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Graviton: physical time and thermodynamics

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Abstract:

In classical mechanics, time is something that passes uniformly regardless of whatever happens in the world. For this reason Newton spoke of absolute space and absolute time. On the other hand, Einstein's Special Theory of Relativity predicted that time does not flow at a fixed rate: moving clocks appear to tick more slowly relative to their stationary counterparts. Quantum mechanics does not neglect the time either. In standard model, photon does not experience time. Some new theories suggest that time does not exist at the quantum level. The study of the quantum universe shows us that time does not exist. It shows us that time is a function of relativity only and exists relative to some arbitrary point of reference [1]. Whatever else may be said about time, one thing is certain. It defies definition. The best we can say is that we all know what time is, intuitively. The Seventh Edition of Webster's Collegiate Dictionary tells us that time is "the measured or measurable period during which an action, process, or condition exists or continues." Of course, what the lexicographer has done here is to tell us that time is defined by its measurement and that measurement is of a period during which something occurs. He has not told us what time really is [2]. In fact it is the definition of a clock. What is the nature of physical time, really? In this paper, I have tried to answer this question.

Keyword: time, clock, sub quantum energy, graviton, observable and invisible universes, non obvious universe, Minkowski formula, photon, relativity

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Introduction

The nature of time in physics is that when does time appear? Which physical existence does not experience time? Photon experiences time, because in Compton's effect and in gravitational blueshift (and redshift) photon's energy changes so it experiences time. Virtual photon decays to color-charges and magnetic color, and also is made up of them, so virtual photon experiences time too [3].

But graviton does not decay to other particles and moves with the constant amount $V_G > c$, its energy remains constant (graviton principle), so, no time passes for graviton (the unit existence in universe). In other words, everything in universe (and even the universe itself) is made up of units that have not experienced passing of time. This conception is very important to understand the nature of time. What is time, really?

For finding the answer of the above question, at first we should answer this question: what is a clock? The answer of the last question returns to this fact that everything is made up of energy, and converts to energy, too ($E = mc^2$). Energy is formed of gravitons and no time passes for graviton. But everything behaves as a clock. In fact everything is a clock. A photon, an electron, an atom, earth, galaxy and even the visible universe, each one is a clock. Everything has a starting point in space with its lifetime. So, in general form everything is a space-time.

Our experiences about time come from clocks. There is no time without a clock. Newton thought there is a clock that shows absolute time in universe and Einstein showed running of clocks depends on velocity and intensity of gravity. From the viewpoint of an observer outside the black hole, time stops, but what stops, is a clock running. A man is a clock, and this makes us get an image of time different from a clock. No one is able to think about time without imagining a clock. Time without clock is never imaginable. Time is a name for a clock running the same as motion for an object's movement. We are able to resolve many historical problems of time by this conception about time and clock.

Theoretical formalism of reviewing

In reviewing graviton and Newton's second law, I have presented the new definition of graviton as follows [4]:

Graviton principle: graviton is the most minuscule unit of energy with constant NR mass m_G that moves with a constant magnitude of speed so that $|V_G| > |c|$, in all inertial reference frames. Any interaction between graviton and other existing particles represents a moment of inertia **I** where the magnitude of V_G remains constant and never changes.Therefore;

$$\nabla V_G = 0 \text{, in all inertial reference frame and any space} \qquad (1)$$

Based on the principle of graviton, a graviton carries two types of energy generated by its movement in inertial reference frame. One is transmission energy and the other one is non-transmission energy. In physics, we represent energy summation (both kinetic and potential) by a Hamiltonian equation and energy difference by a LaGrangian. Therefore, in the case of graviton, we use a Hamiltonian to describe the summation of energy generated by transmission energy T and non-transmission energy S as follows:

$$E_G = T + S \qquad (2)$$

Since the speed and mass of graviton are constant, then $E_G = constant.$

Sub-Quantum Energy

According to the principles of modern physics, Sub-quantum energy (SQE) is preferred and defined in a way that it could be generalized and by using it, quantum and relativistic phenomena could be explained [4].

Definition: Sub-quantum energy is the least electromagnetic energy that is defined as below:

$$SQE = h\nu_{least,}\ \nu_{least} < \nu, \forall\ E = h\nu, where\ E = h\nu\ is\ detectable \qquad (3)$$

Relation (3) shows *SQE* in terms of energy. Every other photon consists of some *SQE*, so that;

$$E = nSQE,\ where\ n\ is\ an\ integer \qquad (4)$$

$$E = nSQE = nm_{SQE}c^2 = n(m_{SQE}c)c = np_{SQE}c\ \Rightarrow E = np_{SQE}c \qquad (5)$$

For two photons with energies E_1 and E_2 we have:

$$E_2 = h\nu_2 = n_2SQE, E_1 = h\nu_1 = n_1SQE, E_2 > E_1\ \Rightarrow\ n_2 > n_1, n \propto \nu \qquad (6)$$

There $n_1$and n_2 are integers.

With increasing a photon's energy, its frequency also increases. Thus there should be a logical explanation between energy increase and frequency increase. Therefore, based on *SQE* definition and relation (6) we can relate the relation between photon's energy and frequency and the interaction between *SQE*s in a photon's structure, i.e. with increasing the number of *SQE*s in photons, the interaction between *SQE*s in photons will increase and the frequency that originates from the interaction between *SQE*s will increase too.

Note: Although $n \propto \nu$, this proportion does not necessarily represent an equation, but simply represents the physical fact that frequency has direct relation with the number and interaction of *SQE*s in a photon. Besides the relation between *SQE*s and ν, could conclude that the linear speed of *SQE* in a vacuum relative to the inertial frames of reference, is actually the speed of light c. Since *SQE* in a photon's structure has a linear speed equal to c and also it has nonlinear motions, the real speed of *SQE* is when all *SQE* nonlinear motions turn into linear motion and it only takes linear motion. In other words the limit speed of *SQE* is V_{SQE} which is faster than light speed c, i.e. $|V_{SQE}| > |c|$.

Consider that in special relativity the light speed is constant, and in general relativity besides increasing of photon frequency while falling in a gravitational field, its speed also increases (relation 4); that we could take it as a proof of $|V_{SQE}| > |c|$.

Sub-Quantum Energy Principle

One *SQE* is a very small energy with *NR* mass m_{SQE} that moves at $|V_{SQE}| > |c|$ relative to inertial reference frame and in every interaction between *SQE*s with other particles or fields the speed value of *SQE* remains constant; as in every physical condition we have;

$$\nabla V_{SQE} = 0 \text{, in all inertial reference frames and any space} \qquad (7)$$

SQE principle shows that in every condition the speed value of *SQE* remains constant and only the linear speed of *SQE* converts to nonlinear speed and vice versa. Considering the definition of *SQE*, every photon consists of some *SQE*, if we ignore the zero rest mass of photon, much better and more real, physical phenomena may be investigated. Thus, a photon with energy *E* has mass $m = E/c^2$ and a linear momentum **p** = **mc**. In other words, a photon is a part of matter and has nonzero mass before creation that after converting to photon carries the same mass that had in the matter and after absorption by a particle (e.g. an electron) the mass of photon is added to the mass of the particle. According the definitions of graviton, *SQE* and photon we can write;

$$|V_G| > |V_{SQE}| > |c| > |V_{particles}| \qquad (8)$$

So the constancy speed of light is a law [4].

On the constancy of the light speed

Einstein has provided special relativity framework in which Maxwell's equations worked in all inertial frames, and Newton's laws also almost worked for any objects moving slowly with respect to a frame. From this new framework, all sorts of other effects could be derived, and they were all confirmed. The framework ran into trouble with gravity, and had to be replaced by General Relativity. We can stop within relativity. We can also think beyond that. In this paper, we have chosen the latter. According the pair production and decay, we have generalized speed of light from NR-particle into the structure of particle [4]. This is providing a framework in which all particles/objects obey of same law in motion.

Minkowski formula and time

Our physical observations and experiences are limiting of the visible universe or spacetime laws. Because human being and their tools are formed up of spacetime being and obey of spacetime laws. In this paper, let's focus on speed and momentum of real and virtual photons [3], so I use light-like interval that given by; $c^2t^2 = r^2$ or$S^2 = 0$. World lines of NR-particles relative an inertial observer in (x, y, z, t) frame (by argue not directly) in Minkowski spacetime [5] can be written as follows:

$$Real\ spacetime;\ x^2 + y^2 + z^2 = c^2t^2 \qquad (9)$$

$$Virtual\ spacetime;\ x^2 + y^2 + z^2 = V_{SQE}^2 t^2 \qquad (10)$$

$$Non-obvious\ space:\ x^2 + y^2 + z^2 = V_G^2 t^2 \qquad (11)$$

Equ (9) shows photon world line is border of real spacetime, world line of other particles such as electron that moves with speed v<c, is given by;

$$Particles\ worldline;\ x^2 + y^2 + z^2 = \mathrm{v}^2t^2, \mathrm{v} < c \qquad (12)$$

World line of other physical being such as virtual photon and graviton is outside of the real spacetime. In Equ (10) when $V_{SQE} = c$ virtual particles appear in real spacetime, it is detectible indirectly (in photon structure). When $V_{SQE} < c$ it is a part of quantum particles such as electron. Boundary between real spacetime and virtual spacetime is speed of light c. In gravitational blueshift and zero point energy; virtual photons leave virtual spacetime and enter into the real spacetime. Also in gravitational blueshift gravitons of the first leave non-obvious space and enter into virtual spacetime, then leave virtual spacetime and in the second case leave virtual spacetime and enter into real spacetime and they are a part of real spacetime being such as photon and electron.

According to $|V_G| > |V_{SQE}| > |c|$, every visible (detectable) physical being decay, also every virtual particles decay too. But graviton does not decay, in the other word; time does not pass of graviton; the reason is that graviton does not decay to other physical being. If graviton does not experience "time passing", so what means t parameter in the Equ (11)? This equation is an assumption, for an inertial observer in real spacetime, it is not the only option, the imaginary of Minkowski's formula is discussed [6]. If a graviton writes its world line equation, it maybe same as; $x^2 + y^2 + z^2 = 0$. By solving this equation in imaginary space we have;

$$x^2 = (-1)(y^2 + z^2) = i^2(y^2 + z^2) \qquad (13)$$

$$x = \pm i\sqrt{y^2 + z^2} \qquad (14)$$

Graviton's life is independent of time. It exists and moves in an imaginary space that for human being is not conceivable. Graviton carries information and moves so much faster than light speed. According to color charges and magnetic color G, G^-, G^+, G^m, in fact graviton is pure information that for a real observer it moves with infinite speed, remember quantum entanglement [7, 8].

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Thermodynamic basic-level state of a system and *SQE*

Every system emits heat energy; in fact a system works on itself continuously that is positive work on the environment. Let's name it the "Inherent power of system". So, every system has an inherent power that is greater than zero $P > 0$. If a system loses its inherent power, it is at basic-level state of thermodynamics. In other words, a system would be at inherent power, if its inherent power was zero $P = 0$ (figure 1).

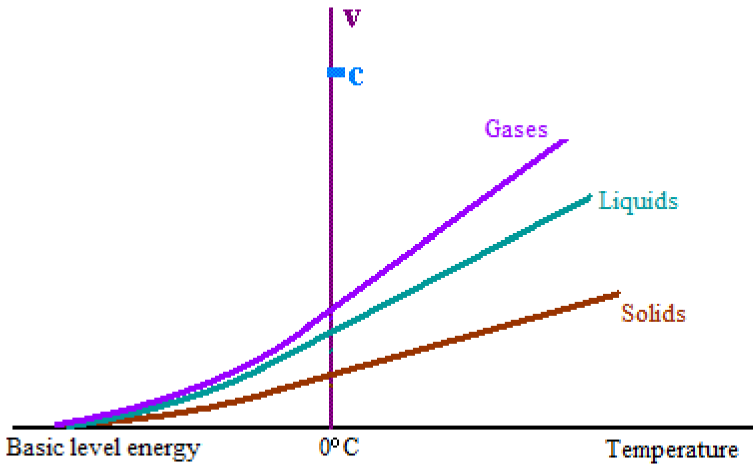

Fig 1; Velocity and temperature of systems

When a system is at basic-level energy, its charged particles are not able to work on each other, so the system does not emit heat energy. When a system is at basic-level energy, then its temperature is absolute zero. Suppose a system is at basic-level energy, it contains n *SQE*s that are moving with velocity v1=0 in system. We give heat to it, in fact k SQEs with speed c enter the system, and particles of system absorb them. In a real environment the inherent power of a system cannot be zero, even in space, because there is cosmic background radiation in space.

First law of sub quantum energy thermodynamics

A system works on the environment with inherent power$P > 0$. To stabilize or increase the internal energy of a system, we must give heat energy to system with power $P' \geq p$.

The second law of sub quantum thermodynamics

There is no actual physical process by which we can make the inherent power of a system P one-way.

Consider that in an actual physical process the inherent power is not constant. Because heat energy incomes and outgoes of an actual systems.

Third law of sub quantum thermodynamics

An actual physical system never approaches the basic-level energy.

There is no physical process to take a system to the thermodynamic basic-level state.

Entropy and sub quantum energy

Entropy (ΔS) of a system is equal to its inherent power (P), $\Delta S = \mathrm{P}$, so entropy of a system approaches zero only at basic-level thermodynamics.

Time in physical being

It's quite clear that Isaac Newton founded classical mechanics on the view that space is something distinct from body and time is something that passes uniformly regardless of whatever happens in the world. For this reason he spoke of absolute space and absolute time, so as to distinguish these entities from the various ways by which we measure them which he called relative spaces and relative times. On the other hand, Einstein's Special Theory of Relativity predicted that time does not flow at a fixed rate: moving clocks appear to tick more slowly relative to their stationary counterparts.

But this effect becomes really significant only at very high velocities which approach

the speed of light. Einstein generalized Special Theory of Relativity to include gravitation. In general relativity, space-time is curved by matter and not only distances stretch or shrink (depending on their direction with respect to the gravitational field) but also the flow of time appears to dilate. So, running clocks (proven by experiment) show the following results:

1- In inertial frame when velocity increases, clock runs more slowly (Special relativity).
2- In gravitational field a clock runs more slowly as gravity increases (General relativity).

Quantum mechanics does not neglect the time either. In standard model, photon does not experience time. Some new theories suggest that time does not exist at the quantum level. The study of the quantum universe shows us that time does not exist. It shows us that time is a function of relativity only and exists relative to some arbitrary point of reference [9]. Whatever else may be said about time, one thing is certain. It defies definition. The best we can say is that we all know what time is, intuitively. The Seventh Edition of Webster's Collegiate Dictionary tells us that time is "the measured or measurable period during which an action, process, or condition exists or continues." Of course, what the lexicographer has done here is to tell us that time is defined by its measurement and that measurement is of a period during which something occurs. He has not told us what time really is [10]. In fact it is the definition of a clock. What is the nature of physical time, really?

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Time Function

The properties of graviton enable us to explain that how a clock is running and how it slows. Properties of graviton; $\mathrm{V_G} = \mathrm{v_G} + \mathrm{s_G} = \text{constant}$ and $\mathrm{E_G} = \mathrm{T_G} + \mathrm{S_G} = \text{constant}$ show that transferring movement of graviton converts to non-transferring movement and *vice* versa. So, time function depends on (v, s) or (T, S). Everything is a clock and its time function is defined by t=t(s, v). When a clock is forming, its running depends on the conditions of perimeter. When a force acts on it, s and v do change. An inertial observer is able to explain running clock in inertial frame and gravitational frame by function t=t(s, v). There is a simple analysis about time dilation that is based on time function and work-energy theorem. This analysis allows every inertial observer resolves time dilation's problems so easily.

Time function and work-energy theorem

According to the graviton principle the transferring movement of graviton depends on intensity of external forces that apply on it. Usually an observer compares running of a clock with another clock or with its last situation. Suppose an inertial observer is seeing a clock at situation A, a force acts on it and clock goes to situation B, suppose the work of force is W, then;

1- $\mathrm{W} > 0$, clock runs slowly at situation B relative to A.
2- $\mathrm{W} < 0$, clock runs faster at situation B relative to A.
3- $\mathrm{W} = 0$, clock runs at situation B the same as A.

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Proof;

In inertial frame according to work-energy theorem$W = E_2 - E_1$, if $W > 0$, then $E_2 > E_1$ and $v_2 > v_1$. So, clock works more slowly than before. When $W < 0$, then $E_2 < E_1$ and $v_2 < v_1$. For $W = 0$, $v_2 = v_1$ (See time dilation in special relativity).

In the gravitational field $W > 0$, gravity force and displacement have the same direction.

Clock goes from high h_1 to h_2, so $h_1 > h_2$, and clock runs slowly at h_2, relative to h_1. $W < 0$, so $h_1 < h_2$, clock goes upward and it runs faster at h_1 relative to h_2. $W = 0$, $h_1 = h_2$,, clock runs the same at h_1 and h_2. (See time dilation in general relativity).

According to graviton principle, when graviton enters a clock, clock runs more slowly than before. If graviton leaves a clock, it runs faster than before (From the viewpoint of an observer outside the gravational field).

From work-energy theorem and time function, it is concluded that any system which does negative work on itself, will not experience the passing of time. This is thermodynamic (arrow of) time. In other words, any system with entropy is a clock. The more the entropy of a system is, the faster its life-span will finish. Therefore we can define a coefficient of entropy-lifespan without dimension as follows:

$$\Delta S - t = \frac{m}{M} \qquad (15)$$

In the above formula, m is the mass which the system loses as a result of entropy and M is the mass of the system. So the more a star's radiation relative to its mass is (bigger than coefficient of entropy-time), the faster it will decay.

The entropy of fermions in the obvious world is zero, so in normal conditions they have infinite life-span. Photons' life-time in the space is also infinite, because their entropy in the space is zero. However while they are escaping from a gravitational field, their life-span will decrease due to the gravitational redshift. A photon will lose all its energy while escaping from a black hole and its life-span will end. Virtual photons as long as they do not interact with other particles, they also have infinite life-time. Due to this reason, electric fields are constant, whereas gravitons with constant speed and energy will never experience passing of time.

On the other hand, the entropy of a system is, spreading of information. A star radiates due to its inherent power which leads us to notice its existence and physical features. The information related to a star is able to be revealed through the photons which it emits. As for an electron, we can reveal and understand both its existence and properties when either we directly observe it by a real photon or we can reveal it through a virtual photon which is emitted by an electron. These revelations are related to the obvious world, but the information related to the existence and properties of fundamental particles are also spread by gravitons with a speed faster than light speed $V_G, V_{G^+}, V_{G^-} > c$ that is not observable to us. Therefore quantum entanglement is explainable in a non-obvious space. An important conclusion from this discussion will be as follows:

In an obvious world, physical time does not exist independent of matter (energy). Whenever "time" is involved, one clock is associated, because the man has also a physical existence and consequently he is a clock, too. On the other hand a physical existence (able to being obvious) is made in its own space, and the moment it is created, its time starts.

Therefore, man is a clock, too and when we talk about the nature of time, apart from comparing the rhythm of clocks' movement, nothing else is explainable in physics.

Conclusion

Attention to photon structure and using new definitions for graviton, we can use the sub-quantum space to describe the nature of time in order to understand better the nature of space-time, and review of thermodynamics laws and entropy. As long as we do not review relativistic Newton's second law, physics does not stand on its actual position.

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