, is shown as follows:

| Coordinate | Symmetry | Conservation | Physical constant | Coordinate integral |
|---|---|---|---|---|
| Quantity ($r$) | broken | none | $k$ | $I = \int \eta \mathrm{d}r$ (1) |
| Space ($s$) | space movement | momentum($p$) | $h$ | $m = \int \rho \mathrm{d}s$ (2) |
| Time ($t$) | time movement | energy($E$) | $c$ | $E = \int \varepsilon \mathrm{d}t$ (3) |

where $k$ is Boltzmann constant, $h$ is Planck constant and $c$ is velocity of light; $\rho$, $\varepsilon$, $\eta$ are separately density of mass, of energy and of information; and $m$, $E$, $I$ are separately mass, energy and information. Considering information equals negative entropy and based on the second law of thermodynamics, we have

$$\mathrm{d}H \geqslant \frac{\mathrm{d}Q}{T} \tag{4}$$

in which $H$ is entropy, $Q$ is heat and $T$ is temperature. Because $E = -Q$ and $I = -H$ in the system, we get

$$\mathrm{d}I \leqslant \frac{\mathrm{d}E}{T} \quad \text{or} \quad E \geqslant \int T\mathrm{d}I \tag{5}$$

Analogizing with $E = mc^2$ (6)

We should have $E = ITh^2$ (7)

Contained here is the idea of unifying the macrocosmos and micro-world, and combining the theory of relativity and quantum theory.

The analytical method for triad physical system required setting up of triad interaction at first:

$$T_{\mu\nu} = (T_{pq})_{rst} = \begin{pmatrix} T_{rr} & T_{rs} & T_{rt} \\ T_{sr} & T_{ss} & T_{st} \\ T_{tr} & T_{ts} & T_{tt} \end{pmatrix} \tag{8}$$

$T_{\mu\nu}$ is triad interaction matrix (two order tensor), $T_{pq}$ is the interaction between $p$ and $q$ ($p$, $q = r, s, t$). Because space is three dimension, $T_{ss}$ itself is also a three order matrix (two order tensor):

$$T_{ss} = (T_{ij})_{3\times3} = \begin{pmatrix} T_{11} & T_{12} & T_{13} \\ T_{21} & T_{22} & T_{23} \\ T_{31} & T_{32} & T_{33} \end{pmatrix} \tag{9}$$

in which $T_{ij}$ expresses the interaction between $i$ and $j$ ($i, j = 1, 2, 3$).

The general action of triad unified field becomes

$$S = \int L(r, s, t)\mathrm{d}t = \int g_{\mu\nu} T_{\mu\nu} \, \mathrm{d}t \tag{10}$$

in which $g_{\mu\nu}$ is triad gauge matrix corresponding to $T_{\mu\nu}$ .

$$g_{\mu\nu} = (g_{pq})_{rst} \begin{pmatrix} g_{rr} & & g_{rs} & & g_{rt} \\ & \begin{pmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \\ g_{31} & g_{32} & g_{33} \end{pmatrix} & & \\ g_{sr} & & & g_{st} \\ & & & \\ g_{tr} & & g_{ts} & g_{tt} \end{pmatrix} \tag{11}$$

$SU(3)xSU(2)xU(1)$ symmetry can be embedded in Eq. (11). This is the mathematical form of a new unified field.

If we replace asymmetric quantity coordinate with symmetric charge coordinate, we can construct standard model more easily; but we may also meet same problems like standard model.

## TRIAD UNIFIED FIELD THEORY

Applying the principle of least action and calculus of variations, we have

$$\delta S = \delta\int L(r,s,t)\mathrm{d}t = \delta\int g_{\mu\nu}T_{\mu\nu}\mathrm{d}t = 0 \tag{12}$$

Eq. (12) means

$$\int\left[\left(g_{\mu\nu}\frac{\partial T_{\mu\nu}}{\partial r} + T_{\mu\nu}\frac{\partial g_{\mu\nu}}{\partial r}\right)\delta r + \left(g_{\mu\nu}\frac{\partial T_{\mu\nu}}{\partial s} + T_{\mu\nu}\frac{\partial g_{\mu\nu}}{\partial s}\right)\delta s + \left(g_{\mu\nu}\frac{\partial T_{\mu\nu}}{\partial t} + T_{\mu\nu}\frac{\partial g_{\mu\nu}}{\partial t}\right)\delta t\right]\mathrm{d}t = 0 \tag{13}$$

A possible result of Eq. (13) is that every item equals zero in it:

Quantity term $g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial r} + T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial r} = 0$

$$\begin{cases} g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial r} = -\,T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial r} \\ g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial r} = 0,\ T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial r} = 0 \end{cases} \tag{14}$$

Space term $g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial s} + T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial s} = 0$

$$\begin{cases} g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial s} = -\,T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial s} \\ g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial s} = 0,\ T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial s} = 0 \end{cases} \tag{15}$$

Time term $g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial t} + T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial t} = 0$

$$\begin{cases} g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial t} = -\,T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial t} \\ g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial t} = 0,\ T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial t} = 0 \end{cases} \tag{16}$$

As unified field exists, there must be $g_{\mu\nu} \neq 0$ . So, we get $\dfrac{\partial T_{\mu\nu}}{\partial r} = 0$ from $g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial r} = 0$. It means that $T_{\mu\nu}$ is independent of $r$ . Therefore, we can choose Einstein tensor which is only relative to space and time as $T_{\mu\nu}$ :

$$T_{\mu\nu} = -\,kG_{\mu\nu} = -\frac{c^4}{8\pi G}\left(R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R\right) \tag{17}$$

in which $k = \dfrac{c^4}{8\pi G}$ is constant, $G_{\mu\nu}$ is Einstein tensor, $R_{\mu\nu}$ is Ricci tensor and $R$ is total curvature. This is Einstein equation (Pauli, 1958) in the general theory of relativity.

Eq. (17) describes dynamic field. Comparing with static field equation which contains cosmic item

$$T_{\mu\nu} = -\,aG_{\mu\nu} = -\frac{c^4}{8\pi G}\left(R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R + \lambda g_{\mu\nu}\right) \tag{18}$$

we can find that the cosmos constant must be zero in motional cosmos.

As the space is three dimension, we can let $s = (x_1, x_2, x_3)$ and $t = ix_4$ .

Combining $\dfrac{\partial T_{\mu\nu}}{\partial s} = 0$ and $\dfrac{\partial T_{\mu\nu}}{\partial t} = 0$ , we get

$$\frac{\partial T_{\mu\nu}}{\partial x_\lambda} + \frac{\partial T_{\lambda\mu}}{\partial x_\nu} + \frac{\partial T_{\nu\lambda}}{\partial x_\mu} = 0 \tag{19}$$

Meanwhile, let $g^{\nu\mu}g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial x_\nu} = -\,g^{\nu\mu}T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial x_\nu} = J_\mu$ , we have

$$\frac{\partial T_{\mu\nu}}{\partial x_\nu} = J_\mu \tag{20}$$

Eqs. (19) and (20) are Maxwell equations (Trainor and Wise, 1981), in which $T_{\mu\nu}$ is the electromagnetic field tensor including electrical field $E$ and magnetic field $H$

$$T_{\mu\nu} = \begin{pmatrix} 0 & H_3 & -H_2 & -iE_1 \\ -H_3 & 0 & H_1 & -iE_2 \\ H_2 & -H_1 & 0 & -iE_3 \\ iE_1 & iE_2 & iE_3 & 0 \end{pmatrix} \tag{21}$$

For Yang-Mills gauge field (Yang and Mills, 1954), we can choose

$$T_{\mu\nu} = \frac{\partial B_\mu}{\partial x_\nu} - \frac{\partial B_\nu}{\partial x_\mu} + i\varepsilon(B_\mu B_\nu - B_\nu B_\mu) \quad (22)$$

Thus, it can be concluded into Eq. (13) in form.

Therefore, Eq. (13) containes Einstein gravitational field, Maxwell electromagnetic field, and Yang – Mills gauge field. So, (10) has been an action of the unified field.

When we process dynamic systems, there is $\delta t = 0$. We can get dynamic equations of triad unified field theory (UFT) from Eq. (13) as follows

$$\begin{cases} g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial r} + T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial r} = 0 \\ g_{\mu\nu}\dfrac{\partial T_{\mu\nu}}{\partial s} + T_{\mu\nu}\dfrac{\partial g_{\mu\nu}}{\partial s} = 0 \end{cases} \quad (23)$$

For unifying gravitational and electroweak fields (Pandres, 1999), supersymmetry theories (such as supergravity, superstring, SUSY Yang – Mills theories, M theory) are developed. But these theories introduce elusive 10 or 11 dimension; and the triad UFT can directly get 11 dimension system which possesses realistic meaning:

Real integrated space — Imaginary integrated space

$$\begin{pmatrix} g_{rr} & & g_{rs} & & g_{rt} \\ & \begin{pmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \\ g_{31} & g_{32} & g_{33} \end{pmatrix} & & & \\ g_{sr} & & & & g_{st} \\ & & & & \\ g_{tr} & & g_{ts} & & g_{tt} \end{pmatrix} \text{ – link dimension – } \begin{pmatrix} ig_{rr} & & ig_{rs} & & ig_{rt} \\ & \begin{pmatrix} ig_{11} & ig_{12} & ig_{13} \\ ig_{21} & ig_{22} & ig_{23} \\ ig_{31} & ig_{32} & ig_{33} \end{pmatrix} & & & \\ ig_{sr} & & & & ig_{st} \\ & & & & \\ ig_{tr} & & ig_{ts} & & ig_{tt} \end{pmatrix}$$

3 + 2 = 5 dimensions — 1 dimension — 3 + 2 = 5 dimensions

There is only five dimension integrated space in the realistic world. (Here, I use term "integrated space" for differentiating from four dimension space-time in relativity and abstract space in mathematics.) The model will help to eliminate uncertainty from 11 dimension M theory or 10 dimension string theories to 5, 4, 3 dimension realistic world when retrenching.

The vacuum is realistically the integration of quantity-space-time which has decided physical constants.

## TRIAD COSMOLOGY

The basic triad cosmos model based on triad physical framework is shown Fig. 2.

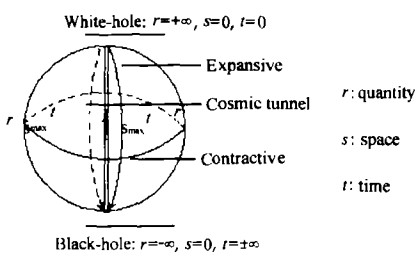


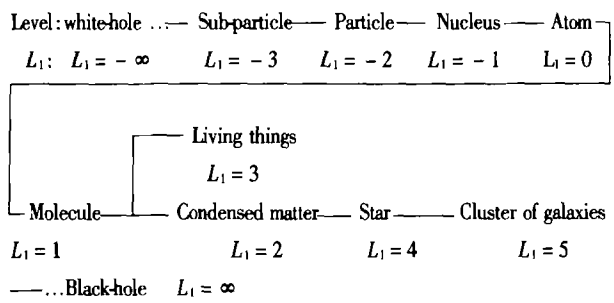

**Fig.2 Triad cosmos model**

The dark substances or negative substances should be inside the cosmos or in cosmic tunnel. All the substances spurt out from the white-hole and falls into the black-hole, which forms a cosmic cycle. The CPT theorem should be correct in the cosmos.

All the living beings, fruits and seeds are like the model. The holo – cosmology can be correct only in the model.

Spreading the cosmos out, I can give following world picture.

We all know that there exist some steady structural levels in the physical world such as particle, nucleus, atom, molecule, condensed matter, star, galaxy, and so on. We must describe these levels with a parameter. I introduce structure level $L_1$ for this aim. For atom level, $L_1 = 0$; for molecule level, $L_1 = 1$; for condensed matter level, $L_1 = 2$; for nucleus, $L_1 = -1$; and so on. Living things are very special, therefore I give it $L_1 = 3$. All the levels which we have found in the physical world are shown as follows.




substance or matter whose structure level is $L_1$ consists of substances or matters whose structure levels are $(L_1 - 1)$ .

Let us consider a natural system with energy which is on structure level $L_1$ . I classify the energy as structure energy or system energy $E$ and process energy or environment field energy $E_p$ . Structure energy $E$ is the energy stored and produced in the inner system. And process energy $E_p$ is the energy formed and produced in the environment or between system and environment. When a natural system is static and steady, its structure energy $E$ is constant. $E_p$ is a dynamic concept. Where there is interaction or motion, there is $E_p$ . Meantime, $E$ may divide as inner structure energy $E_s$ and combined energy or inner field energy $E_c$ . $E_s$ is the static energy ( $= mc^2$ ) of substances which form the system. The meaning of $E_c$ is same as that in atomic physics.

Based on the conservation law of energy, we get

$$E = E_s + E_c \tag{26}$$

If we suppose energy which is produced or stored in a system is negative, and energy which comes from the environment or escapes from a system is positive, we have

$$E = -|E_s| - |E_c| < 0 \tag{27}$$

A natural system is steady only when $E_p < |E_c|$ for definite $L_1$ . $E_p < |E_c|$ is important. It means $-E_c < E_p < E_c$ . If $E_p < -E_c$ , "environment" will be more steady than "system". When $E_p \geqslant |E_c|$ , the natural system whose structure level is $L_1$ will fall apart. But its inner structure whose structure level $\leqslant L_1 - 1$ will keep steady relatively unless $E_p$ is strong enough to destroy the inner structure energy system. Thus, all levels will relatively become independent of each other. The result may be called as the law of level independence.

The more a system stores energy, the more steady the system is. Hence, for a motional system, the system equation for optimizing is

$$\min E = E_s + E_c \tag{28}$$

subject to $E_p < |E_c|$

$L_1$ = constant, $L_2 = 0, 1, \cdots$

Generally, we should pay attention to $E$, $E_c$ and Ep that are functions of $(r, s, t)$ .

When $E_p \geqslant 0$ , the dual problem of $E_q$. (28) is

$$\max |E_c| \tag{29}$$

subject to $E_p \geqslant E_s$, $E_s < 0$

$E_p \geqslant E_c$, $E_c < 0$

It is shown from Eqs. (28) and (29) that the principle of minimum energy is equivalent to the rule of maximum combined energy.

While $E_p < |E_c|$ , the inner structure of a system is steady, but its state or status may vary as $E_p$ changes ( for example, solid, liquid or gas). Therefore, we must describe the things with another parameter. I introduce state level $L_2$ for this purpose. $L_2 = 0, 1, 2, \cdots$ correspond to various states of system on definite $L_1$ . $L_2 = 0$ may be called basic state; $L_2 = 1$ may be called first excited state or first dissipative state; $L_2 = 2$ may be called second excited state or second dissipative state; and so on. For atom system, $L_2 = n - 1$ is the principal quantum number. Thus, we may call $L_2$ as generalized quantum number ( for condensed matter and higher levels, $L_2$ is as if a macro-quantum number). For definite $L_1$ and $L_2$ , while environment possesses energy $E_p$ and the energy changes $dE_p$ , we have $E_p + dE_p < |E_c(L_2 = 0)|$ for system existing. $dE_p$ will influences the system properties. When $0 \leqslant dE_p < E_c(L_2 + 1) - E_c(L_2)$ , the system will keep in state $L_2$ ; when $dE_p > E_c(L_2 + 1) - E_c(L_2)$ , the system will leap to state $L_2 + 1$ ; when $dE_p \leqslant 0$, the system will fall to state $L_2 - 1$ . If a lot of substances jump meantime from $L_2$ state to $(L_2 - 1)$ state , much energy will be released uniformly like laser.

When there exist two and more fields or forces in the environment, a system which is in state $L_2$ may divide into multiple sub-state levels (we may introduce $L_3 = 1,2,\cdots$) according to various conditions. These seem generalized Zeeman effect and Stark effect.

The idea for generation of substances in triad physics concentrates to become that "coupling introduces mass and waving produces particles", which is an extension of wave-particle duality. The coupling waves of quantity-space-time can produce massy particles so that we do not need Higgs mechanism for introducing mass. The basic ideas include that origin vibration in quantity direction produces gluon G; that space direction graviton g ; that time direction photon $\gamma$ ; that basic coupling wave of quantity-space introduces down quark d; that the basic coupling wave of quantity-time introduces up quark u; that the basic coupling wave of space-time produces neutrino $v_e$ and that the basic coupling wave of quantity-space-time produces electron e. All the basic coupling waves are genons or basicons (generation I). Genons are relative stable. When excited by energy, genons will become excitons (generation II and III). Excitons are relative unstable and will decay into genons.

In addition, the triad methodology can also be widely applied to sciences and technologies. For example, there are many triad systems in science and technology as shown Fig.3.

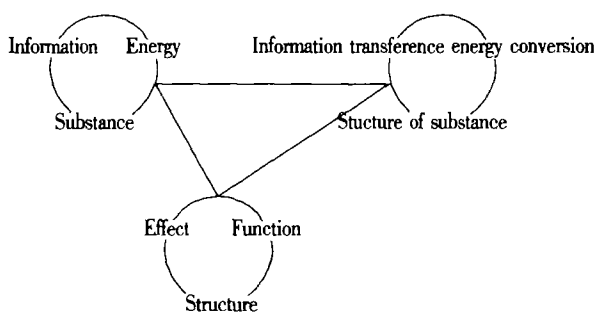



**Fig.3 Triad System and Triad Methodology**

The triad methodology can also be applied to other systems, from bridge construction to ship design, from economics to management, even from literature to music. It is a generalized method for thinking, analyzing and systematizing in sciences and arts.

Although the above thoughts are only preliminary ideas, I believe that the ideas will promote new scientific advances.

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