

Vacuum Mechanics A Realistic Theory of Everything (VRTE)

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(1 June 2009)

Abstract. Lacking of rational **philosophical ideas** (physical models) which explain the **mechanisms** of the four main physics theories (i.e. electromagnetic field, special relativity, general relativity and quantum mechanics), physicists have failed to unify the four basic forces of nature (electromagnetism, gravity, weak and strong force). Based on the new concept of **Vacuum mechanics** (i.e. the mechanism of vacuum medium) which acts as the **same one common mechanism** for all natural phenomena, then a simple and realistic theory of everything is possible to be achieved!

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1) Introduction. This is a simple and understandable theory of everything (TOE). It was the fruitful product of the author's original article "**Vacuum Mechanics a New Approach to the Theory of Everything**" (VMTE), together with the four expanding papers; "Completed Maxwell electromagnetic field theory" (CEMT), "Completed Einstein special theory of relativity" (CSTR), "Completed Einstein general theory of relativity" (CGTR) and "Completed Quantum mechanical theory" (CQMT) respectively [1].

To **modernize** the story of this paper, we will relate it to the recent two great scientific books: The first one is "**The trouble in physics**" written by **Lee Smolin**, a founding member of the innovative Perimeter Institute for Theoretical Physics. It is one of the popular books of this kind which talking about "The Rise of String Theory, the **Fall of a Science** and What Comes Next". And here, **we will try to answer the five great problems** in physics (that prevent physicists from TOE and which was mentioned in the book) by using **Vacuum mechanics!**

The second book is "**The Lightness of Being** (Mass, Ether, and the Unification of forces)" written by **Frank Wilczek**, a Nobel Prize winner in physics 2004. For me (the author), I found that it is the first best book ever written by a top level physicist which accept the **existence** of (something like) **the Ether** (Aether)! And here, we will compare it to our **Vacuum medium** concept!

By the way, here is the **acknowledgement** for the authors of the two books. And it was assumed that all readers have read them all. Anyway, without reading them before, ones may be able to get some idea, but it is advised to read them all for full understanding!

1.1) Why TOE could not be found? Let us start with Einstein's idea to **unified gravity with electromagnetism** via a five-dimensional theory which was explained in Lee Smolin's book, chapter 3 "The World As Geometry". But Einstein could not success for the theory until the end of his life. Beside Einstein's five-dimensional unified theory, several theories that **involved extra dimensions** are invented. And the most popular one is of course, **it is string theory!** Anyway, as we know none of them could success their goal.

For me, I am not so happy with any extra-dimension theory. Why nature has to hide the extra dimensions? **There should be a simple intuitive way for her to build the universe** and here, this article "Vacuum mechanics: A realistic theory of everything" is one that we asked for! And also we will see later that even Einstein's dream via a five-dimensional theory mentioned above, **could be done** with our familiar four-dimension. In VRTE, **it is no need for the fifth dimension** (which has to curl up to a tiny piece in order to hide from us) to unify gravity with electromagnetism. Instead, we just used what which was called "**condensed of vacuum medium space**", something like a tiny black hole to do the job!

1.2) How and why physics is in trouble? Lee Smolin has told us (in the first chapter of his book) about the "the Five Great Problems in Theoretical Physics" which is **the core of our failure** to complete the present **scientific revolution in physics**. Of course no one yet knows why and how it is being so; otherwise it is easy to find TOE. Here we try to investigate and see **what should be the cause of these problems!** Once we know the cause behind the problems, then we would find the correct way to solve them without difficulty.

First let us start by considering the four **main theories in physics**, i.e. Maxwell electromagnetic field theory (EMT), special theory of relativity (STR), general theory of relativity (GTR) and quantum mechanical theory (QMT). And all these great theories have work so successful that it seems to have nothing wrong with them! Anyway, as we will see next that **all of them have one of the same weak point within!** And the problem we want to talk about is not a complicate one as the problem 2 (problem with reality in QMT) which was point out by Lee Smolin in his book. Instead **it is the simple problem about our intuitive feeling** which was ignored by almost theoretical physicists -- people who knew them best. It is the problem of **lacking of their physical models which explain their mechanism or how the theories work!**

Actually, if we just only use their **mathematical formulas** (provided by the theories) for solving the relevant job, **it is no need to know** about the philosophical idea behind the theory. But if we want to put them to work together such as trying to merge GTR with QMT forming a TOE, for example, then the problem occur as we are now facing. Someone may ask why the **model** (mechanism) of the theory is so important. The reason is that if we do not understand how the theory works then it may guide to **wrong misinterpretation** which then lead to something crazy. Indeed this is a **crucial point**, since we all know that "**understanding is the progress of science**", later we will see some examples of **serious side effect** due to the misinterpretation.

2) What wrong with physics theories? Up to now we have found the clue that **lacking of understanding** the mechanism of the theories should be **the cause of the trouble in physics**. Here we have to point out one important concept that "when we deal with any mechanism, **we must have something to work with**", we can not deal with any mechanism **via nothing** otherwise it is just an abstraction, **not a real** (physical) one! So this means that there must be some "**medium**" which act as the carrier of the mechanism! Below, we will point out what the mechanisms of the mentioned theories should be, and then later we will try to show how they work!

2.1) Problem of electromagnetic field theory. Nowadays, we may say that everyone familiar with "**mobile phone**", but it is interesting to note that no one know exactly how the equipment communicate with each other! Someone may say that it was done via the built-in radio transmitter and receiver. Yes, it is, but the problem is that "**how the radio wave signals propagates through vacuum space**"! Beside the radio wave propagation problem, there are other problems such as how the radio signal was sent from the antenna, what was the radiation resistance is, etc. All of these problems are due to **the lacking of mechanism which explains how the phenomena work!** (Please see detail in CEMT mentioned in the introduction.)

Scientists who believe in **James Clerk Maxwell** who invented electromagnetic field theory, would say that radio wave propagate via aether, while main part of physicists seem to believe in **Albert Einstein** who created special theory of relativity without aether! But it is crazy, how radio wave could be created without any medium (aether). Some physicists have tried to explain that radio wave could propagate by **mutual creation between electric and magnetic field**. At first sign the explanation seems to solve the problem, but instead it create more severe problem because both electric field and magnetic field are **simultaneous created** from the common current source, so this will **violate the principle of causality!**

2.2) Problem of special theory of relativity. Now how about STR, it seems that it requires no “mechanism” or anything as it does in EMT? Actually, the answer is yes it does! The main philosophic problem of STR is the “**increasing mass**” of the moving object. Where did the increased mass come from, and **what is its mechanism?** This is a severe problem because it means that **we could get mass (or energy) from nothing!** Anyway, remember that historically STR was invent to solve problem in electrodynamics; the increasing of the moving electron’s mass in electromagnetic field. So this should be the clue for the desired **mechanism** beside Lorentz force.

By the way, from the mathematical formula involved we could see that the increasing mass is due to the “**gamma factor**” of Lorentz transformation. Then if we know the **physical meaning** of Lorentz transformation, which should be the “**mechanism**” that we are looking for! Beside the mentioned problem, STR comes with counter intuitive “side effect”, i.e. length contraction and time dilation of the moving object. So the mechanism we found may show us the **correct interpretation** of the crazy side effect just mentioned.

2.3) Problem of general theory of relativity. Because GTR was extended from STR by including gravity, so it has the same philosophic problems as STR do. Further more GTR itself was born with another serious philosophic problem about space-time. The theory says that **space-time could be curved and distorted by the gravity**, it is alright. But remember that is vacuum space is empty, then how space without “anything” could be curved, i.e. **what is its mechanism?** Thing get worse when the theory say that gravity wave could propagate by the **vibration of empty space-time**. This is crazy, and how could we understand it?

But if there is “**something**”, something which is a **physical medium** involved in the vacuum space, and then the problems may be solved. Indeed, the physical medium mentioned could act as the mechanism of the theory. This mechanism may be able to explain **how the gravity works**, or the mechanism which could show **how gravity wave propagates!**

2.4) Problem of quantum mechanics. To find the clue of the cause of problem, first let us start with Nobel Prize Laureate Richard. P. Feynman word which was talking about **electrons’ interference phenomenon**, “The question now is, how does it really work? **What the machinery is** actually producing this thing? Nobody knows any machinery. ...” [2]. Of course it does not mean that it is no need any mechanism for the quantum phenomenon, **this is physics, not a magic!** So there must be “**something**” which act as the mechanism we are seeking.

By the way, it is interesting to note that according to **quantum field theory**, vacuum space was filled with **zero point energy**. May be this energy will give us the clue of the mechanism which involved with **electrons’ wave** for the interference phenomenon. Also the concept of **virtual particles – antiparticles** seem to point to same direction that there is “**something**” in vacuum medium, something which provide the underlay mechanism!

Lastly, let us return to another word from Richard. P. Feynman, “**Nobody understands quantum mechanics**” [3]. From my opinion it is quite clear that because it is lacking of the **mechanism** behind quantum mechanical theory! And even through quantum mechanics is a successful tool in prediction with a great accuracy, but if we do not **understand** it correctly, it would be **misinterpreted** to something crazy such as the problem of “**reality**” which was point out in Lee Smolin book!

3) Reconsider vacuum space. Up to now, we have found that all the main theories mentioned are involved with “**vacuum space**”! Yes, it is the space which we thought that **it is an empty space**, may be it is not empty at all. Ah, some one would say that you will go back to the **old aether concept**, won't you? Don't you know that it was proved that aether does not exist? Or, do you have any new way of proving? The answer to the first question is yes and no. Yes, I believe in something which has some general property like aether. And no, **it is not something** as the aether **which filled the empty vacuum space, but it is vacuum medium space itself!** For the second question, the answer is that the conventional prove is not so clear cut and we will show how it is. And the answer to the third question is, yes we do; we have a **simple scientific experiment prove.** All the new idea mentioned will be explained next.

3.1) Vacuum medium – the primordial substance. It is the geometrical structural gravitational potential energy; the energy that each of its infinitesimal part holds each other together by its internal gravitational force and forming to be the **physical fabric structure of our space** called **vacuum medium space!** And we could see that gravity is the property vacuum medium space. If we interpret that the existing of vacuum medium space itself as positive energy and its internal gravitational force as negative energy, then the total energy is zero, i.e. **the principle of conservation of energy is preserved!**

In more detail, vacuum medium is a **uniform, transparent** and **continuous medium** which have a peculiar mechanical property. It is very thin in mass density ($\rho = 23.3 \times 10^{-28} \text{ Kg./m}^3$) so **it is permeable by all matters** almost without any observed resistance. But it has very **large elastic coefficient** and sensitive to shear force (rotational force) while not to compressive or longitudinal force. The reason is that normally the elastic resistance against change of volume is larger than that change of relative orientation, especially if the volume is the **fabric structure of the whole space!**

The most **fascination** about the vacuum medium energy (in which we will see later) is that it has a far reaching consequence; it is the same thing as what which was called “**dark energy**” in cosmology!

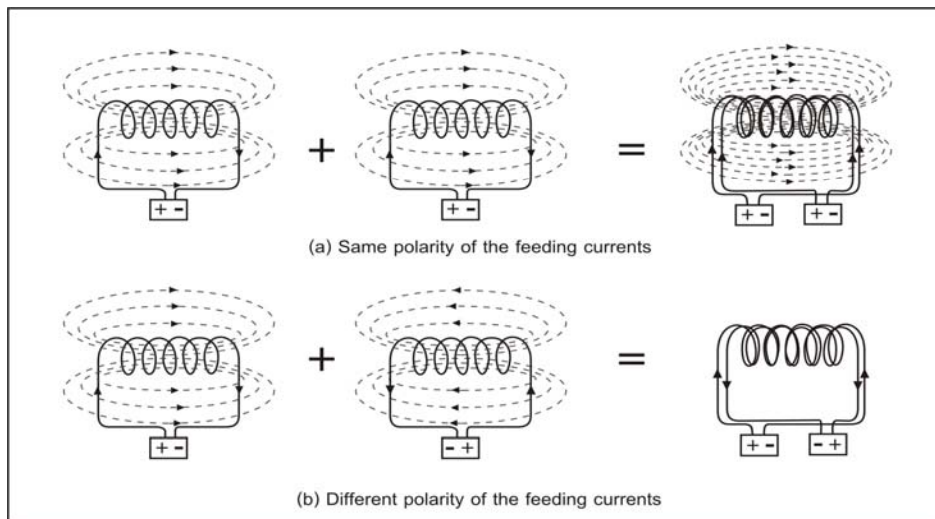


Figure 1 Two-solenoid experiment.

Experiments prove for the existence of vacuum medium could be done without difficulty. The simplest one is “Two-solenoid experiment” as shown in the diagram in figure1. The experiment is about the magnetic field B generated by a direct current flowing in solenoids according to the formula,

$$B = \mu_0 in \dots (1). \text{ [Where } \mu_0 = \text{ permeability constant, } i = \text{ feeding current and } n = \text{ no. of turns.]}$$

If both two identical solenoids were feed with the same amount (and same polarity) of direct currents as in (a) then **the sum of the generated magnetic field is double**. But if the feeding currents are opposite as in (b) then the sum of the generated magnetic field is **zero**. But according to the **law of conservation of energy**, the generated magnetic field energy **cannot be destroyed!** So where is the generated energy gone? The only one sensible explanation is that there is a **cancellation of the opposite phase of internal rotational stress** in the vacuum medium. So this would mean that **vacuum medium is existed**, won't it?

3.2) Misinterpretation of aether. As mentioned early that vacuum medium has some property like aether, we would like to point out some important things which were used to explain against the aether in the past time. This is crucial because **it is not clearly proved for the non-existing of the aether or vacuum medium** (in our case)!

First, it was told that if aether is a **physical medium** and acting as the carrier for light wave, then it must be very rigid in order to bear such a high speed of light. This concept was based on the wave speed in solid material in which the speed in the denser material is higher than in the lower one. **But this analogy is not quite right** because if aether was assumed that it is something like earth atmosphere, but with thinner density than air. So in this case we have to compare the aether to something like **hydrogen gas** which has a thinner density than air. Then we would found that wave speed in hydrogen gas is faster than normal air, i.e. for air's mass density $\sim 1.2 \text{ Kg./m.}^3$ and sound speed 331 m/s , while hydrogen mass density $\sim 0.089 \text{ Kg./m.}^3$ and sound speed 1284 m/s .

Second, it is about the null result of the famous **Michelson-Morley experiment** which was interpreted as “**no aether is existed**” (i.e. **there is no relative motion** between the earth and the aether). But what which was normally be omitted to be mentioned, is the length contraction of equipment's arm in the direction of earth rotation. The crucial point is that **we have no way to prove this contraction of equipment's arm!** People seem to believe in length contraction than the dragging of aether along the earth (and also the reason for explaining the side effect of the appearance of stars aberration for the dragging of aether).

Up to now we can say that there is no other experiment (except the Michelson-Morley experiment) was made and shown clearly that **there is no relative motion** between the earth and the aether. So what we need now is to do an additional experiment test on **other moving frame** (besides the moving earth). Fortunately, our technology about space explorer today could provide a suitable inertial moving frame for a better experiment test. **Space shuttle or space station** which is orbiting is what we expect to give us the **final judgment test!**

3.3) Einstein & aether. We have learnt and understood that conventional STR had rule out the existence of the aether when Einstein invent it in 1905. Anyway, Einstein's relationship with the aether **was complex and changed over time** as explained by Frank Wilczek in his book [3]. In 1920, Einstein had made a quotation as;

According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standard of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense.

Frank Wilczek had explained further and concluded that in GTR, Einstein used the concept of curved space-time to construct a theory of gravity. And to describe GTR, we can also use (what which he called) **metric field** which has **mathematical idea equivalent to** curved space-time. Anyway, there is no detail about Einstein's aether!

Now according to **Einstein's new idea** that GTR and STR do not deny the existence of the aether anymore, but the followed important problem is **how could we merge the aether into both** (conventional) **theories?** Indeed, we will see next that we could get STR and GTR which based on aether concept (aether-based) by using the new concept of **Vacuum mechanics!**

4) Origin of matters. Beside vacuum medium which is the fabric structure of vacuum space, now we will talk about matters which immersed in the sea of **vacuum medium space**. When some parts of vacuum medium were condensed, they form to be something like **tiny black holes**. Indeed, we can show by indirect prove that they should be tiny black hole (please see detail in VMTE). **Electron** and **proton** are two sizes of the tiny black holes and both of them are the **only two** kinds of **elementary** particles in the universe!

4.1) Electron black hole mechanism. In section 3.3 of VMTE, we have explained qualitatively about the formation of the only two kind of elementary charge particles, i.e. electron and proton. Now we will explain in a more **qualitative** way by using **Einstein's electron theory** mentioned (in VMTE) together with the **Reissner-Nordstrom solution** (of Einstein's field theory) [a] as follow.

According to Einstein's electron theory [4], he proposed that the electrical elementary particles (electron or proton) are **held together by gravitational forces**. In summary, he tried to approach the inquiry into the structure of the material particles based on the assumption of a **material energy-momentum tensor in the present of gravitational fields** together with **Maxwell's energy tensor**. Finally, he had got the desired formula (2) below.

$$F_{ik} s^k - (1/4\kappa) \cdot (\partial R / \partial x^i) = 0 \dots (2).$$

The first term in equation (2) is the **Coulomb repulsive force** which is **held in equilibrium** by a **gravitational force** in the second term. Of course, this seems impossible because Coulomb repulsive force is much stronger than gravitational force. Anyway, based on our new concept that electron and proton are tiny black holes, we would found that the problem was easily eliminated!

By using the **Reissner-Nordstrom solution** we could explain how electron or proton is staying stable in the surrounding vacuum medium space. Actually, the equation (3) is the solution of Einstein-Maxwell equation, which is the spherically symmetric, static, exterior field of a **charged particle**. Originally, it was used for considering **the gravitation field** of a charged particle and was hoped to be a useful model of electron, but failed!

$$ds^2 = \left(1 - 2m/r - 4\pi\epsilon^2 / r^2\right) dt^2 - \left(1 - 2m/r - 4\pi\epsilon^2 / r^2\right)^{-1} dr^2 - r^2(d\theta^2 + \sin^2\theta d\phi^2) \dots (3).$$

[Where the second term $2m/r$ in parenthesis is the gravitation field due to electron mass, and the third term $4\pi\epsilon^2 / r^2$ is the gravitation field due to electron electric field.]

Again, armed with the concept that electron is a tiny black hole immersed in the surrounding of vacuum medium, and then we would found how Reissner-Nordstrom solution should **be a rational model of electron** as below.

In diagram (a), it shows an electron sphere with radius r_e surrounding by vacuum medium. On the surface of the sphere, the suction force of electron black hole was countered by the internal tensile force (stress) in vacuum medium around, so **the total force on the surface of the sphere is zero!** In this situation the $2m/r$ term **must equal** to the $4\pi\epsilon^2 / r^2$ term, or equivalently we may say that **the effect of curved space due to gravity was canceled by the effect due to electric energy**. And then the line element metric will be **Minkowski (flat) space-time** there!

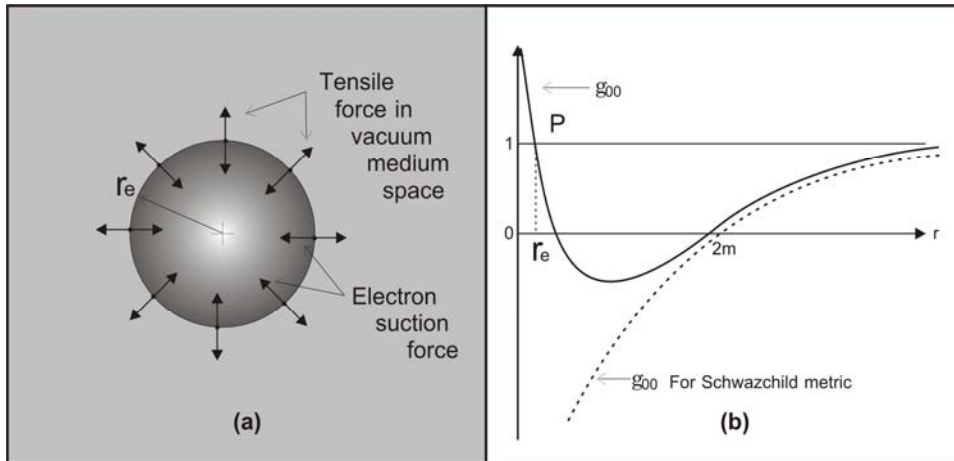


Figure 2 Electron black hole model.

According to diagram (b) which is the graph between the metric $g_{00} \left[= \left(1 - 2m/r - 4\pi\epsilon^2 / r^2 \right) \right]$ of **Reissner-Nordstrom** equation, and the **radius** r [5], we would found that at point P where $r = r_e$, $g_{00} = 1$, and we could calculate that electron radius r_e is equal to $1.5 \times 10^{-13} \text{ cm}$. Indeed, we also found that it is the same order as the classical electron radius, so it give us **confidence in the proposed electron black hole model!**

4.2) Matter formation. When **proton** and **electron** come close together, they attract each other and forming to be **hydrogen atom**. But **they can not attach together** because of the existing of vacuum medium between! Anyway, if they were forced to “attach” together by tearing off the vacuum medium between, then a **neutron** particle was created. And this compressing force which was used to overcome the tensile force of vacuum medium, it was named as “**weak force**”!

Next if two neutrons and two protons were forced to “attach” together, then a **nucleus of helium atom** will be created. Also this compressing force which was used to overcome the tensile force of vacuum medium between, it was named as “**strong force**”. Finally, when the **nucleus of helium atom** was created, it will attract the near by electrons and forming to be **helium atom**. This is the initial state of the **process** for forming **all kind of the matters in our universe** by using only two elementary particles, i.e. **proton** and **electron!**

5) Vacuum mechanics – the mechanism of vacuum medium. In physics, when we deal with rigid solids, we use the mechanics of rigid bodies as the tool. And when dealing with liquids or gases what we used is fluid mechanics. In the same way, we should use **Vacuum mechanics**, i.e. the mechanism of vacuum medium when dealing with **vacuum medium**. We will see its detail via the mechanism of the main theories in physics now.

5.1) Mechanism of electromagnetic field. With the concept that electrons and protons are tiny black holes, it is easy to explain electrostatic field and magnetic field phenomena. When an electron or a proton is staying still, it will attract the surrounding vacuum medium. And this will create the internal stress in the vacuum medium around, which is appeared as **electrostatic field**. But when it is moving, it will rotate (in the direction parallel to the motion’s axis) and create rotational stress while dragging the surrounding vacuum medium along – this is **magnetostatic field!**

In CEMT, conventional concept that “**different type of charge particles attract while the same types repel**” could be explained by the mechanism of vacuum medium. We know that “any size” of tiny black hole “attract” each other. But because they also attract the surrounding vacuum medium, so under certain distance apart, the same sizes of tiny black hole repel each other, while different size attract. This is because under such condition the attraction force between the black holes was affected by the vacuum medium between. So the better concept is “**different size of charge particles attract while the same sizes repel**”!

Also, we have explained how to **derive Maxwell equations** using the guideline from the concept of “**the quasi-elastic body model of aether**” developed by Professor Arnold Summerfeld. Then with this new concept; the dynamics action of stress-strain relations in vacuum medium, we could easily show that electromagnetic wave was create and propagate **by disturbing and vibrating** of the elastic vacuum medium. Also, the radiation resistance could be easily explained that it is the **resistive action of vacuum medium**!

5.2) Mechanism of relativistic effect. In CSTR, based on the concept which **vacuum medium space** act as **absolute privilege reference frame**, we have shown that it is possible to derive **Lorentz transformation** by using **k-calculus**! Also it provide us “**physical**” **meaning (interpretation)** of the Lorentz transformation, i.e. it is the relative “distance” and “time” measured by using light speed c which propagated via vacuum medium (while Galilean transformation deal with imaginary infinite light speed via empty vacuum space)!

The mechanism of “**increasing mass**” is easy to explain via the new concept, i.e. it is an “**additional inertial mass**” that resist to the moving mass which is “**immersed**” in vacuum medium space! (This is analogous to the **dragging force** act on a moving car, a flying plane etc. due to the existing of the earth atmosphere.) Similarly, **relativistic momentum and kinetic energy** all are not the **real property** by themselves, but arising from the effect of the **dynamic resistance of vacuum medium**.

Finally we have shown that **length contraction** of a moving object is **not a real** value; it is a relative length which occurred because Einstein tried to keep the constant velocity of light referenced to the moving observer! In the same way, **time dilation** of a moving clock “should be” a relative time, but instead **it is a real effect** because the clock’s mechanism is slow down due to its increased mass!

5.3) Mechanism of gravity. Under the concept that matter was **composed** with large amount of “**condensed vacuum medium**” (tiny black holes), then this is the reason that matters could **attract** each other. And this attraction force used vacuum medium as the transmitting medium and this is the **mechanism of gravity**. Also the conventional concept that gravity wave propagate via empty space could be rationally replaced by the propagation via the vibration of vacuum medium!

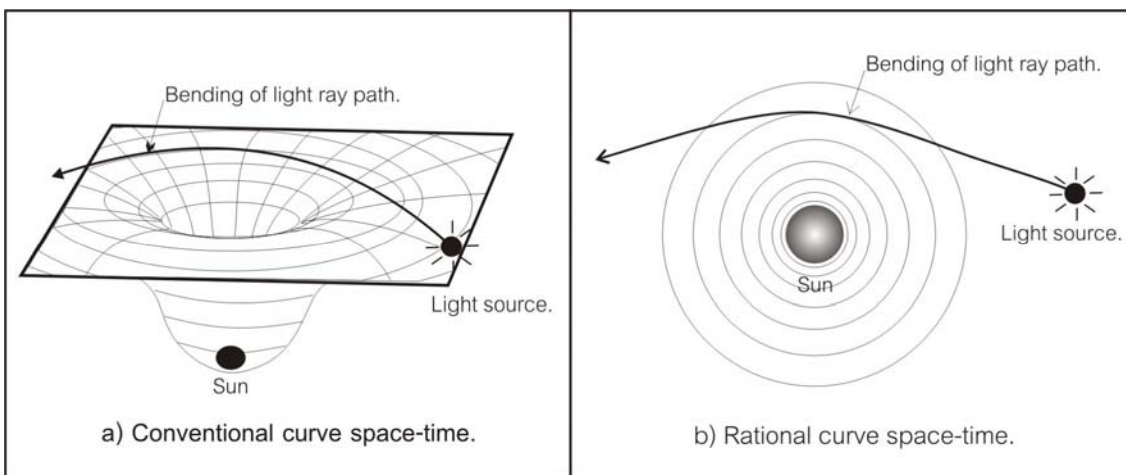


Figure 3 Light ray path through curve space-time.

In CGTR, we have explained in detail how **space-time could be curved and distorted** by the gravity. Here in short, it is due to the non-uniform of vacuum medium energy density which was created by a huge mass near by. So the traveling light ray passing, it will be **curved toward the denser space!** This is a more rational and understandable explanation than the conventional curve space-time as shown in the diagram fig.2.

Also, the problem of the **curvature of the universe** could also be settled using vacuum medium universe. Because the universe's volume is so huge, so even the **very thin density of vacuum medium has the total mass much more than all the visible matters!** This is the missing dark matters that most of cosmologists look for, and what follow is the possible **closed universe**. Indeed all of the **philosophic problems** could be solved using the concept of **vacuum medium universe!**

5.4) Mechanism of particle wave. In QMT we have show in detail that **electron wave** could be easily visualize analogous to a moving **water beetle wave**. When a beetle is moving on water's surface, it will disturb surrounding water and creating a co-moving **"surface water waves"** in front. In the same way the moving electron will disturb the surrounding vacuum medium and creating a **co-moving wave-packet!** Anyway, there are two different points between them; first the beetle wave is a 2-dimension wave, while electron wave is a 3-dimension wave. Second, beetle wave is a **vertical transverse** of water surface wave, while electron wave is a **rotational transverse** wave-packet of vacuum medium!

Once we got a **physical model** of de Broglie (particle) waves, **new derivation** of de Broglie wave relation based on wave-packet of vacuum medium is possible. And then it leads us to do a more rational derivation of **Schrödinger equation**. So the old mystery quantum mechanics was change to **"quantum vacuum mechanics"** i.e. quantum mechanics of vacuum medium which is now **could be understood by anyone!**

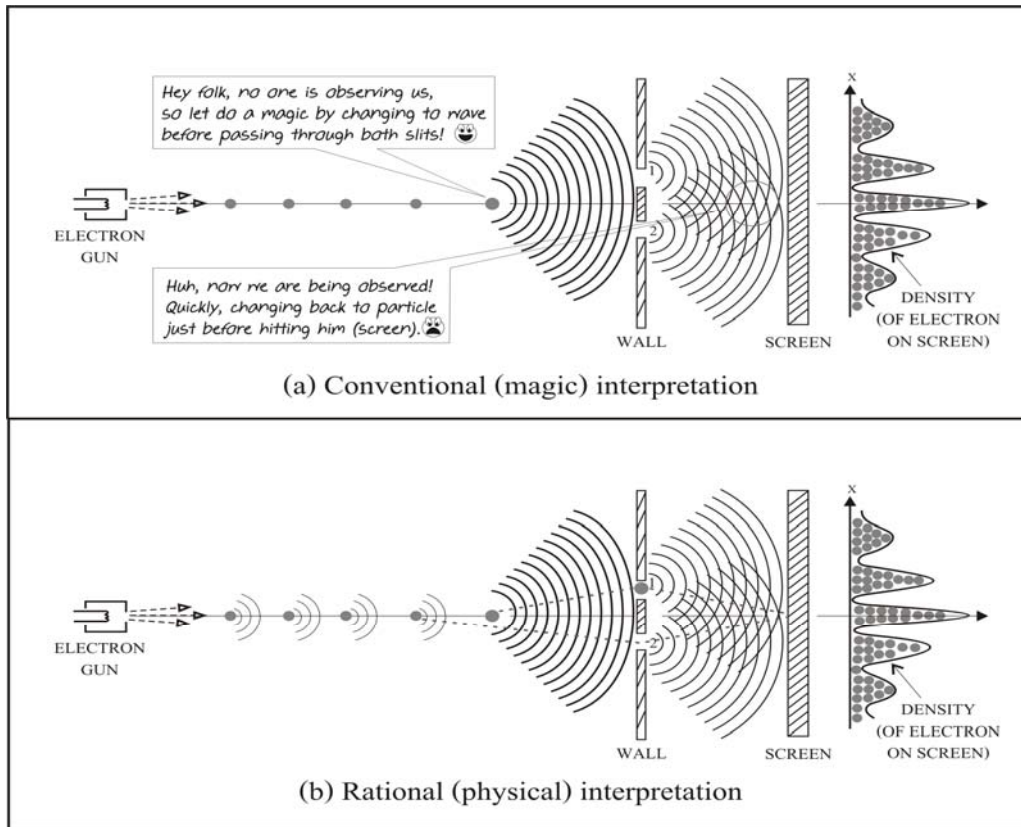


Figure 4 Wave collapse interpretation.

Based on **quantum vacuum mechanics** it is easy to explain the existing problems in the conventional theory. Indeed all the problems could be solved under the new concept, and here is the explanation of one of the most crazy problem; the well known “**wave collapse interpretation**”!

In conventional interpretation as shown in diagram fig.3(a) above, there is **no explanation** “how each electron convert itself into waves, passing through both slits and then the two part of waves **collapse** back into a single particle on screen”. It is something like the “**magic of electrons**”! But, armed with the concept that particle wave is the co-moving wave of vacuum medium, it is easy to visualize and understand how electrons do the magic.

In diagram fig.3 (b), all the electron particles **moving together with their own created particle waves**. Some of electrons pass through slit 1, while others pass through slit 2 randomly. While each electron passes through slit 1 **or** 2, its co-moving waves will pass through both slit **1and** 2 at the same time. After passing through both slits, both the waves will interfere each other while moving toward screen. Because the constructive interference zone **carries most of the energy of waves** (the high probability density), then it will guide the co-moving **electron to follow within the zone!**

6) Vacuum mechanics a realistic theory of everything. Up to now, we have seen what vacuum medium is, and how Vacuum mechanics works in nature. So it has given us some clue about the theory of everything, and here we will make the conclusion.

6.1) TOE -- Unified field theory. Conventionally, by definition TOE requirement is only to unify the four basic forces of nature. It does not mention anything about matter, and this may be because it was thought that matter is part of the basic force. Instead, VRTE has shown explicitly that all the four basic forces and matter are unified as follow.

a) **Gravity** is the internal contraction stress force occurs in vacuum medium. It is responsible for holding each of infinitesimal part of the medium together and forming to be the fabric structure of our universe. So we may say that **gravity is the intrinsic property of vacuum medium!**

b) **Matter** is the grouping of the only two real elementary charge particles i.e. electron and proton. And because both electron and proton are condensed vacuum medium, so **matter is a grouping of condensed vacuum medium!**

c) **Electrostatic force** is manifest of the internal stress force occurs in vacuum medium surrounding charge particle. Because charge particle acting as tiny black hole, so it is not surprise that electrostatic force is much higher than gravity. While a moving charge particle will rotate and dragging the surrounding vacuum medium, which is then appeared as **magnetic force!**

When charge particles are moving periodically (such as in an antenna), disturbance waves of vacuum medium (around) were created. The disturbance waves compose of two parts; the first part is a vertical variation one which appeared as electric field, while the horizontal variation part is appeared as magnetic field, so the total variation is electromagnetic field waves. In conclusion, **electromagnetic force is the action of the disturbance waves of vacuum medium!**

d) **Weak force is the attach force between electron and proton.** Normally electron will attract proton (as in hydrogen atom), but due to the existence of vacuum medium in between, so they can not “**attach**” together. External force was used to override (tear off) the tensile stress of vacuum medium in between, so this additional force which make proton attach to electron was named as **weak force!**

e) **Strong force is the attach force between proton and proton (or neutron).** Normally two near protons should attract each other due to its black hole force. But at a certain close distance they will repel each other due to the tensile force of vacuum medium (existed) in between. So external force was used to override (tear off) the tensile stress of vacuum medium in between, and this additional force which make the two protons “**attach**” together was named as **strong force!**

6.2) A Universe Made of Marble. After succeeding in creation of **general theory of relativity**, Einstein was frustrated about the structure of the field equation [6]. On one side of the equation was the curvature of space-time, which he likened to “**marble**” because it’s beautiful geometric structure. However, he hated the other side of this equation, describing matter-energy, which he considered to be ugly and which he compared to “**wood**”!

While the “marble” of space-time was **clean and elegant**, the “wood” of matter-energy was a **horrible jumble** of confused, seemingly random forms, from subatomic particles, atoms, polymers, and crystals to rock, trees planets and stars. Einstein’s grand strategy was to **turn wood into marble** that is to give a **completely geometric origin to matter!**

Actually, Einstein’s idea about the “completely geometric origin to matter” should mean that the universe as a whole was created from the “marble” i.e. **the universe made of marble!** Anyway, based on the concept that the universe is composed of a huge volume of vacuum medium space-time, and immersing with the condensed vacuum medium (i.e. matter), than the universe made of marble is really the **vacuum medium universe**. So in conclusion, VRTE (Vacuum mechanics a realistic theory of everything) is the true complete theory, i.e. **it unified vacuum medium space-time with all of the matters in the universe!**

7) Solution to the troubles in physics. Up to now, we are ready to solve the five great problems mentioned in Lee Smolin’s book by using our new concept of **Vacuum mechanics**. Actually the readers could get some clue about the solution to the problems from the early sections, now we will see it in detail.

7.1) Problem of unification of the particle and forces. This is the problem 3 in Lee Smolin’s book. Readers who read all the previous parts of this paper would found that, actually this kind of unification **is exactly the concept** of our **Vacuum mechanics** a realistic theory of everything (VRTE) explained in section 5. Also we could see that it is the same concept of Einstein’s **universe made of marble**; a completely geometric origin to matter!

7.2) Problem of dark matter and energy. To explain and solve the problems about the dark energy (matter), first let’s start with the Friedman-Lemaitre-Robertson-Walker Universe as explained by the equations;

$$\frac{\dot{s}^2 + kc^2}{s^2} - \frac{\lambda}{3} = \frac{8\pi}{3} G\rho \dots\dots (4)$$

$$\frac{2\dot{s}^2}{s} + \frac{\dot{s}^2 + kc^2}{s^2} - \lambda = -\frac{8\pi}{c^2} Gp \dots\dots (5)$$

Where the **size of the expanding universe** measured by a relative cosmic scalar factor $s(t)$, λ is the cosmological constant which correspond to the **repulsive force** that counteracting the conventional attractive gravity as required by Einstein for **static universe**.

For static flat universe in which $k = 0, \ddot{s} = 0, \dot{s} = 0$, then equa. (x) and (y) give $\lambda = 8\pi G\rho = -(8\pi / c^2)Gp$, and then $\rho = -p / c^2$ which mean that the **cosmological constant** has a **positive energy density with negative pressure!** And at present time, the term $\lambda / 8\pi G$ is what was so-called as “**vacuum energy density**” [7] (while $\lambda \approx 4 \times 10^{-52} c^2 .m^{-2}$), and its main part is the **dark energy** density. But, unfortunately we **do not know** what it is, and why it has such a strange property (negative pressure)!

Armed with the new concept of **vacuum medium universe** (detail in CGTR, section 7.3 the origin of universe), it is not difficult to explain the mentioned problems as follow.

According to the **vacuum medium universe** all the **visible matters** (condensed vacuum medium) are immersed in the **sea of vacuum medium space** as show in the diagram above. (Please be careful that what which was shown in the diagram is not true scale, it just showing how the overall view of the universe looks like for us who located at the center!)

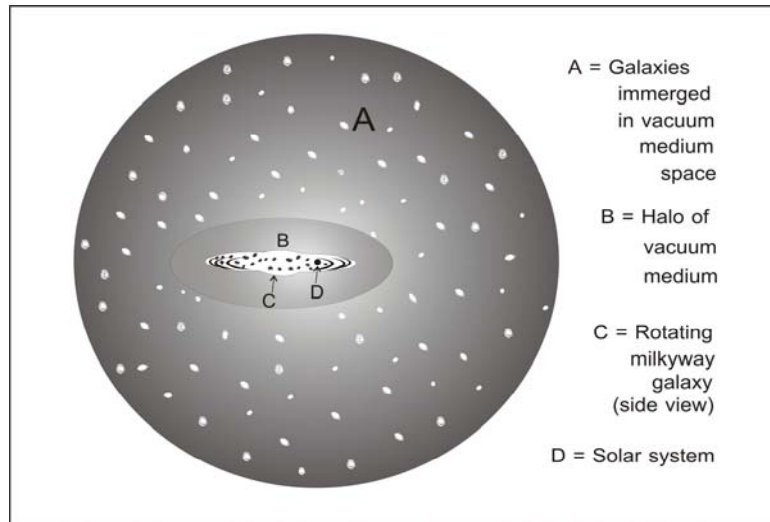


Figure 5 Vacuum medium universe.

Now we could see that actually **the dark energy** is **vacuum medium energy** which is the fabric structure of our universe and it is the main part of the total energy of our universe (we talked in sect. 3 and detail in VMTE). And the vacuum medium energy has a **constant** mass density $\rho = 23.3 \times 10^{-28} \text{ Kg./m}^3$ (calculated from the mechanical property of vacuum medium), which we have called it as **“ambient mass (energy) density”** (see detail in CGTR). Indeed, the value of this ambient mass density is the same order as the **critical density** of the **vacuum energy** mentioned above (i.e. $\rho_c \approx 60 \times 10^{-28} \text{ Kg./m}^3$)!

Actually the ambient mass density is **quite small**, but due to the **huge volume** of the universe, so it is the main part of the matter and energy comparing to the visible matter ($\rho_m \approx 18 \times 10^{-28} \text{ Kg./m}^3$) of the universe! And it is easy to explain why the **rotational speeds** of galaxies **are not corresponding** to their observed masses. The reason is because all the rotational galaxies **dragging** the surrounding vacuum medium as shown in the diagram for the Milky Way galaxy. Also the forced rotational dragging vacuum mediums around galaxies create their own **rotational stresses** which were manifest as the **(unknown) interstellar magnetic fields!**

To see the reason of the **“negative pressure”** of the dark energy is easy, it is because vacuum medium energy has the **internal gravity** (contraction force) as its intrinsic property (see detail in VMTE)! If we interpret that the existing of vacuum medium (space) as positive energy and its internal gravitational force as negative energy, then the total energy is zero, i.e. **the principle of conservation of energy of the universe is preserved!**

Now we can show mathematically how the **negative pressure** works via its **internal gravity** in **vacuum medium universe** while preserving the **principle of conservation of energy** as follow.

For the **adiabatic expansion process** in the early state of the universe, its volume **V** and the energy **E** change according to the thermodynamics law as in $dE = -pdV \dots\dots(6)$, [where **p** = pressure]. And by the definition of vacuum medium density ρ is **constant**, so we can write as

$$p = -dE / dV = -d \rho V / dV \dots\dots(7), \text{ or } p dV = -pdV \dots\dots(8), \text{ or } \rho = -p \dots\dots(9).$$

From (9), we can see that **vacuum medium density ρ has internal gravity (negative pressure) = $-\rho$** . Also from (8), we can see that when the universe's size is zero, both ρ and ρ is zero. But when the universe's size is increasing, its energy is increasing while at the same time it always equals its negative pressure (energy). Then the **total energy of the universe is zero** and the **principle of conservation of energy is preserved!**

Finally, some one who familiar with the "inflation" concept in the **early universe** would found that **scalar field** concept was just an ad hoc solution; it is a hypothetical matter without any of its own property! Also it is facing with the severe problem of "**infinite hot dense amount of energy**" (at the beginning of the **big bang**) which **contradicts** to the **conservation of energy!**

But again, **armed** with **vacuum medium energy** which acts as the **scalar field energy**, it gives us a more physical meaningful and also the **new inflation** process in the beginning of the universe is **not violate** the principle of conservation of energy i.e. there is no need the **infinite hot dense amount of energy** for creating inflation of the big bang! Indeed, **vacuum medium** with its **internal gravity** will act as the inflation in **de Sitter universe**. But unlike the conventional de Sitter universe which is empty universe, vacuum medium universe is a physical one with **positive** vacuum medium energy together with its **negative** pressure within!

7.3) Problem of quantum gravity. More specific, it is the problem of combining general relativity (GTR) and quantum mechanics (QMT) into a single theory. And according to Lee Smolin's book, both the two theories have the problem of "**infinities**".

As we have point out in VMTE (section 2.5 and 8) about the **inconsistency** between GTR and QMT (which does not involving with infinity's problem), and we shown how to **merge** them together via **Vacuum mechanics**. Here we will give a brief summarized for the previous solution in VMTE (before solving the infinity's problem) while talking some more detail about **quantum vacuum** concept of QMT, especially in **quantum field** theory.

7.3.1) Conventional vacuum + quantum vacuum = vacuum medium. Let us first refer to the conventional GRT which say that vacuum space is merely an **empty space** without anything within! In contrast to **quantum vacuum** of QMT, especially in quantum field theory, in which it is very complicate and difficult to understand! Indeed, we often facing with what which was called as vacuum polarized, vacuum fluctuation, vacuum expectation, etc. But it is interesting to note that we **do not know definitely what exactly (quantum) vacuum is!**

Now, let us see some explanation about the **meaning** of the quantum vacuum. The first one is "Vacuum is defined **as the state of (nonzero) minimum energy...**, it is **not a well defined concept** and no one can eliminate it from quantum theories, but it has **an exact mathematical** precise and logically satisfying meaning.....[12]".

Another one, it was viewed as an energetic sea of dynamic medium which composed of **infinite** numbers of **virtual particles and antiparticles** continually creating and disappearing. For example in QED, in which pairs of electrons and positrons will appear out of quantum vacuum and quickly annihilate each other and disappear. So we can view that there is **free electromagnetic field** in absence of any sources! To describe a field mode, we simply describe the equivalent harmonic oscillator quantum mechanically. And we would found that the energy of the field mode has the frequencies which run up to **infinity**. In other words, we could say that there are **infinite** numbers of "**virtual photons**" which were created and annihilated in vacuum space!

Armed with Vacuum mechanics it is easy to solve the difference between the **infinite energy of quantum vacuum** of QMT and the **empty space** in GTR because **vacuum medium space** is neither empty space (without anything) nor quantum vacuum (with infinite energy). Instead it is has a definite energy as explained in VMTE in which it is more reasonable that than empty space of GTR as mentioned in section 5.3.

Now to explain the **infinite energy of quantum vacuum** in QMT, we would find that the source of “infinity” arises from the assumption of infinite frequencies of the quantum mechanically **harmonic oscillator**. But it is interesting to note that **how could the oscillator “oscillate” up to infinity?** Indeed, we will find that **Vacuum mechanics** could solve the problem!

According to **vacuum medium space-time**, in which we would see the “**Mechanism of light wave**” in section 10 of CEMT. When an electron in an atom was excited and moves from its **normal state** of lower energy to **excited state** of higher energy, **immediately** it will jump back from unstable (excited) state to its normal (stable) state!. And because the “transition time” is very short, so the jumping back electron will transfer its **impulse force** back to the surrounding vacuum medium. This makes the disturbed vacuum medium **oscillates and radiate** out as a wave packet of **photon**!

Now we have seen that actually **photon** is the wave packet of an **oscillation** of a short disturbed **vacuum medium**. And frequency of the oscillation is **inverse proportion** to the length of the jumping back time of electron, i.e. the shorter time means the faster frequency. Anyway, the oscillation’s frequency **can not be infinite** because it means that the jumping back **time must be zero**, and to do so it requires infinite energy which is impossible. So the possible of the **oscillation** of vacuum medium is up to a **certain range** of frequency which is depending on the property of vacuum medium!

7.3.2) Conventional black hole vs. vacuum medium black hole. Now we will consider the problem of **infinity** in conventional black holes, in which it is commonly believed in physics society that these conventional black holes do **physical exist**. The reason behind is follows from the mathematical formula of GTR which predicts that a huge massive star to **collapse** into a **singular point of infinity dense black hole**!

Anyway, the serious problem followed is what **physics** of this **abstract** black hole is, **where does the whole huge mass go?** And up to now it seems that the concept about black hole is **still in doubt**. What which was thought to be the most prominent evidence about the existing of black hole is the famous X-ray binary, **Cygnus X-1**. But there is **no conclusive proof** that Cyg X-1 is a black hole [8]!

Also, it is interesting to note that even **Einstein** himself did not believe in this black hole [9]. For me (the author), I felt that **it is unconvincing** for the huge massive star to **collapse** into a **mystic black hole** in which we could not understand, I do not think that god is a **magician**!

In contrast to our new concept of **tiny black holes** of condensed vacuum medium (energy), i.e. electrons and protons) are seem to be more reasonable; they do not have **infinite energy** density! (Someone may wonder why the tiny black hole does not suck the surrounding vacuum medium. Yes it does by creating the **internal stress** in the surrounding vacuum medium!)

By the way, it was pointed out that in the early state of the universe (which was explained by the **hot big bang** theory), the universe starts with very **small volume** but with **infinite density**! Armed with the concept of vacuum medium universe (above), it is easy to see that the universe could start without any need for the “hot big bang” as summarized below.

According to **vacuum medium universe**, vacuum medium energy is the **raw material for constructing the fabric structure of space-time**! This means that at the starting moment the universe is zero in size (no space-time) so there is no vacuum medium either. When the universe is expanding its size, vacuum medium must be increased (while keeping its **constant density**) for expanding the fabric structure of space-time. Also, when the universe is reducing its size, then vacuum medium is also decreasing. This is an **inflation universe without hot big bang** concept!

In conclusion, as Lee Smolin has pointed out that if **infinities** are signs of missing unification then there is an essential part of physics **has been left out**. And as we have seen above, under our single new concept of vacuum medium, we could solve the mentioned problem. Indeed, **vacuum medium** is an **essential part of physics** we are asking for!

7.4) Problem of standard model of particle physics. First let us summarize what the “standard model” is. Conventionally, the standard model is a **relativistic quantum gauge field** theory. And one who familiar with it would know that nowadays it is a successful “**unified theory**” which involved the three basic forces i.e. electromagnetic force, weak force and strong force, but does **not include gravity!** So it was called as “the **theory of almost everything**” by Robert Oerter, and it is also the name of his book which talks about the standard model [10].

Actually, the standard model is a **mathematical** theory of elementary particles which includes the three fundamental interactions, i.e. electromagnetic (QED), weak, and strong (QCD) interactions into a **single formula**. But its mathematical structure is quite **complicated** and **arbitrary** [11]. Anyway, in conclusion we may say that the standard model is able to describe the complex behavior of our micro physical world i.e. atoms, molecules which forming to be solids, liquids, gases, rocks, plants and animals!

By the way, beside its **successful in prediction** about any (non-gravitational) **process** in the **universe**, the standard model was criticized as “an extraordinary **ad hoc** and **ugly** theory that it was clearly nonsense” [10]! It comes with several problems including the problem of the **long list** of adjustable constants, as point out by Lee Smolin. But before answering **how nature chooses the values of these constants**, first we will talk about “**Higgs**” which is the recent hottest issue that involved standard model!

7.4.1) What is Higgs? It is interesting to note that **Higgs** which is the most popular thing in recent big science’s news, i.e. the operation of **CERN’s Large Hadron Collider** for finding **Higgs boson**, and the **Nobel Prize winners in physic 2008** for discovering **Higgs mechanism**, but we **do not know what exactly Higgs is!**

Conventionally, **Higgs field** was postulate to be “**matter field**” which is existed by **pervading** in vacuum space [13]; it is something that was arisen from the **vacuum!** In one sense, the Higgs field plays the role of a **new type** of vacuum, analogous to the old-fashioned **aether**, which acts like a continuous background **medium** and pervades all of space-time [8].

Following the problem of Higgs is what which was called “**Higgs mechanism**”. Conventionally, Higgs mechanism is the action of **spontaneous symmetry breaking** of Higgs field, which **give mass** to all fundamental particles. Technically the mechanism is well understood, but at a **physical** level its meaning is **not yet fully grasped** in particle physics [14]! So how could we clearly understand the “mechanism of Higgs while we do not understand Higgs?”

7.4.2) Solution to Higgs mechanism. Armed with our **Vacuum mechanics**, now we will show that it is easy to understand about vacuum, Higgs and Higgs mechanism as follow.

First, for the **strange property** of the **vacuum** (according to quantum mechanics) just mentioned, it is not difficult to explain by using the property of our **vacuum medium** as mentioned in early in section 3.1. As we have seen that the mechanical property of vacuum medium could be used to explain the mechanism of all natural phenomena such as electromagnetic field and quantum field. Then something which was called as vacuum polarized, vacuum fluctuation, etc, is the **effect of the mechanism** of the vacuum medium!

Second, in general view, the idea of **Higgs field** (as described above) and vacuum medium **are alike**. One difference is that the former has no origin and detail property, while the latter do has the **origin and intrinsic property** (as explained above). Another most **distinct different property** is that Higgs field occurs when we are dealing with “**high energy**” such as in high energy interaction of particle. Then what is it means? According to **vacuum medium space**, when vacuum medium was disturbed with very fast moving (closed to speed of light) particles, then the action is as if the vacuum medium has a **huge energy density!** But actually it is not; instead it has the same old density which will be explained next.

Third, to **understand** about the **Higgs mechanism** in more detail, we have to compare between the conventional concepts with our Vacuum mechanics concept as show in the diagram fig.6.

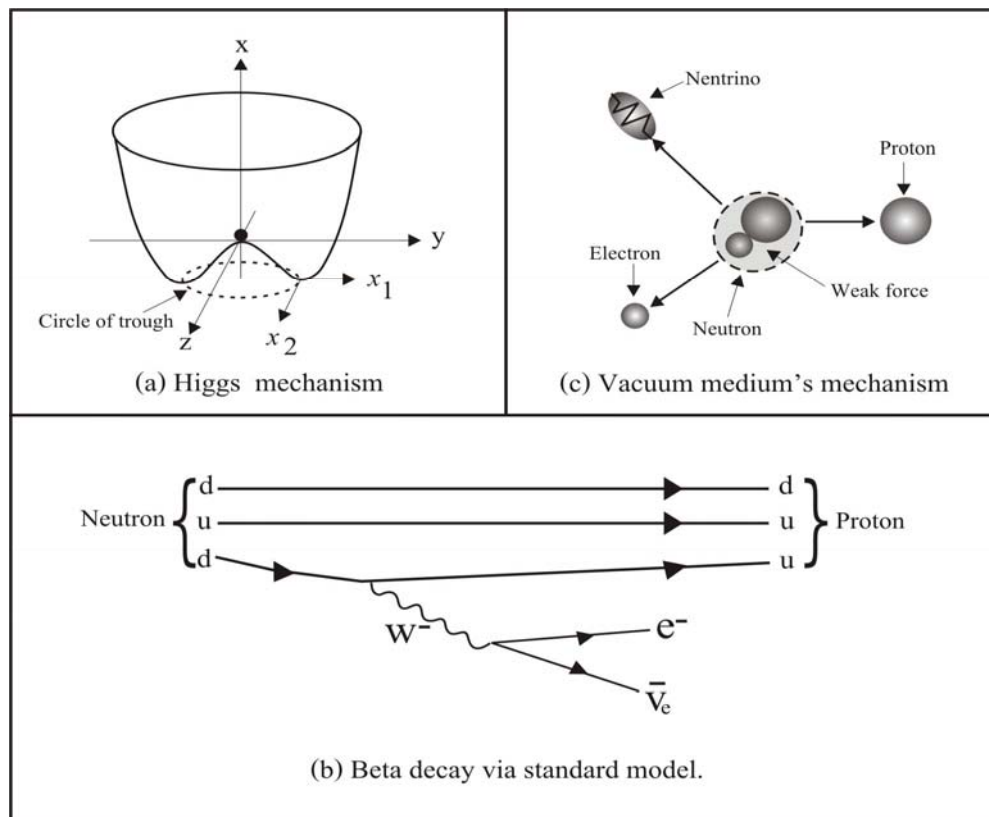


Figure 6 Vacuum mechanics vs. Higgs mechanism.

The **abstract idea** of the Higgs mechanism seems to occur in some physical phenomena such as **ferromagnetism**. And it is usually demonstrates by using the shape resemble a **sombrero** or sometime called the Mexican hat potential shown in (a). In brief, the action of spontaneous symmetry breaking in Higgs field is something like this; According to Schwinger's quantum field, at each point in space, there is infinite collection of **harmonic oscillators**, and which was supposed now there are two identical **quantum field** (pictured as a ball) oscillate perpendicular to each other (in X-Y) at the central hump (A). When the energy is lower, the ball (field) will roll down and becomes trapped in any arbitrary point in the trough around the central hump (at B); now the **original symmetry** is broken

Next, in the trough the exact location is **irrelevant**, since the trough itself is still **symmetric**. But now when the field oscillates about the ball's position, the same two directions look very **different!** In the direction across the trough, the field oscillates as a harmonic oscillator; it looks like a normal particle with **mass**. But if the field oscillates in the direction along the trough (which is flat) then it correspond to a **massless** particle. And the process we just described is the **Higgs mechanism!**

Now, if we try to use the standard model to explain a familiar (but interesting) process, i.e. the **beta decay** of a neutron into a proton plus an electron and a neutrino as shown in (b), we would found that it is very **complicate** and **difficult** (even for someone who familiar with it)! Instead, it is easy to understand by using Vacuum medium's mechanism shown in (c) as follow;

First, as we have explained in section 4.2 that when **proton** and **electron** were forced to “attach” together then a **neutron** particle was formed. And the compressing force which was used to overcome the tensile force of vacuum medium between is the **weak force**! So the created neutron was **maintained** by the balancing force between the attach force (between proton and electron) and the tensile force of the vacuum medium between. And because the balancing force is not firm, **it is not stable**; this is the reason for decaying of the neutron!

Finally, to explain about the **neutrino** which was emitted during the decaying process; what is it? Armed with our **Vacuum mechanics**, it is easy to understand that the created neutrino is the **disturbed part** of the vacuum medium (in between the electron and proton) which was arisen by releasing the **weak force** from the neutron!

7.3.3) How nature chooses the constants values in standard model. According to the model, some of the long list of adjustable constants is the **masses of quarks and leptons**, while others tell us the **strengths of forces** involved. (Remember that the model consists of six kinds of quarks i.e. particles which constituents of proton, neutron and many others similar. And six kinds of leptons i.e. particles which not made of quarks such as electron and neutrino, and which interact with each other through electromagnetic, weak and strong force.) Now, we will gradually show how the new concept of **Vacuum mechanics** could answer the problems involved as follow.

a) According to **vacuum medium universe**, there are only **two sizes** of **elementary particles**; i.e. **electron and proton**. Knowing the mechanism of electron (tiny) black hole of vacuum medium, together with the mass density of vacuum medium, then it is possible (in principle) to calculate **electron mass**. And because **proton** is also a (bigger) tiny black hole, so it is also possible to calculate its **mass** in the same way as was done with electron.

b) Now, let us talk about the concept of **antiparticle**. It was told that in early state of the universe, **particle-antiparticle** (such as **electron-positron**) pairs were created from the radiation of high energy photons (which was explained by the hot big bang theory). But in the present universe, no stars or galaxies **made of antimatter** which represent of 50% of particles, where are they? More specifically in the process of **electron-positron** pairs production (which was predicted by Dirac equation), both the created particles **can not stay as the stable** electron and positron. Only **normal electron** (which is not created from pair production) can be survived, so what wrong?

Armed with Vacuum mechanics, we have show that electron and proton are **tiny black holes** of vacuum medium. So what which was thought as the created **electron and positron** particle pair, they **are not real (stable) particles**. Actually they are pair of **opposite spin vortices** of vacuum medium which look like normal particle! (This is analogous to Lord Kelvin idea about atoms in 1867. He envisaged atomic interactions in which each atom was a **vortex in ethereal fluid**, and vortices could only appear in equal and opposite pair [15]. And to derive the evolution of the vortices we may use the same way as was done in electromagnetic field [16]). So **this is the explanation why our universe is a matter (not antimatter) universe!**

c) Next, let us see the problem of **photon** which was said that it **has no rest mass**, while it has energy and momentum. How could we understand something like this? The reason behind the problem is because we **misunderstood** that photon (light wave packet) is an **isolate energy entity** (particle) and can **propagate by itself!** But according to the mechanism of light wave packet (mentioned early), photon is a portion of the vacuum medium which was disturbed, oscillate and propagate. So the mass (energy) of the moving photon **is the mass of the oscillating medium** mentioned. And when the disturbed portion of the medium is stop oscillating, this means that there is no **photon** (light wave packet), and this is the reason why it was said that photon has **no rest mass!**

d) Now, it is time to talk more about the **neutrino** which was doubt whether it has mass or not! According to the standard model neutrino must be **massless**, but this will contradict to experiment result which indicate that neutrino has a very **small mass**, so which one is right? The reason behind the problem is because we **misunderstood** that neutrino is an **isolate energy particle** (something like photon). But according to the decay mechanism of a neutron (mentioned above), the created neutrino is the **disturbed part** of the vacuum medium which was released from the decay neutron. And we have learn that vacuum medium has its very small mass density, then it is not surprise that neutrino must also has its **mass** but a very small one!

e) Up to now, we have explained the entire particles that are **stable** (and have a **long life**), and which manifest themselves in a daily environment with a normal room temperature. All the **remaining** and **unfamiliar particles** are the extremely **short life** particles which were found in **high energy** experiment. So armed with Vacuum mechanics concept, we could say that all of them **are not real** particles, instead they are the **disturbed parts** of the vacuum medium which were **created** and **scattering** during high energy collisions!

f) One problem about the **disturbed parts** of the vacuum medium that were **arisen** during high energy collisions (which were thought to be new kinds of elementary particles), are they randomly created or not? Actually it is random process, but not fully arbitrary because **it was guided** (or control) by three main criteria; one is the property (such as mass, spin, etc) of the input particles, and the other is the appropriate **conservation laws** (which ultimately connected to **symmetry**) such as energy conservation law, conservation of charge, etc that involved in the collisions. The last one is the understandable property of the environment, i.e. the sea of vacuum medium!

g) Lastly, let us talk about **quarks** which were explained as the composite part of **nucleons** (proton and neutron). While quarks were told to hold together and forming to be nucleon, but they cannot stay as a free particle. Then we do not know what are they (quarks), and where they from? But according to our Vacuum mechanics concept, we have learn that **proton is an elementary particle** which is a condensed (tiny black hole) of vacuum medium, while a neutron is composed of an electron and a proton. Also we knew that protons and neutrons were forced to "attach" together and **forming to be a nucleus** under the balancing force between the **strong force** and the tensile force of the vacuum medium between. And because the balancing force is not firm, **it is not stable**; this is the reason for the **alpha decay** of the nucleus (of radioactive element)!

In conclusion, we could say that **nature chooses** the values of the constants in standard model corresponding to **what the nature are** (according to Vacuum mechanics)! First, **vacuum medium sea** of our universe is the stage where the particles' interactions occur. Second, **electron** and **proton** (tiny black holes of vacuum medium) are the two sizes of the **real elementary particles** (which form to be any kind of matters). Third, the movement of an electron through vacuum medium will create disturbance and manifest as a **photon**. Forth, any interaction between **particles** create disturbance of vacuum medium and manifest as **unfamiliar particles**. Lastly, all of particles interactions work under the appropriate **conservation laws** which ultimately connected to **symmetry**. Indeed this is the main concept which was written in the mathematical formula of the standard model!

7.5) Problem in the foundation of quantum mechanics. As mentioned early about the problems in QMT (section 2.4) and giving an explanation how the mechanism of particle wave works (in section 5.4), here we will summarize what and how **quantum vacuum mechanics** work (detail was explained in CQMT). And then showing how to solve the problem in QMT, by **making sense of the theory** as point out by Lee Smolin.

7.5.1) Quantum vacuum mechanics. In CQMT, we have improved the conventional QMT by giving it with a suitable physical model, i.e. the mechanism of vacuum medium (Vacuum mechanics). Then what we got is a new more complete and understandable quantum mechanical theory - **quantum vacuum mechanics**! And under the new concept, we could derive a new understandable **Schrödinger equation**, also it permits us to explain physical meaning of the mysterious **Plank constant h** and the **uncertainty principle** as follow.

Physical meaning of Plank constant h . Conventionally, Planck constant h is a proportional constant derived from the mathematical formula of “**black body radiation**” ($E = hf$). But, due to lacking of understanding its physical meaning, Plank constant was thought as a **magic** constant!

Viewing from our new concept of quantum Vacuum mechanics, we would found that actually the **physical meaning** of Plank constant h is -- one unit of the “**quantum action**” of the vacuum medium’s wave packet created by the changing state of an electron in an excited atom of the “black body radiation” phenomena! (Please see detail in CQMT.)

Mechanism of the uncertainty principle. Conventionally, **Heisenberg’s** uncertainty principle based the measurements which show us that we can not determine both the **position** and the **momentum** of subatomic particle such as an electron with **unlimited** precision, but only accordant with $\Delta p \cdot \Delta x \approx h$. The problem is that we do not know how and why it is so! Instead, based on **quantum vacuum mechanics**, it is easy to explain that it is due to the wave packet (of vacuum medium) created by the moving electrons, which act as the **mechanism** of uncertainty principle! (Again, please see detail in CQMT.)

7.5.2) Does God play dice? According to the uncertainty principle which gives the **probability** interpretation (of quantum mechanics) as **representing the ultimate reality**, and was accepted by almost all mainstream physicists. But only a small group of physicists, including Einstein, do not accept the statistical interpretation. Einstein’s position – he has quoted as saying that **he could not believe** that “**God plays dice with the world!**”

(By the way, for Niels Bohr which is the **positivist** leader of mainstream physicists, physical theory such as quantum mechanics is to describe relations between measurable quantities. The theory **does not tell** one whether anything **characterized** by these quantities **really exists**, nor whether this question makes sense! [17])

For Einstein who is a **realist** physicist, a physical theory reflects the behaviour of **real objects**; their existence is not brought into question. He felt that quantum mechanics, although an accurate description of nature, must be an **approximation** to some more fundamental concept. And indeed we will see that **Einstein was right**, our new concept of completed quantum mechanical theory (CQMT), i.e. quantum vacuum mechanics **is what he asking for**, and now we will explain why **God does not play dice!**

To consider the concept of **probability** in quantum mechanics, we have to return to its origin of **particle-wave duality** of subatomic particle such as an electron. As we have shown (in CQMT) that actually the wave nature of electron is due to the **co-moving wave packet** (of vacuum medium) created by the moving electron! And these co-moving wave packets are responsible for the **interference patterns** which occurred in the two-slit experiment as shown in the diagram fig.4. So we can say that the existing of vacuum medium (of space-time) is the cause which gives the measurement (of the moving electron) be **statistic!**

Now **it is interesting** to note that if there is **no vacuum medium**, then the moving electrons can not create electron wave. So the moving electrons will go straight pass though the slit direct to screen (without guiding from wave) and pile up as a **smooth curve** without interference pattern as shown in the diagram. So in principle, **we can make a measurement of electron with unlimited precision**. Then it is the returning to **deterministic** concept of classical mechanics!

In conclusion, according to conventional QMT, it was claim that probability is **inherent in the basic nature of microscopic** process while reducing **determinism of the macroscopic** level to a mere consequence of the mean values of the probability. But according to classical physics, probability **is a matter of ignorance**, and the statistical treatment was used where the system under consideration is too complicate and involving with a large number of the variables. And even in case of the QMT, quantum vacuum mechanics has shown that **it is not an exceptional**. Finally what we got as the answer is **God does not play dice!**

7.5.3) Is God a magician? Let us refer to Einstein's word again; "This (quantum) theory reminds us a little of the system of delusions of an exceedingly intelligent paranoiac, concocted of incoherent element of thoughts" [18]. For me, as was mentioned early in sec.2.4), that lacking of **understand** it correctly, it would be **misinterpreted to something crazy!** Here we will give some more examples of **serious side effect** due to the misinterpretation.

First, let us continue to talk about the **Uncertainty principle** which was used as a **magic tool** for solving the problem of **virtual particle** in quantum vacuum! Traditionally, it was said that creating pairs of virtual particle and antiparticle are possible (even it violates energy conservation principle) because of the **magic** mathematical formula of the Uncertainty principle (10).

$$\Delta E \cdot \Delta t \approx h \dots (10) \quad \Delta t \approx h / \Delta E \approx h / 2mc^2 \dots (11)$$

The reason that the Uncertainty principle **can save the life** of virtual particle and antiparticle pairs is due to the short time (of the existing time's period) of the created particles which was kept to be according to equation (11). In short, the production of virtual particle - antiparticle pairs could be possible if the energy required to make the particles is **borrowed** for a sufficiently short time! [19] So far so good, but the problem is how could it be something like that? It seems crazy, **how could nature be cheated!**

Armed with **quantum vacuum mechanics**, what we got is a more rational **physical meaning** (mechanism) of the Uncertainty principle (above) and not a **magic** mathematical formula as was believed. Together with the explanation (in sec. 7.3.3) that particle – antiparticle pairs actually they are pairs of **opposite spin vortices** of disturbed vacuum medium not **magic** pairs of particle – antiparticle as misunderstood. So up to now we may conclude that **God is not a magician**, isn't it?

8) Mass, Ether, and the Unification of forces. This is the main topics of Frank Wilczek's book (The Lightness of Being) in which he has talked about the **origin of mass**, proposed **new Ether**, and explain **how to unify the four basic forces** of nature (as mentioned early). Anyway, what we will talk here is about some of his interesting idea of ether and the unification, and then compares them to our concept of **Vacuum mechanics!**

8.1) Grid – the new Ether. As it was called by Frank Wilczek, and he has explained in detail and then summarized as below.

- a) Grid is the **primary ingredient** of physical **reality**, from which all else is formed, **fills** space and time!
- b) Every fragment of Grid – each space-time element – has the **same basic property** as every other fragment.
- c) The Grid weighs, with a **universal density**.
- d) The Grid contains a **metric field** that gives space-time **rigidity** and cause **gravity**.
- e) The Grid also contains **enduring material** components. The cosmos is a multilayered, multicolored super conductor.
- f) The Grid is **alive** with quantum activity in which it is spontaneous and unpredictable. And to see the activity, we must disturb it.

8.2) Grid vs. Vacuum medium. Now we will compare Frank Wilczek's Ether (Grid) above to our Ether (Vacuum medium) as explained in section 3.1. And we will see what the difference is and how could we **answer** the remaining question of the Grid?

Item	Grid	Vacuum medium	comparison
a	primary ingredient	primordial substance	same idea
a	ingredient fills space-time	fabric of space-time	different idea
b	same prop. of space-time	homogeneous & isotopic prop.	same idea
c	Grid weighs, universal density *	specified constant mass density	same idea, but * = no value
d	metric field gives rigidity #	fabric structure of space-time	same idea, but # = no detail
d	metric field cause gravity @	Intrinsic property of vac. medium	same idea, but @ =no detail
e	contains enduring material	disturbance of vac. medium \$	different idea, \$ see note
f	alive with quantum activity	disturbance of vac. medium \$	different idea, \$ see note

Note In Vacuum mechanics, vacuum medium **is the only one** primordial substance exists. Beside vacuum medium, **there are only two sizes** of material particles, i.e. electron and proton which both is the **condensed** vacuum medium (tiny black holes).

Under the **high energy collision** between subatomic particles (in the sea of vacuum medium), **disturbance** of the surrounding vacuum medium creating different types of scattering pieces (of vacuum medium) which exist as many kind **short life** particles.

8.3) Unification of forces. Frank Wilczek has tried to unify **gravity** into the standard model by using the concept of **supersymmetry**. But we will not talk all about it; instead what we interest is his consideration about gravity [3']. One of the most interesting **alternatives** to us is what he said that “The other forces [beside gravity] **might be derived from gravity**. It is easy to imagine how nonuniversal force [other forces, except gravity] might arise out of a universal one [gravity]... (Apparently **Einstein** himself had hopes of **constructing a theory of matter along these lines.**) ...” {Note that the words in square buckets were added by me, the author.}

Talking about **Einstein** concept of constructing a theory of matter in which Frank Wilczek also mentioned, it is surprisingly that this is the same concept we used for **Electron black hole mechanism** as explained in section 4.1!

So far, the readers would notice that actually what we have done with gravity (to unify it with the other forces) in our theory, it is the **same idea** as Frank Wilczek idea just mentioned! In brief, we start with **gravity** which is the intrinsic property of vacuum medium. Then we showed that **electromagnetic force** was the suction force of the tiny black holes of vacuum medium (condensed vacuum medium), i.e. it is a **strong gravitational** force. Next, we have seen that **weak force** is the attach force occurs between electron and proton which forming to be neutron. Finally, **strong force** is the attach force occurs between neutrons and protons which forming to be a nucleon. So, all of the four basic forces of nature was **derived from one common substance** i.e. vacuum medium which is the raw material used in constructing our universe!

9) Seer from outside. In chapter 18 of Lee Smolin’s book, he talked about the important of “**seers**” beside “craftspeople” in scientific community. He started with “Perhaps there is **something wrong** with the way we are going about trying to make a revolution in physics.” Then he went on with “The one thing everyone who cares about fundamental physics seems to agree on is that **new ideas** are needed.” And also “We are **missing something big.**”

Next Lee Smolin has explained “**how to find the missing idea**”. He said that beside of having craftsperson which highly skilled in the practice in physics community, **seers** who know the subject thoroughly **are needed!** The seer need not be the most technically proficient of physicists, but be able to work with the tools of the trade, and communicate convincingly in its language. Seers are different from craftspeople that they are dreamers. They go into science because **they have questions about the nature of existence** that their schoolbooks don’t answer! Lastly, he added that “real seers” were not welcomed in scientific community, so he asked for it. “**During revolutionary period, you need seers, who can peer ahead into the darkness.**” He said!

For the author opinion, I agree with Lee Smolin. I am a retired communication engineer who has fall in love with fundamental physics. During study radio communication course in the college, I was not so happy with conventional explanation that “**radio wave could propagate without any carrier**”, how could it be that! And it is interesting for me to find it out since then, with the solution which was already talked early in this paper.

Working as an **amateur** physicist, it seems for me that I am acting as an “**outside seer**”! There is an advantage for people who work as engineers that they were taught with “**Mechanics**” as one main basic course (and it was told that there is **mechanics in their blood!**) Also most of engineering works are so “**obvious**” that there is no need to talk about their “**reality**”. So all engineer having the habit of trying to “**understanding**” their daily works which may call it as “**engineering sense**”! Anyway, I have kept in mind that I am not a professional, so what I want to do is just to “**make sense**” of what which involve in the matters of our story.

By the way, it seems to me that the relation between craftspeople and **outside** seers (mainly are engineers) is worst than the relation between craftspeople and **inside** seers which both of them are physicists. The reason may be because physicists seem that engineers are not the professional, while engineers seem that the physicists are not so open-minded. Anyway, this kind of the problem seem to be one of **human nature** which normally occurred in **every society**, doesn't it?

Talking about “**vacuum medium**” actually it is not totally a **new idea**; some of its aspect is similar to the old **aether** which was ignored by mainstream physicists since STR was accepted. Physicists do not so worry about the **mechanism** which explained how the theory works, while their main goal is that STR can give them with predictability and accuracy. Anyway, it is alright if we used STR separately from others theories, but if we have to use STR as one main tool for finding TOE we have to make sure that it is a **complete theory**!

Finally, as we have seen early that once we have ignored the concept of “**vacuum medium**”, what follow is not only the problem in STR, instead it also have a serious consequence in EMT, GTR and QMT. This is because the craftspeople do not interest in “**philosophical idea**” behind the theories involved. As Lee Smolin has told that **Einstein** had encouraged a young physicist in studying **philosophy science**, otherwise it is like someone who has seen thousands of trees but has never seen a forest! Analogously in our case, craftspeople are so smart about all physics theories involved, but they still **could not found the theory of everything**!

10) Conclusion. Up to now we have shown that **what the idea** of “Vacuum mechanics - a realistic theory of everything” **is, why it was overlook** and **how it could solve the problems in modern theoretical physics**! And here are the final short summary and some additional comments.

a) **Vacuum medium** is the only one single primordial substance which formed to be the fabric structure of our universe and the matters' composition within. All natural phenomena are the appearances of the **mechanism** of vacuum medium, i.e. **Vacuum mechanics - a theory of everything**!

b) Actually, the main problem for finding TOE is the lacking of the complete tools used, i.e. the theories of electromagnetic field, special relativity, general relativity and quantum mechanics. Lacking of rational **philosophical ideas** (physical models) which explain the **mechanisms** in these four main physics theories lead to the blind alley!

But, why **philosophy** (philosophical ideas) is so important for **physics** (science)? The reason is because it is the **rational** way of thinking; it is not something that does **not make sense** or a **magic**! This is according to one definition of philosophy which was defined as “a knowledge of effect from their causes and of cause from their effect” [20]. Without understanding how the nature really work, then what followed may be a correct one or a **mislead** one!

c) So what we have done (to get the TOE) is just “**putting Vacuum mechanics into modern physics theories**”. Then the same one **common mechanism** of vacuum medium gives us a rational and understandable electromagnetic phenomenon, the correct relativistic effects in relativity theory, a realistic physical action of **magic gravity**, and finally we turn the **ghost field** of particle wave to a realistic wave of vacuum medium!

d) It is interesting to note that modern physicists seem to believe in the abstract of **mathematic** (invented by human) more than **physics** (which was invented by god)! They have **ignored** to understand how **physically** the natural phenomena work. This is the main reason why they got struck, how could physics (science of nature) progress **without understanding**?

Someone may herd about the ancient **Maya civilization**, they (Maya) were very smart about mathematic, and could calculate and predict very accurate astronomical events. Anyway, **without understanding** it, they imagined it as the **magic of god**, which then leaded them to sacrifice human life!

Nowadays, modern physicists (who live in modern scientific period) do something similar to the Maya (who lived in pre-scientific age); they **believe in mathematic than in physics**, especially in the **standard model** of particle physics which based on the **magic** of quantum field! And what they have sacrificed is the huge amount of money to be paid for the CERN's Large Hadron Collider!

e) By the way, we could see that what was written in this paper is very a short one, and it is not fully mathematical rigor. What we have done **is just enough to give the new idea to the readers with some confidences for opening the door to TOE**. So what was left here should be the work of academic people who are involved in the matter to complete it **for the virtue of academic merit and the progression of our world's advanced knowledge!**

f) Finally let us close this article with **Einstein's** word about his dream for the theory of everything as below;

"I want to know how God create this world. I am not interest in this and that phenomenon, in the spectrum of this or that element. I want to know His thought; the rest are details."

Now, could we say that VRTE provide the solution for Einstein? The answer is yes and no! Yes, **we do know how** God created this world via **Vacuum mechanics**. But we have to accept that we **do not know why** he has to do something like that!

11) References.

(Precaution; Several text books with different authors were used as the reference and each author used different pattern and different notation for the same formula. Here in this paper, the author has made some change of the original pattern and notation for the readers convenient, so please be careful!)

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[3] Frank Wilczek, "The Lightness of Being" chapter 8 - The Grid (Persistence of Ether) p. 73 - 111. For [3'] p.149-150, and for [3''] in chapter 10 - The origin of mass p. 128 – 132.

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