Vibration – The 5th Dimension To Redefine Spacetime Measurements

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ABSTRACT
Although our collective scientific understanding has made significant progress over the past several decades, there remain several unsolved and important mysteries of a fundamental nature. Theories have explained the physical properties of a particle or a state of a system in terms of position and time by using the 4-vector space-time measurement. However, determining a system's state along with all the functioning details can be more completely understood by expansion of this 4-vector measurement system as set forth by Einstein. This paper proposes and explains the rationale to consider vibration as the fifth dimension (as an expansion of this 4-vector system), to form a 5-vector continuum with space-time-vibration triad. This theory constitutes a holistic modified paradigm, which the author defines as the "Space-Time-Vibration" (STV) continuum.The author proposes this 5-vector continuum as a natural extension potentially explaining a few gaps in our understanding.

Keywords - *Vibration, Space-time measurements, Dark Energy*
PACS Nos.: 11.10 Ef, 11.10 Jj

I. INTRODUCTION

The creation of the universe has offered manydiffering cosmological theories and curiosity questions.Here, the author provides a plausible explanation to uncover the underlying principleof nature and our universe.The intrinsic value of 'vibration' in space-time representations forms a 5-vector continuum to explain different energy-matter states and various modifications since the Big Bang, where the laws of physics cease to operate. This proposed 5-vector continuum is the extension of Einstein's 4-vector spacetime continuum [1]. Thus the vibration is introduced here as the fifth dimension in STV continuum.

This workfurther supportsthe hypothesisthat 'vibration', like space and time,is a separate dimension in its own right, holistically characterizing the current fundamental geometry and measurement of the universe [2,3]. It was notedearlier that when the vibration in the QHO (Quantum Harmonic Oscillator) is stopped, the state doesn't become 'nothing', but rather, a highly potential stateremains,withoutany creation[2]. Since there is no vibration in this state, there is no Space and no Time also present in this state. This state is not 'nothing', but it is 'no-thing'. This vibration-less condition is termed the Absolute Like Potential Energy (ALPE) state. And creation is projected out again when vibration is initiated in the QHO. The various energy states within the Oscillator (from gross energy to subtle DE and beyond) depend on different degrees of vibrations in the QHO. Thus, vibration as a continuum (with space-time) can give us a more comprehensive representation and broad visualization of the energy-matter dynamics of our universe.

II. VIBRATION AS THE 5TH DIMENSION – EXTENDING SPACE-TIME CONTINUUM

This paper proposes vibration asa fundamental dimension in the space-time continuum, expanding the possibilities for better understanding of our universe and its multiplicities. Thisproposedapproach offers a more complete understanding of interactions between energy and matter. We usually quantify vibrationin terms of frequency (as the inverse of time), but its significancein relation withthe physical universe is more profound and relevant. Vibration has unique intrinsicproperties and profound significance, withthe unique and fundamental ability to be the origin of spacetime itself. If we are actually able to stop this vibrational movement, space and time also will vanish along with it.

Vibration is more than mere oscillations, or inverse of time; it is the quintessence energy state of the universe(encompassing both quantum and classical energy systems). It is not simply movement -the holistically quantified vibrational energy can render an explanation for all space-time measurements,collectively explainingmany inconsistencies. Vibration flows like energy itself, giving rise to space and time.

Vibration has not only relation with time, but it has an inseparable relation with space also. The energy packets of quantum particles in QHO are nothing but vibrations. Space-time is not motionless but is continuously pulsating, and the resulting space-time movement confirms existence of vibrational forces. In fact, everything in this universe is nothing but the collection of vibrations, as observed by Erwin Schrödinger, "*the 'energy levels' are virtually nothing but the frequencies of normal modes of*

vibration……and the theory of 'quantum jumps' also has a possibility to be replaced by the vibration theory". [4]

As per conventional understanding, the space-time measurements are applied to determine physical properties of an energy system. As explained above, space-time is the outcome of vibrations. The vibrationallows changes in space-time to be measured according to the different degrees of vibrations. Consequently, any consideration of a body's energy content accounts for the vibrational energy of that body.

In reality,space and time, cannot exist without vibration, whichappears to be the fundamental ingredient of the universe. Consequently, working with space and timenecessarily shouldinclude vibration as the fundamental backgroundfor both.By removing vibration from consideration, the entire universe (along with spacetime) will simply become non-existent. Accordingly,this principle of vibrationis keyto understanding the universe, since vibration of a subatomic particle (or an energy packet) is the crucial factor determining its properties. The authortherefore proposes expansion of the space-time continuum to include vibration.

A. Significance of 5-Vector Continuum:

In short, the three vital factors, namelyspace, time and vibration, are the actual building blocks necessary and sufficientto understand matter and energy. This space-time-vibration triad (STV triad)forms a single 5-vector continuum, which is mutually dependent on each other.

Therefore, adding vibration as a separate dimension in the STV continuum, we getthe STV continuum of 5-vector.The coordinate x goes to $\rightarrow X^0, X^1, X^2, X^3, X^4$, to form this continuum. Or, we can compress all the 3 space dimensions into one dimension and think of the STV continuum having a property of a 3-vector continuum (Fig.1).

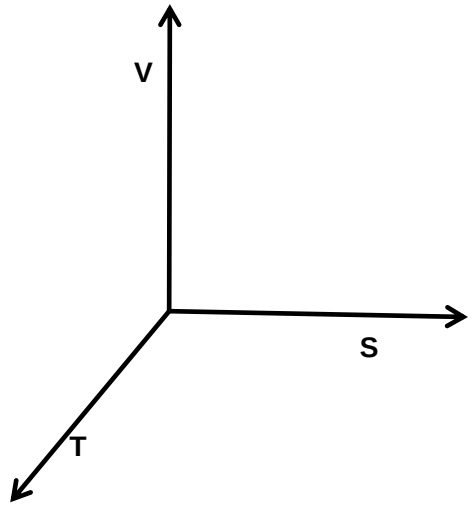

Fig.1:Space-time-vibration (STV) continuum

B. Dynamics of Space-Time-Vibration Continuum in Five-Dimension Representation:

Let us now explore the nature of the vacuum energy, an underlying background energy state existing throughout the Universe. Starting from the gross potential energy state as in the Newtonian potential, if we proceed toward still finer energy state, we can observe that the energy state becomes gradually subtler as it goes from atomic state to subatomic and lastly to vacuum energy state. In other words, we observe as the state of energy becomes finer, its immensityincreases (in terms of both power and range). It is also observed that subtler a state, the more pervasive it becomes. Additionally, the subtler (and hence more unified) energy states form the building blocks of the grosser energy states. The description of the energy dynamics varies widely from the gross state (as in classical physics) to the subtler states. And it is well knownthat finally the quantum state forms the building blocks of a classical object and explains the workings of energy in much deeper level than the classical one.As we progress through subtle energy states from quantum state to still subtler,say to vacuum energy state, the same dynamic principles (as applied to explain quantum state)may not work to fully explain the subtler changes occurring in the subtler states - just as the classical energy dynamics does not work at the quantum state.

Thus, to understand vacuum energy we need to get into still subtler energy principles than that of the quantum state. The conventional quantum mechanics seems to be inadequate in such cases. That is the reason why by applying ordinary quantum physics to the vacuum energy (or the DE), we arrive at many incoherent results. For example, both Quantum Electrodynamics (QED) and Stochastic Electrodynamics (SED) calculated the DE to be staggering 10^{113}joules per cubic meter [5,6]. But it is very strange that we do not have any clue as to why this huge energy does not create any gravitational effect or any other manifested effect.

Vacuum energy,at its true essence is nothing but Dark Energy (DE). This dynamic field is known to haveenormousenergy yet exists in a dormant state- it creates no tangible effects on its surroundings. And as we know, this DE energy field, which is fundamentally composed of STV, gets itself warped in the presence of any energy body (massive or massless) in it.

Interestingly, the energy body that creates curvature in the DE, which is composed of STV, is also essentially composed of STV. But the STV of one energy body that creates curvature in DE is not in thesame vibrational state as that of the STV, which is curved (DE). It is the curved DE that gives the notion of gravity. In other words, one set of STV with one

vibrational state creates curvature into another set of STV with another vibrational state. This interaction between two such different states of vibration gives rise to gravitational effect. The difference between these two sets of STV is only due to the difference in the nature of vibration in them. The grosser vibrational STV (massive or massless energy body) curves the subtler vibrational STV (DE, which has essentially more energy).

Another example is Higgs boson. Quantum Field Theory has calculated the Higgs mass to be 10^{18} GeV. But experimentally we get the Higgs mass to be mere 125 GeV. This inconsistency is called gauge hierarchy problem.

To solve this problem (related to both DE and Higgs boson), a cancellation theory, known as supersymmetry theory, has been created. This theory hypothesizes that after a huge renormalization, the bigger energy is brought down to smaller energy, which we find now around us. This theory says that the energy was extremely huge in the past, but as time evolved, much of its energy was cancelled by the super partner particle. For every bosonic particle there was a fermionic super particle. And for each fermionic particle there was a bosonic super particle. That is why in colliders like Large Hadron Collider, we try to create a situation prevailed in the past by colliding two particles with exceptionally great velocity. At the time of collision, the high magnitude of pressure, temperature etc. within the collided particles, simulates the condition that prevailed just after the Big Bang. And the super symmetric particles, which existed in the remote past (just after the Big Bang) to cancel out huge energy, are expected to be detected in this collision.

But the theory of Like Potential Energy [2] proposes that the huge energy (as in DE, and Higgs mass) doesn't get cancelled. But this energy only gets to a subtler state of vibration so as not to make it detectable.

This theory of LPE, fits to explain the property of the DE (i.e. having more energy but less vibration in DE QHO).The vibration as proposed in this paper has direct link with LPE.

Also, it is hypothesized that any matter or energy particle is actually in a state of DE, when analyzed beyond its quantum state. And the DE is nothing but combination of STV.

We,therefore, propose to take theDE fieldas a suitable candidatedetermining the actionby the 5-vector continuum (comprising ofthe STV). The DE state is proposed to be in Like Potential Energy (LPE) state to have huge energy and minimal vibration so as not to manifest this energy in the form of gravitational effect or any other effect on its surroundings [2]. The same LPE state, under certain limiting conditions gets transformed into the ordinary energy state in any ordinary matter or in any subatomic particle [3].Perhaps as the energy state diminishes (from subtle to gross), its dynamics transform from a more to a less fundamental energy state. To state it differently, the energy states follow a sequence (from subtle to gross) of LPE state to Quantum state to Classical state. The LPE state, which is subtler than the quantum state, is to be studied separately.

C. The Theory

Let us take a holonomic, independent coordinate system for this vacuum energy state (DE)with total kinetic energy as T and the total potential energy as V in the field.

Then the Lagrangian L is given by:

$$L = T - V$$

The subsequent Euler-Lagrange equation is given by:

$$\frac{d}{dt}\left(\frac{\partial L}{\partial \dot{q}_j}\right) - \frac{\partial L}{\partial q_j} = Q_j$$

Replacing *L*,

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{q}_j} - \frac{d}{dt}\frac{\partial V}{\partial \dot{q}_j} - \frac{\partial T}{\partial q_j} + \frac{\partial V}{\partial q_j} = Q_j \quad \text{...(Eq.1)}$$

Where q_j is labeled as the generalized coordinates; in this case there are five coordinates with space, time and vibration. Q_j is to be taken as the non-conservative value of energy. In this case $Q_j = 0$ as there is no external force applied to the system.

Hence the (Eq. 1) becomes:

$$\frac{d}{dt}\frac{\partial T}{\partial \dot{q}_j} - \frac{d}{dt}\frac{\partial V}{\partial \dot{q}_j} - \frac{\partial T}{\partial q_j} + \frac{\partial V}{\partial q_j} = 0$$

We should note that, for a mechanical system, the term $\frac{d}{dt}\frac{\partial V}{\partial \dot{q}_j} = 0$, but in studying the vacuum field with vibration as fifth dimension, $\frac{d}{dt}\frac{\partial V}{\partial \dot{q}_j}$ has a non-zero value.

Let us now consider the field to be $\phi(x)$ in space-time-vibration continuum. In this case of a field

$\phi(x)$, the field itself becomes the coordinates, as x goes from 0 to 4

$$\rightarrow X^0, X^1, X^2, X^3, X^4$$

$\phi(x)$ has the implication that we go to a limit where we take its points to be so dense that they form a continuous field. These points are the values of the field $\phi(x)$ at different locations in STV.

Now we can have a Lagrangian of the field $\phi(x)$ that starts from the summing over position and then extending up to time and vibration. Thus, Lagrangian is replaced by an integral. Hence, we have:

$$L = \int dx \mathrm{L}\left(\phi(x), \phi_{x^0}, \phi_{x^1}, \phi_{x^2}, \phi_{x^3}, \phi_{x^4}\right)$$

……(Eq. 2)

Where L is Lagrange density and

$$\phi_{x^0} = \frac{\partial \phi}{\partial t}, \quad \phi_{x^1} = \frac{\partial \phi}{\partial x}, \quad \phi_{x^2} = \frac{\partial \phi}{\partial y},$$

$$\phi_{x^3} = \frac{\partial \phi}{\partial z}, \ \phi_{x^4} = \frac{\partial \phi}{\partial \sigma}$$

The term $\frac{\partial \phi}{\partial \sigma}$ (or ϕ_{x^4}) in (Eq. 2) is the most important term in the Lagrangian asit indicates the vibration derivatives of the field ϕ (i.e. the change of the field ϕ ($\square\phi$) as the vibration of the field changes a little). σ may undergo various modifications, and accordingly the corresponding field will also undergo some alterations. **This alteration due tomodification in vibration σ, is postulated here to give rise to various changes in spacetime, and subsequently changes in the patterns of energy and matter.**

Even the DE and the Dark matter arise out of this change, namely $\frac{\partial \phi}{\partial \sigma}$. This term $\frac{\partial \phi}{\partial \sigma}$ in the Lagrangian (Eq.2) has a close relation with the vibration factor in the equation obtained in paper [2], the equation being,

$$\frac{\partial \psi}{\partial t} = \frac{\psi}{i\hbar}(x\rho - i\hbar\omega), \text{ where } \omega = \frac{\partial v}{\partial x}.$$

Here, the term $\frac{\partial v}{\partial x}$ is the vibration factor generated due to vibration in the QHO under certain boundary conditions as proposed [2]

[Note: In this calculation, we have considered the vacuum, which is a massless field. But the above-generalized Lagrangian (Eq. 2) can be applied to any energy field with or without mass. In case of field with mass; a mass term will appear in the Lagrange density.]

Here t, x, y, z, σ are taken as having1 time coordinate (*t*), 3 space coordinates (*x*,*y*,*z*) and 1 vibration coordinate respectively (σ) in a 5-vector STV continuum.

Therefore, we can rewrite Eq. 2:

$$L = \int\iiiint\int d^5 x \mathrm{L}\left(\phi(x), \phi_\mu\right) \text{ ….(Eq.3),}$$

where μ runs from 0 to 4.

The action *A* is given by:

$$A = \int L\left(x, \dot{x}\right)dt$$

Replacing *L*, from Eq. (3) we get:

$$\boxed{A = \int d^6 x \mathrm{L}\left(\phi(x), \phi_\mu\right)} \text{ ……. (Eq. 4)}$$

(Eq. 4) is the modified general structure of field theory with STV 5-vector continuum.

The (Eq.4), thus derived with vibration as a fifth dimension which explains more completely, the equations of motion obtained by means of action principle.

The above Lagrangian equation mayoffer other significantalternatives related to vibration. This option postulates the intrinsic relevance of considering vibration as a fifth dimension in generalized field equations.

Further, the (Eq.4) can better explain the fundamental nature and behavior of any energy field and completely study the measurements of various energy systems existing in the universe, if applied to both quantum and classical field theories.

III. RESULTS

This paper shows the pivotal importance of the vibration in the study of energy and matter at the most fundamental level, and thus proposes it as a separate dimension, to form a 5-vector continuum of STV to fully understand the workings of the universe

starting from classical state to quantum state to LPE state to finally the ALPE state. The ALPE state, having the vibration tending to 0, is perfectly undifferentiated and indiscrete state. Therefore, in the subtlest level of quantum state, the discrete quantum state gets transformed in indiscrete ALPE state [3].The proposed 5-vector continuum thus provides the complete energy-momentum dynamics of any creation in the universe.

IV. DISCUSSION

A. How is 4-Vector Continuum Compatible with 5-Vector Continuum?

Till Einstein, the prevalent notion was that space and time are two totally separate entities. Space is space and time is time. But Einstein discovered that space and time are very closely related, so much so that they can be called just the spacetime. In other words, the change in space influences time and the change in time influences space. That is why he added time to be the extension (continuum) of the already existing 3 space dimensions. Thus Einstein's 4-vector space-time continuum got its birth. This 4-vector continuum does not provide any explanation as to why the huge DE (a massive $10^{113} Joules/m^3$, as per Quantum Field Theory calculations) doesnot cause any gravitational effect by producing curvature in its surroundings. Also, the dynamics of the DE and other still finer particles does not fall under the purview of 4-vector system. Taking vibration as fifth vector of the STV 5-vector continuum, a plausible explanation can be suggested with regard to the nature of DE and further subtler particles until the QHOenergy goes to infinity and the corresponding vibration goes to zero. In other words,this explains the anomaly of Vacuum catastrophe. [3]

B. Vibration is Observer Specific

The fundamental basis of all physical and observable existence beingSpace-time-vibration (STV), any physical law must constitute these three basic ingredients. It was previously noted thatof these three factors, it is vibration that gives rise to the other two. The defining principles of quantum physicsrepeatedly emphasize the observer'spivotal role in understanding and recording the natural phenomena. Even the so-called 'constants' of the nature are observer-specific.As such, a law perceived by humans may not be viewed the same by other creatures. Science has proven this fact with experiments. For instance, if a tennis ball moves at 70km/hour in one measurementat a particular instance, it is understood that all humans will measure the same speed at that instance. But interestingly, a housefly will not measure the same velocity of that tennis ball as humans do. Experiments prove that the velocity perceived by humans is to about 4 to 5 times slower for a housefly, because this creature perceives 'time' 4 to 5 times faster than we do. [7,8]

These differencesin perception are only with regard to time perception, for which science has proof. Extrapolating from the same logic, the perceptual differences are highly likely with regard to space and vibration also. Since the time perception differs in various creatures, all perceptions regarding other laws of nature also must and should differ for different creatures. This difference is highly probable for relativity theory also. Thus, we have proofs that no law in the nature is absolute. The law differs according to our individual perception of STV.

C. Origin of the Universe Revisited

The study of 5-vector continuum, LPE state and still more potential states will take us to the fundamental constituents the whole universe is made of. They are as discussed above - space, time and vibration (STV). Taking the energy-vibration dynamics of LPE in 5-vector continuum, we can understand that the inner workings of the DE perfectly satisfy the LPE dynamics where it is proposed that energy increases with the decrease of QHO vibration [2].

Now, let us study such QHO under LPE dynamics when the energy $E = \infty$, and the vibration displacement $dx = 0$. We will then find that with the cessation of vibration, space and time also cease to exist. Which means, the whole creation literally stops when the vibration is brought to a perfect halt (under the LPE boundary conditions). This gives us a clear clue that our universe might have been originated from a motionless state with infinite energy source. Though there is infinite energy in this state, the energy state remains without any vibration, and the energy does not have any manifested effect like gravity etc.

Before the beginning of the creation, the entire cosmos was in a totally vibration-less, undifferentiated state (ALPE state), a statethat is all-pervasive and beyond STV limit.

V. CONCLUSION

The most significant postulate of this paper is to propose that there exists no creation without having vibration as its component. Using this concept of fifth dimension, stemming from the explanations of the LPE state [2], the initial start-up of the universe, and what existed prior to this can be better understood. This theory can provide a fitting solution to many unsolved questions, like the existence before the Big Bang,the mystery of DE, vacuum catastrophe,etc., which may form a separate study. Also, the effect of vibration as the fifth dimension in the Special Theory of Relativity theory (forming a Space-Time-Vibration continuity equation)can be presented as a separate research study.

By using vibration as the fifth dimension we can demystify and uncover many such profound truths related toour cosmos. It may even unfold the study of

many other particles that are more fundamental than the particles in the Standard Model. By studying the vibration and the LPE state, we understand that the whole world of energy-matter can be perceived in different states of existence. The perception from gross to subtle happens from: Classical state to Quantum state to LPE state to ALPE state.

ACKNOWLEDGEMENT

The important contribution made by Dr. TGK Murty, former program director, ISRO, and an outstanding scientist, is duly acknowledged. His appropriate guidance and encouragements were very much significant to institute this paper for the wider scientific community. Dr. Jogi Pattisapu, MD, University of Central Florida, contributed significantly in proof-reading and making appropriately scientific suggestions. The author cordially acknowledges his contribution.

REFERENCES

[1] On the electrodynamics of moving bodies, A. Einstein, June, 30, 1905
[2] Nityayogananda, S. Pramana - J Phys (2017) 88: 4. doi:10.1007/s12043-016-1311-x
[3] Nityayogananda Swami, Global Journal for Research Analysis (2018) https://www.worldwidejournals.com/global-journal-for-research-analysis-GJRA/file.php?val=October_2018_1539072247__100.pdf
[4] 'What is matter?', Erwin Schrodinger, Scientific American, September 1953
[5] Peter W. Milonni – "The quantum Vacuum"
[6] de la Pena and Cetto "The Quantum Dice: An Introduction to Stochastic Electrodynamics"
[7] The Guardian Press association Time passes more slowly for flies ,study finds (https://www.theguardian.com/science/2013/sep/16/time-passes-slowly-flies-study) (2013)
[8] Emilie Reas Small Animals Live in a Slow-Motion World (Scientific American https://www.scientificamerican.com/article/small-animals-live-in-a-slow-motion-world) (2014)