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# Unification of Quantum Mechanics with the Relativity Theory, Based on Discrete Conservations of Energy and Gravity

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Additional information is available at the end of the chapter

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## 1. Introduction

The history of physics has two great revolutionary theories, such as relativity and quantum physics. However, the new discoveries of the particle physics do not fit with the principles of both theories. One of the main questions is how to explain the break of symmetry in proton-antiproton collision experiments and formation of more matter particles than that of anti-matter ingredients. The theory, which can explain this phenomenon, should answer to the question how matter in the beginning of universe formed and what is the space-time structure of the universe.

In accordance with the modern physics, the small-scale experiments of particles physics have to be described by the Standard Model of quantum mechanics. However, the phenomenon of matter/antimatter symmetry breaking appearing at subatomic scale requires formulation of the new dynamical laws. Presently it is not clear that the mystery of the small-scale dynamics is due to the incompleteness of the mathematic formulation of dynamics of physical events at small scale or to the change of mathematics. The problem is that our present knowledge on mathematical description of change at small scale of space-time frame and physical theories do not distinguish what special features should have the initial state (position) of universe.

Quantum mechanics suggests that at sub –atomic scale the features of initial sate, the position and velocity of a particle cannot be measured. At this scale, the differential equations of dynamical evolution do not work and the change of the state of a system cannot be found by its velocity and position where takes place appearance of wave-like performance.

The problem is that the concept of “rest energy” or “rest mass” can not be explained on the basis of the our present knowledge of static energy conservation law. The static state of “rest

mass" requires application of uncertain amount of energy to keep a body at certain constant position within infinite time duration.

Quantum mechanics relates the problem of "rest" to the uncertainty principle. By quantum mechanics, a particle cannot be at rest because at the "rest" the position and velocity both have to be certain, which cannot be possible.

In classic formulation of Neother theorem, the concept of energy conservation is uncertain due to the continuous feature of the energy conservation. The symmetry principle, revealed from this theory became also uncertain. Therefore, the scientific basis of symmetry breaking, observed at small scale, cannot be explained because of classic energy conservation principle.

The energy as an identity may be conserved discretely because continuous energy conservation in the form "energy can not be destroyed and created" leads to the arbitrary and infinite feature of the dynamical events: the amount and origin of conserved energy within this formulation is uncertain.

The non-continuous energy conservation in the non-arbitrary frame requires existence of boundary of the energy conservation, which has to be localized within space-time framework. But our present understanding of space-time frame does not describe what the space and time are.

There are many concepts, related to the nature of space and time variables but the true nature of time (space as well) is not known. Particularly it is not clear why space has three dimensions while time has only one. Due to this reason all the physical theories, describing motion distinguish difference between the past and future. The second law of thermodynamics, correlating irreversible time arrow with the increase of randomness does not explain evolution of biological events in direction of more ordered states.

By relativity, space and time are not absolute variables. Unfortunately, the theory of relativity is the theory of geometric space-time and it does not explain why the space-time unit connects the parameters having different dimensions.

Based on these problems, the aim of our chapter is to give analysis of the quantum mechanics and relativity within the principles of classic energy conservation law and to describe main features of these theories within alternative concept of discrete energy conservation. In the frame of discrete energy conservation the classic symmetry principles gets entirely new feature which occupies the special part of the present work.

In the present chapter, we also discuss one of the mysteries of the physics related to the transformation of the space-time variables. Physics accepts invariance in time, which does not fit with the CP violation. We will discuss also Paolo Scaruffi analysis [1] on the laws of classic physics that "why do objects in accordance with the first law of motion have a preference for travel in a straight line at constant speed is not clear. Where does this property come from? It is not clear also, why a body in motion tends to remain in motion and a body at rest tends to stay at rest. These questions are open to interpretation".

In our work, we have suggested a new space-time dynamic boundary mapped discrete energy/momentum conservation law for unification of quantum mechanics and relativity scales

interactions, which is based on a new non-Lagrangian mathematical foundation of non-invariance action principle and commutation of frequency domain differential operators of conjugated canonical space-time variables. We showed that the phenomenon called space is the materialization of background “vacuum” energy in the momentum of dark matter, while time phase destroys everything material, reversing the alignment of dark matter momentum to the initial state of “vacuum” energy. Therefore gravity is not the geometry of space-time, it is the dynamic order to hold discrete energy conservation cycles and its power source is the background coupling of space-time phases.

The mechanism of mass generation has been described in the chapter in detail. It is shown that generation of correlated mass and its conservation takes origin by consumption of energy of discrete space-time background frame, moving in direction of space phase expansion. The “continuous parity” conservation may result only by discrete commutation of **SU (2)** group of interactions with the coupling energy of background virtual space-time ingredients, recycling its discrete uniform energy to the **2:1** confined interactions of nuclear. The uniform exchange of energy, generated by not-yet observed background **[T-B]** bi-meson field through interaction with the **uu**-quarks, regulates discrete energy conservation within nuclear and background polarization state.

The new non-Lagrangian time/space dependent function shows that the “resulting weak response force” gets its origin from the action-advanced response non-invariant parity of three-component interactions  $(\mathbf{V}-\mathbf{A})/\mathbf{A}$ , providing a new deterministic description of nature and fundamental dynamic symmetry. With the static, single non-correlated existence of the identity and physical parameters, the energy and momentum (mass) are not conserved. The physical reality and its parameters as the resulting (not passive relativistic) quantities, do not exist independently of the advanced response interactions: in formulations of classic and quantum physics, the fundamental Lagrangian action is not conserved.

## 2. The physics of Einstein’s relativity

The question “What is the wrong with the relativity theory?” appears frequently in discussions related to the relativity theory. Of course, the relativity theory is not a complete theory. Particularly, the energy –matter equivalence in  $E=mc^2$  formulation is not complete from two reasons: the concept of rest mass and the conditions of energy-mass equivalence of the special relativity is not clear. What mass is equivalent to the energy and what features has the rest mass as an equivalent to the energy? What is the performance of this equivalency at dynamical conditions out of the vacuum? What is the connection of the mass with the dynamics of the space-time frame? There is no physical meaning of the increase of the inertia (mass) with the increase of the velocity even with application of Lorentz transformations.

The special statement of relativity that space and time variables are not absolute variables and they form the non-separable space-time unit is very important statement of this theory. From this statement follows that description of the change by classic differentiation where change of the function (space function, such as length) has a relation with the independent time input

leads to the appearance of the uncertainty. Therefore, change of space has to be correlated with the response of the time to the change. Unfortunately, this concept, which follows from the analysis of relativity, was not realized in the mathematic formulation of the special relativity.

General relativity is not a complete theory because it cannot describe space-time structure at small scale. However, general relativity, as the special relativity, also has an important statement that space-time structure is determined by the energy and mass in it, which makes it non-linear. The problem is that general relativity describes this relation by geometry, which cannot show change of the structure of space-time with the change of energy and matter. Due to this incompleteness, the general relativity leads to the singularity at small-scale physics (atomic scale) and at high space scale called black holes.

Another big problem of the relativity is its concept, based on continuous dynamics, which leads to the relation of the motion to the relative reference frames. Elimination of continuity and description of the natural events by discrete dynamics do not need application of “reference frames” for relation of the motion. In discrete dynamics, the motion is related to the action force: in the presence of the action, an event changes its state, but when there is no action force an event returns to its initial state.

Based on the discrete dynamics, the Newton’s laws of motion and gravitation could be unified. The motion is the result of the action force, therefore the Newton’s first law that ‘if a body is not affected by any force it will keep its initial uniform motion in straight line’ eliminates that the body before “affect of any force” had a motion due to the result of some force.

Einstein showed that space and time are simply different dimensions of the same space-time continuum. All events and quantities decompose into time and space components, which depend on the observers. Einstein connected the curvature of space-time of an event with the energy and momentum of the objects. By Einstein opinion the energy and momentum are the same quantities of space-time which has four dimensions. That is why space-time is the same in relation for all reference frames and change of the event is realized through change of the space and time components of this frame. The relative quantity of energy and momentum depends on the observer.

The problem of this approach is that the dynamical space-time variables were connected within continuum framework, which did not allow distinguish personal properties of time and space identities. Later we will show that the difference in performance of space and time variables do not involve dimension of these parameters but deeply is connected with the asymmetric phases, binding the boundary of the space-time phases. The relative quantity of energy and momentum has to be determined by the asymmetry in the boundary of these variables. The contraction of the length and time dilation cannot be described without specification of the boundary of these variables. Therefore, contraction of space and time delay cannot be without relation of these parameters to their initial boundary. The relative ratio of space-time variables in the dynamic space-time frame (by relativity-decomposition of space-time continuum to its ingredients) may be different for the observers, participating differently in the space-time event and sharing directly or indirect the energy recourses with the event.



In Newtonian physics, time flows at a constant rate for all observers. This statement of Newtonian physics appears from the concept of “independent time”. Therefore, in accordance with the Einstein’s relativity flow of time has different rate for different observers. Therefore, by relativity time is the personal property of an event: different observers, giving different time flow for the same event, present their “personal time”. The problem is that relativity equations do not clarify why different observers could measure the same speed of an event by their own measurements. It is not known also how to unify the measurements of the different observers.

Einstein determines the dynamics of matter by the geometry of space-time and that geometry is determined by the distribution of matter. As in the case of special relativity, in general relativity many questions remain open. Particularly general relativity does not explain the origin of mass and energy, which curves the structure of space-time. The question related to the Newton physics, how the moving body responses to the action, in the relativity theory also remains open. If this energy has an external origin, how this energy is generated and how it interacts with the space-time remains open. But if this energy has an internal origin within space-time frame, the mechanism of the energy generation and the energetic features of space is the subject of interpretation. It is not clear also if the universe is a single system, what energy makes its expansion.

The main question here is the energy content of the space. What is the property of the vacuum, is it the empty unit? How the empty space may have energy? Unfortunately, the basic formulations of special and general relativity do not provide answer to these questions without which the relativity theory itself became the “observer” between Newton’s physics and quantum mechanics.

### 3. Fundamental basis of quantum principles and their problems

Quantum mechanics did not solve problem of classic mechanics by modification of its causal dynamical laws but applied entirely new concept of probability, which was a new philosophy for description of nature. Description of the causal nature by mathematical formulation of classic differentiation had boundary problems, which lead to the uncertainty [2]. Description of the position and velocity by classic approach through application of boundary of variables to the mathematical formulation could solve the problems. Dirac’s relativistic quantum mechanics concept is the realization one of these ways but Dirac’s concept kept the probability feature of the quantum mechanics.

The fundamental basis of the quantum mechanics was very important due to the application the uncertainty in the description of the “change phenomenon” instead of mathematic formulation of classic physics. Unfortunately, the derivative of the function without involving of the function itself leads to the uncertainty. Therefore, the physical observables, such as momentum and velocity of the classic formulation were replaced by the possible states of operators on a wave function. The starting point of quantum mechanics was that it transformed the physical parameters to the differential operators: the time operator replaced energy while momentum by spatial operator.

In accordance with the quantum mechanics, the physical state of a body cannot be described by classic state and it has to be described by “quantum state”, presented by wave function. The change of the wave function describes evolving of a system with time. It is clear that during change of a system with time the evolving wave function cannot be merged with the law of relativity.

It is necessary to note that Schrödinger equation is not free from the continuous energy conservation principle due to the involvement of single time derivative as an energy operator. The another problem of the Schrödinger equation is that it involves Hamiltonian as the linear operator of the wave function. The Schrödinger equation is a single particle's equation that is why Hamiltonian does not describe the interaction of the particle with its surrounding medium. Due to this features this equation has a problem of “locality” of a body, described by the wave function.

Due to the absence of “absolute frame of reference”, description of the state of a particle was one of the difficult subjects of the relativistic and non-relativistic concepts. Shrodinger equation contains only first order derivative with respect to the time. Dirac tried to give description, such as a differential equation first order for space and time, which may lead to the simple relativistic relation between energy and momentum.

To eliminate the problems of the Schrödinger equation, Dirac suggested the relativistic quantum mechanical wave function in order to fit the concept of relativity. Dirac equation is the first attempt for generation of theory consistent with the principles of quantum mechanics and relativity theory.

Dirac equation was similar to the Schrödinger equation, but his proposal suggested existence of the anti-matter. The main principle of Dirac equation [3, 4] is that Hamiltonian, correlated with the input wave function, was described through complex value, involving the sum of energy-momentum consistent:

$$\left( \beta mc^2 + \sum_{k=1}^3 \alpha_k p_k c \right) \psi(\mathbf{x}, t) = i\hbar \frac{\partial \psi(\mathbf{x}, t)}{\partial t} \quad (1)$$

Dirac assumed that presenting Hamiltonian through energy-momentum sum might describe the atomic spectra and discrete angular momentum of an electron.

It is clear that the form of the wave function and its evolution is determined how the total energy and energy-momentum has been described. Hamiltonian of Schrödinger wave function involves the total energy of a system. Making the Schrödinger equation relativistic, Dirac used some additional transformation expressions and got a equation

$$-\frac{\hbar^2}{2m} \nabla^2 \phi = i\hbar \frac{\partial}{\partial t} \phi. \quad (2)$$

Dirac equation in this form still is not a complete dynamical model because it presents the dynamic behavior of a free particle and cannot explain why an electron has a spin angular momentum of half a quantum. The Dirac's relativistic wave equation [3, 4] was the first try to communicate relativity with the quantum mechanics. The left side of the equation (1) describes momentum ingredients:

$$\left(\beta mc^2 + c(\alpha_1 p_1 + \alpha_2 p_2 + \alpha_3 p_3)\right)\psi(x, t) = i\hbar \frac{\partial \psi(x, t)}{\partial t} \quad (3)$$

It is necessary to note that Dirac proposal, suggesting existence of anti-matter (particularly positron) does not explain properly physical state of negative energy, introducing it as a "sea" of negative particles. It could not explain also how matter may degenerate into negative-energy states.

The relativistic feature of Dirac's proposal was explained by his suggestion that relativistic description of a particle should involve multiple wave functions for other potential particles.

But Dirac's equation does not involve first order space-time derivatives which in the form of symmetric ingredients have to describe energy and momentum parts of the space-time frame. Dirac's equation also does not involve any information about initial values of the wave function at every discrete time instants; therefore, it could not lead to the definite solutions for communication of relativity with the quantum mechanics. The initial values of wave function of Dirac equation are freely chosen.

The special feature of Dirac's concept is the "Dirac sea" which is related to the negative energy solutions. The "negative energy" of Dirac's sea is explained with the principle that every quantum state can only be occupied with one electron. This concept accepts that the total energy and total charge are infinite. Therefore, this principle does not explain the source of infinite energy and infinite charge. The Dirac's sea is possible only with the infinitely many particles.

In accordance with the Dirac concept, when one electron is lifted from "Dirac's sea" via a high energy of  $\gamma$ -particle, there forms "a hole in the Dirac sea". By this concept, the "hole" represents the anti-particle to the electron with the positive charge, namely the positron, which has been proven experimentally.

Dirac equation can be obtained from the lagranjian action principle, but lagranjian action cannot give first order derivatives for the event simultaneously in space and time variables.

O.Klein and W.Gordon proposed [5, 6] the concept, which is applied to describe "particle" behavior in the relativistic mode and an equation, which has to simulate the behavior of a spineless free particle which has a spinless wave solutions. The Klein-Gordon equation is a relativistic version of Shrodinger equation, it is the second order in time, and it describes spinless particles in towards and backwards in time.

The Klein-Gordon equation has the following description:



$$\frac{1}{c^2} \frac{\partial^2}{\partial t^2} \psi - \nabla^2 \psi + \frac{m^2 c^2}{\hbar^2} \psi = 0. \quad (4)$$

The Klein-Gordon equation is the second order for time expression and by separation of positive and negative parts describes time-independent case. In some versions, Klein-Gordon equation was introduced with the second order for time and space but in these expressions have boundary value problems.

Although Klein-Gordon equation claims to be relativistic equation, it does not give complete relativistic picture of a “particle” dynamics simultaneously in space and time coordinates, which in relativistic mode needs to be connected with the space-time frame, required by relativity theory.

## 4. Discrete conservation of energy as the basis for unification of physics

### 4.1. Formulation of discrete space-time field theory

The concept, which we are planning to use, has to eliminate the small-scale phenomenon-point particle concept of classic physics and quantum mechanics probability of location of subatomic particles. The new concept is the discrete dynamical structure of space-time phases. The position of an elementary particle, located within space-time phases is not a point; it exists as a time carrying identity within minimum space frame, called elementary space-time manifold commuting space and time phases.

The problem of classic physics is the description of the events by displacement of a point in space ( $\Delta \mathbf{x}$ ) within certain displacement of time ( $\Delta t$ ), presented in the form of relative simple intervals. Two point particles having the same displacement in space and time could pass the observer’s reference position differently being in “phase” or in “opposite phase” due to the having, phase differences starting from different initial conditions.

Feynman [7] showed that elimination of the infinity in dynamical formulations could be done through substitution of interval of function ( $\Delta f$ ) by the value of the function itself ( $f$ ) but by his opinion in this case the dynamical event will be static.

It is clear that the effect of scale phenomenon to the behavior of dynamical systems can be analyzed by Hamilton canonical coordinate transformations. Unfortunately, a genetic Hamilton’s transformation ( $\mathbf{g}, \mathbf{p}, \mathbf{t}$ )  $\rightarrow$  ( $\mathbf{Q}, \mathbf{P}, \mathbf{T}$ ) has no explicit time dependence and does not preserve this transformation.

We used a new principle of canonical transformation where the transform is the time – frequency representation. The new approach involves commutation of frequency with the time domain through conjugation of the change of function ( $\Delta f$ ) with the local function ( $f_n$ ) itself. In this case, the reciprocal discrete transform within ( $\Delta f$ ) and function ( $f_n$ ) itself can be generalized to the Abelian group due to the generation of dynamic translation within boundary of canonical variables.

We did not replace the interval of the function ( $\Delta f$ ) with the function itself ( $f_n$ ), as Feynman suggested, but we conjugated them together to form entirely new mathematical operator, eliminating arbitrary performance of the coupling constant: the evolution of an event will follow to the discrete dynamic transformations of local function ( $\Delta f/f_1$ ) such as ( $f_2/f_1 \cdot 1$ ). This operator has important features because the field theories involve the differences of the parameters, but not input values itself, such as electricity theory involves the difference of voltages but not voltages themselves.

This formulation does not lead to the confusing approach; it is like frequency of repeating of some action in relation to the previous ground instant, giving the product of time phase  $\Delta t/t_1$ . This function is the frequency domain product, which is different from the classic physic's frequency.

Now we have to apply this concept for space and time ingredients of the space-time unit. The mathematical unit "time phase" as a frequency domain describes the displacement from a specified reference point at the  $t=t_1$ . The time and space phases have a commutation through product of certain position in space within some interval of time ( $S_1 \Delta t$ ) and with interval of space at a moment of time ( $t_1 \Delta S$ ).

It is easy to show that the time domain in the form of time phase is equivalent and commutative to the space phase of an event and describes the relation of passage of time ( $\Delta t$ ) to some local instant state or an event local boundary, such as  $\Delta t/t_1$  where  $t_1$  is the local time boundary of an event. Similarly, we can present the space phase with the same way  $\Delta S/S_1$ , describing the change of space in relation to some starting local boundary of the event. On this basis, the event dynamics can be described by the shift in phase within space-time frame giving the event history equivalently in the form of direction of time or displacement of space phase. Therefore, the commuted phases may be equivalent through commutation of variables, mapped within their boundaries.

The new operator in the form ( $\Delta f/f_1$ ) describes change (vibration) of function around its origin with certain rhythm in the form of fluctuation density to repeat its origin. Similarly, the operator  $\Delta S/S_1$  describes fluctuation of change of space energy density around space origin while operator  $\Delta t/t_1$  describes fluctuation time of change around instant origin in the form of frequency.

The initial values of space and time in the form of  $S_1$  and  $t_1$  are the local dynamic boundary states: if the event within some region has ended,  $t_1$  transforms to the end  $t_2$ , but if the event is continued,  $t_2$  became a new initial state. On this basis, the local boundary is the mixture of past and future, which may have uniform and non-uniform states. Therefore, without correlation of initial and end states the action is not conserved. The non-unitary time domain  $\Delta t/t_1$  describes discrete time integer numbers of the non-continuum event. In the same way the  $\Delta S/S_1$  describes the non-continuum discrete changes of space phase with dynamic ( $i=1, 2, 3$ ) boundary conditions.

The space phase in the form of integer multiplication  $\Delta S/S_1$  involves the numbers of the "pieces" (grains) located in the space medium, while  $\Delta t/t_1$  describes the duration in relation to the instants corresponding to the change of position of these "pieces". It is easy to see that

relation of the space and time intervals to the dynamical local state presents the transformation of continuum intervals to the discrete integers of subintervals at points  $S_1$  and  $t_1$  forming definite canonical variables of the differentiation.

This approach leads to the binding of space and time phases to each other. The relation of space and time intervals to each other usually forms the classic velocity vector  $\Delta S/\Delta t$ . However, this derivative of uncertain intervals represents the singularity at boundary conditions. The infinity in this case arises due to the absence of the commutation of the change with the local boundary of the  $S(t)$  function.

Interaction of time  $[t_1, \Delta t/t_1, \Delta t]$  and space phase  $[S_1, \Delta S/S_1, \Delta S]$  matrices leads to the formation of space-time field. Field as the correlation of the end of the phase with the initial boundary eliminates the infinity due to the conjugated displacements in space  $t_1 \Delta S$  and time  $S_1 \Delta t$ . On this basis an event can be described through change of the action energy applied to the space-time field instead change of position or coordinates of the system. The  $\Delta S/S_1$  shows distribution of energy in space: when  $S_1$  is small the space gets the same property within all regions of the field while at high scale, the space field is non-invariant.

By relativity, the space-time frame is curved due to the presence of energy and mass in it. But by our concept space-time field is the resulting inner product of action of the energetic field  $[E_{act}, \Delta E/E_s, E_s]$ , formed from exchange interaction of action and event's energies:

In accordance with the Lagrangian mechanics, "an object subjected to external influence will choose a path which makes the action minimum". By our concept, this phenomenon is due to the discrete exchange of the action with the response force of the system's field, which forms the action – response non-invariance parity of the interaction. The effect of action of the applied force to the space-time field of a body can be formulated in the form of exchange of energetic fields- $(E_{act} - E_s)/E_s$  :

$$\frac{\frac{\Delta S}{S_1}}{\frac{\Delta t}{t_1}} = \left( \frac{E_{act}}{E_s} - \frac{E_s}{E_s} \right) = \frac{(E_{act} - E_s)}{E_s} \quad (5)$$

$$\frac{\Delta S}{\Delta t} = \frac{S_1}{t_1} \cdot \frac{(E_{act} - E_s)}{E_s} \quad (6)$$

where,  $S_1$  and  $t_1$  are the space and time variables corresponding to the dynamic local boundary,  $E_{act}$  and  $E_s$  are the energies of action and under action systems of interaction at conditions corresponding to the local boundaries of  $S_1$  and  $t_1$ . The interval of time  $\Delta t$  describes the duration of coupling of the event with the action, while  $t_1$  presents the dynamic time instant or time boundary of correlation with the action. In the same way, the interval of space  $\Delta S$  describes the expansion, while  $S_1$  presents the local boundary of space of an event at the instant. The quantity of energy, available for change (scattered energy) and the quantity, determining the response (consumed energy-momentum) have different signs (5) therefore, leads to the generation of direction and causality between local past and local future.

The equation (6), which we generated has based on the space-time consists of energy. Model (6) although is very simple description of event dynamics but it allows to give a new look to the interaction, localized within triangle matrix of space-time-energy boundaries. In accordance with the model (6), the change is the “tree body action” of the space-time-energy operators: space derivative of energy produces momentum, time derivative conservation of identity is the energy and the product of energy derivative in conjugated space-time phases is an event. The product of energy–time multiplication is the identity of an event, localized in the observed space.

As can be seen, the change of a system’s state is the result of interaction of two space-time frames, which presents the change of one field in relation to the action “field”. Model (6) treats the matter field with space phase and antimatter with time phase. The time phase describes the change of event instants over time duration, but frequency domain shows how much of the time instants lie within each given frequency.

Model (6) may be re-written in the form:

$$\frac{\Delta S}{\Delta t} = \frac{S_1}{t_1} \cdot \left( \frac{E_{act}}{E_s} - 1 \right) \quad (7)$$

$$\lambda = \left( \frac{E_{act}}{E_s} - 1 \right) \quad (8)$$

In the classic formulation the change of the space-time frame  $\Delta S/\Delta t$  cannot be the precise Eigen state of the dynamical event but in the model (6) it gives the precise Eigen state of identity due to its conjugation with the Eigenvector of dynamical local position  $S_1/t_1$  and with the exchange energy of the space-time variables ( $E_{act}/E_s \cdot 1$ ). The reflection function ( $E_{act}/E_s \cdot 1$ ) became the Eigen value of the  $\Delta S/\Delta t$ , which covers all the values of correlation of space-time variables. The  $E_{act}/E_s$  describes the density of energy, distributed in time phase as an action of force, while  $E_s$  has a relation to the density of energy distributed in space phase in the form of matter. Therefore,  $\Delta S/\Delta t$ , conjugated with the dynamical local position  $S_1/t_1$  in the form of speed, became the function of state holding conservation of energy within space-time phases. On this basis, the model (6) became the equation of state. The equation of state (6) in its basic form (7) gives the numbers due to the resulting non-unity of the parameters.

Model (4) shows that particles do not have the fixed position during action and measurement, but they possess the change of space phase by coupling with the action energy. In this case, the measurement of the position is the measurement of the velocity and impossibility of the measurements of these parameters in different order is not the subject of uncertainty in nature.

The minimum portion of energy, which by quantum physics called “quanta”, is the elementary space-time “field”. The energy in similar way also is “quantized” within space-time field. The total energy is conserved discretely; it comes in discrete amounts, localized within space-time phases. The energy is the inner product of coupling of space and time fields and exists in the form of resulting Eigen value.

Model (6) shows that the space-time phases in the form of two different inner products of action–response parity display the frequency of energy consumption/restoration cycles. When there is no energy ( $E_{\text{act}}=0$ ) the coupling of virtual space and time phases generates energy, then the generated energy produces the non-virtual space-time frame of identity which conserves the produced energy within momentum. On this basis, time is the product and measure of the consumption of energy. The different frequency of energy consumption for different events leads to the separation of the non-continuum periodic events by real numbers forming the “Time phenomenon”. Time takes its origin only from discrete energy conservation cycle and due to the relation to the initial state, cannot be described only by intervals. Time is the “proper time” only in connection with the Eigen value (proper value). The notion that “time slows down by distance” is the correlation of variables and this correlation is the result of discrete energy conservation.

The interaction of action and response is affected by the initial action in the form of relations of the action  $(E_{\text{act}} - E_s)/E_{\text{act}}$  and response  $E_s/E_{\text{act}}$  strengths, but the outcome is determined by the advanced response given by the mathematical structure of Eigen value, which regulates energy distribution within space-time frame.

In accordance with the model (6), time appears as the personal product of exchange interaction of action-response parity and is the quantity, which holds discrete energy conservation within this parity. Therefore, relation of time to the external system of reference having no energetic parity with the system does not make sense for description of the event dynamics. On this basis, if an observer does not apply the force for interaction with an event, it became the local “photographic plate” of an event. In accordance with the model (6), the instant of time is the dynamic phenomenon and when energy is applied it produces the response in the form of inertia to regulate the continuity of the event.

In accordance with our concept, the description of a “change” in magnitude and in direction is possible only through correlation of space-time canonical variables regulated by Eigen value ( $E_{\text{act}}/E_s \cdot 1$ ).

The classic mathematical tool of differentiation does not describe the boundary of function and the non-boundary concept of time presently is the common acceptable concept of physics. The differential operator in the absence of boundary function leads to the approximation of the action conservation due to the lost of the original function during production of the outcome of the operation.

In accordance with the model (6), when the velocity  $\Delta S/\Delta t$  commutes with the dynamical boundary of space-time it became the non-relativistic operator. The concept of velocity is to be tied to the space-time boundary while description of velocity without boundary leads to the “problem of different observers”. The boundary-mapped space-time eliminates the uncertainty in the continuity and the singularity of boundary conditions. This is the mathematical background of our model based on the new commutation concept.

The conditions  $\Delta S/\Delta t = S_i/t_i$ ,  $\lambda_{\pm 1}$  ( $E_{\text{act}} = 2E_s$ ) are similar to the mathematical principle of involution. The inversion of the action by the same coordinate line does not produce the same action. That is why action-response parity should involve one more dynamic intermediate state,



which leads to the three body interactions. The additional intermediate is the “second material observer” of ( $S_2, 2S_1$ ) interaction. On this basis the “color based strong interactions” is due to the “three sigma” color phases (colors), correlation of which in **1:2** coupling creates formation of three body interactions: the energy of two merged colors is balanced with the third color with formation of “color based elementary space-time unit”. The local state with the dynamic conjugation of two merged colors with the third color leaves Eigen value the same, leading to the conservation of energy and formation of constant interactions. In accordance with our concept, virtual particle appears when the duration of change is equal to the instant of generation.

By prediction of model (6), the action of a force is to change the state of an event, but response of system (negative sign) is appeared to make the action minimum and maintain the initial state of the event.

The action of the force gradually became minimum that is why the force to be needed to maintain the initial state of action. The inversion of an event in non-virtual space-time frame in spatial and time reversal manner cannot eliminate the asymmetry of the action-effect parity. The difference of action-effect quantities determines positive time direction and magnitude of a motion (momentum).

The action-response parity is the interaction of the two fields, which “shakes” each other with the selection of the direction to move: the Eigen value of the space-time structure determining momentum of the system became the degree of freedom of the resulting Eigenvector field.

By Feynmann analysis, Dirac showed that in quantum mechanics there is important quantity, similar to the differential equation, which carries the wave function from one time  $t$  to another, such as  $t+\epsilon$ ,  $t+2\epsilon$ ,  $t+3\epsilon$ . [7]. Feynman developed Dirac analysis and succeeded in representing quantum mechanics directly by the Lagrangian action.

Giving characterization of his research Feynman showed “that the important issue in his development of the space-time views of quantum electrodynamics is that he connected the Lagrangian with the quantum mechanics. But Lagrangian for strong interactions still needs renormalization”. The problem of Feynman’s Lagrangian is the non-conservation of the action. Our concept of gradually advanced response is opposite to the Feynman action and Weyl concepts where has been used the advanced action wave which violates principles of causality. The advanced response as the resulting quantity is the “hidden correlation” of space-time variables to realize discrete energy conservation.

In accordance with the model (6), space-time without coupling with the discrete energy, conservation law can give only uncertain position. This feature of space-time explains why string theory suggests additional dimensions to describe a position. The extra dimension in reality is the correlation of space-time variables with the coupling energy, which through coupling with the Eigen value rotates the space-time vectors in the form of curled up dimensions. Particle without coupling is not observable and has negative existence.

Model (6) connects position-momentum and time-energy relation and shows that these relations within space-time boundary frame cannot be subject of uncertainty because position

as a spatial variable does not have existence, independent of time. Model (6) involves the commutation of first order derivatives of space and time variables from each other.

#### 4.2. The action-effect parity of the “Change” phenomenon

By prediction of the model (6), the action of a force is to change the state of an event, but response of system (negative sign) is appeared to make the action minimum and maintain the initial state of the event. From model (6) also follows that the system, applying the energy ( $E_{\text{act}}$ ) is the origin of the causal effect.

The action of the force gradually became minimum that is why the force to be needed to maintain the initial state of action. The inversion of an event in non-virtual space-time frame in spatial and time reversal manner cannot eliminate the asymmetry of the action-effect parity. The difference of action-effect quantities determines positive time direction and magnitude of a motion (momentum).

The action-response parity is the interaction of the two fields, which “shakes” each other with the selection of the direction to move: the Eigen value of the space-time structure determining momentum of the system became the degree of freedom of the resulting Eigenvector field.

With the discrete energy conservation, the forward action decreases by one while backward response increases by one (7). The advanced response force regulates conservation of energy, mapped within space-time frame. If the response (axial vector) does not change it can not limit the action. This is the non-Lagrangian least action, produced as the resulting exchange quantity.

In accordance with the model (6), the space-time frame without coupling with the discrete energy conservation can give only uncertain position. This feature of space-time explains why string theory suggests additional dimensions to describe position. The extra dimension in reality is the correlation of space-time variables with the coupling energy, which through coupling with the Eigen value rotates the space-time vectors in the form of curled up dimensions. Particle without coupling is not observable and has negative existence (6).

The Heisenberg’s uncertainty and relativistic reference frame will have the same nature, if relativity’s observer has an energetic interaction with an event. The observers of both theories during the measurement will have variable action (variation of consumed energy), therefore Einstein’s and Heisenberg’s observer’s measurements are not invariant and affected by an “external force of a body under measurement”. On this basis, it is obvious that the Heisenberg’s and Einstein’s observers cannot measure the fixed static position.

The Heisenberg’s discovery on non-commutation between velocity and position is due to the problem of classic differentiation, which produces non-conservation of local velocity. Position is the integral product while the velocity is the differential outcome therefore these parameters are not commutative and are origin of the non-invariance of the action-response parity ( $\lambda$ ). The action-response parity generates discrete energy distribution, which is only the way to eliminate infinity from space-time frame.

In the case of Heisenberg's thought experiment the measurement is an application of energy  $E_{act}$  to change the position for getting the information. In accordance with the model (6), the action energy portion cannot be less than energy ( $E_s$ ) of the elementary space-time unit of the light. The space dimension in this case is related to the distance between the wave crests of space and time phases of the light photon. The difference of the phases cannot be smaller than wavelength of the light waves. This is the limit of phase difference of classic space-time frame, which has been called Planck's scale.

On this basis, we can unify Einstein's observers and Heisenberg's measurement. If the observers do not have energetic correlation with the event, they are distant "photographic plates" but if correlate with the event with the same Eigen value, they are invariant observers. Therefore, the Eigen value (the numbers of the scattered energy portions) "is the reference frame which determines the invariance": time is relative to an observer if the observer affects the Eigen value of an event. The Eigen value determines the intrinsic property of a system in the form of identity.

This principle of simultaneity explains Copenhagen interpretations, which states that the outcome of an experiment is only revealed when the quantum system interacts with a macroscopic apparatus of measurement resulting only one outcome.

The measurement changes the energy  $E_{act}$ , applied to the system and correlated with the space-time framework (6). In accordance with the model (6), you cannot measure the parameters at their fixed states, which have no independent existence. The entanglement concept of quantum mechanics may be explained also based on these principles. You cannot measure one parameter determined by space-time, fixing another one because there is no independent existence of the parameters, correlated within space-time boundary. In the absence of measurement, the system has its own deterministic space-time frame, regardless how "quantum physics and relativity observers will observe an event on their photographic plate".

By quantum mechanics, the action is "quantized", but by our concept, the quantization is the energetic discreteness of the classic action and existence of reality by action-response parity. Conservation laws, mapped within Lagrangian framework of classic mechanics results only approximate conservation due to the non-invariance of the action. The invariance requires constant energy supply, which is not possible in continuous mode therefore the underlying mechanism of reality is the non-linearity of the physical events, realized through non-invariance action-response parity and discrete energy conservation.

## 5. The Non-Noether's concept of symmetry and energy conservation law

In accordance with the model (6), the classic principle "the total energy of a dynamical system involving kinetic and potential energies is conserved" can be the true concept only if the system's dynamical coupling with the action is conserved. The statement that "the energy is not created and not destroyed, but transforms from one form to another in self-sufficient system" should lead to the non-invariant energy transformation, disappearance of action and

momentum. By this principle the action, kinetic and potential energies individually are not conserved and even cannot be conserved.

In our concept, we replaced Hamiltonian static sum of energy by the dynamic scattering energy where total energy, distributed within two systems, presents interaction term. The interaction term of Schrödinger equation is linear while the Eigen value of model (6), correlated with the change of local dynamic space-time boundary, determines the proper states instead of Schrödinger's probability.

Model (6) shows that the problem of Hamiltonian in canonical coordinate's transformation is directly related to the principles of energy-momentum conservation. Hamiltonian operator of total energy involves independence existence of kinetic and potential energies but in discrete energy conservation, concept energy has no independent existence. The expression of resulting energy of the system through simple gradient of kinetic and potential energies may produce only continuous displacement therefore leads to the observed problem of Hamiltonian conservation. Hamiltonian sum of energy describes the state of a system as an independence existence but in accordance with the discrete energy conservation concept, the identity cannot be described by its own existence.

The question is why we need discrete energy conservation law is very important which determines all the features of the new physics. The static continuous energy conservation described by Noether's theorem does not limit the boundary of the conserved quantity, therefore leads to the singularity.

By complementary principle of quantum mechanics, "the classical concepts such as space time location and energy-momentum can not be combined into a single picture. One classical concept excludes the simultaneous application of other classic concept. The uncertainty suggests that this reciprocal limitation is due to the uncertainty and uncontrollable exchange of momentum of a particle with the space-time frame of the object where a particle is located".

In accordance with the discrete energy conservation concept, momentum in the form of two reciprocal parameters appears for generation of the space phase of energy conservation. Conservation of energy in the space phase generates a "mass of space", as transformation of energy to mass, to generate the opposite time phase of energy conservation.

In accordance with the model (6), energy as an identity can be conserved only discretely and discreteness is realized with the alternation of the two opposite appearance –disappearance phases: energy disappears in space phase and appears in time phase. When energy is conserved in space phase, it leads to the appearance of mass. Therefore, the "mass" phenomenon is the property of the energy conservation but not the property of a body "affected by a force".

In accordance with the quantum mechanics, forces are manifestations of exchange of discrete amounts of energy. Without locality in space, exchange of energy quanta is not possible. That is why quantum physics concept that "any field of force manifests itself in the form of discrete particles" may be realized only in the presence of space medium, which display discrete existence.

From model (6), we can get Newton's first principle:  $E_{act}=0$  describes the body, which is not affected by any force and localized in the inertial frame. This is the initial state where events move with the uniform motion. Therefore,  $E_{act}$  is the generator of space-time frame, which appears discretely. The state of appearance of  $E_{act}$  is the Planck scale where difference between space and time disappears. Energy is the generator of space-time and energy quanta itself is the space-time cell.

Space-time unit cannot exist alone and has to be interacted with the event where  $s_1/t_1$  is the elementary cell of the space-time frame,  $(E_{act} - E_s)/E_s$  is the event. If there is no action energy  $E_{act}=0$ , everything is going to the initial cell  $s_1/t_1$ . In this case, the initial state and change have different sign and initial state became resources of inertia. In the absence of the action energy, the structure of the space-time changes: correlation of space and time variables  $t_1 \Delta S = S_1 \Delta t$  disappears which lead to the separation of  $t_1$  from  $\Delta S$ . Change of space-time frame is associated with the change of energy-matter structure of an event. This leads to the separation of electron-positron and neutrino-antineutrino pairs and formation of  $e^-/e^+$  and  $\nu^-/\nu^+$  pairs. The  $e^-/e^+$  and  $\nu^-/\nu^+$  pairs form the pre-existing form of matter. The matter is composed from a fundamental cell of space-time frame, presented in the form of minimum  $S_1/t_1$  cell.

## 6. Analysis of quantum mechanics based on discrete conservation of energy

By quantum mechanics, the vacuum energy is to be the virtual particles, which as vacuum fluctuations are created out of the vacuum. This concept does not explain what the nature of lowest vacuum energy is. The important question is why during removal of matter from the vacuum it does not reverses the energy back to the background state.

Quantum mechanics describes energy of empty vacuum in the form of virtual particles giving little push to the start of the universe, which can continue acceleration. The problem is that the calculations of quantum field theories predict  $10^{120}$  times more quantum vacuum energy than that of any possible value.

By quantum mechanics, vacuum cannot have zero energy because of uncertainty principle, which can be violated: the zero energy value is certain. Uncertainty does not describe how the lower energy state may have high zero point energy state.

In accordance with our concept, the zero point energy means that the total energy of space-time is zero ( $E_{act}=0$ ) but this energy is accumulated within asymmetric space-time boundaries. The total energy is distributed within different phases, which are in asymmetric state of opposite boundaries. Vacuum and black hole are two asymmetric boundaries of space-time variables. The theories of quantum physics suggest that due to the uncertainty principle, quantum field cannot have zero value, therefore became the origin of vacuum fluctuations. In accordance with our concept the vacuum and "quantum fluctuations" is due to the discrete conservation of energy within asymmetric space-time phases. At small scale of space, the frequency of fluctuations is generated by time phase and is high while at high space scale the giant size of fluctuations is created by the energy consumed in space phase.



In accordance with our model (6), creation of a particle is the result of discrete conservation of energy, which appears within space and time “fields”. Conservation of energy is not static, therefore mass also is not static and changes with the expansion of space. This feature of mass is the necessary factor for conservation of energy; with the constant mass, energy cannot be conserved. On this basis, vacuum is the asymmetry of space-time boundaries, therefore light cannot exist in vacuum with the constant static speed. Vacuum appears when the energy of the background state is removed for expansion of space. When energy is completely consumed in space, time returns it back to the initial state by negative gravitational force. That is why we replaced the spatial and time coordinates by space and time phases having performance of the energetic fields.

By quantum field theory, vacuum has properties as a particle and these properties cancel out on average, leaving the vacuum empty. By our concept vacuum is the asymmetric boundary of space-time where space identity is very small which is connected with the high amount of time particles –antiparticles.

The classic physics relates local symmetry to the Lorentz invariant quantity, which is connected with the helicity phenomenon, describing the projection of a spin of a particle in the direction of momentum. In the case of discrete energy concept, local invariant inversions are not allowed.

Discrete conservation of energy in space –time phases cannot be realized without boundary of these phases which constrains the expansion of space through left handed neutrino (involved in  $E_s$ ) and right handed anti-neutrinos (involved to  $E_{act}$ ). That is why the right handed neutrino and left handed antineutrino never was observed.

In accordance with the Newton’s physics, mass is the inertial rest energy of a particle and the measure of the resistant to the applied force ( $a=F/m$ ). By special relativity, a massless particle cannot exist at rest it must always move at speed of light. Quantum mechanics suggests that a “massive fermions should have both right and left hand states because field operators that yield a non zero mass for fermions are bilinear products of fields that flip the particles handedness”.

In accordance with the discrete energy conservation, the quantum mechanic’s mass operator, which annihilates left handed neutrino and creates right handed antineutrino can not be described by the sum of doublet due to the continuous nature of this interaction. Therefore, the mass term that changes a particle into antiparticle, which in quantum mechanics called as Majorana mass term, has to be described by discrete term, such as  $(E_{act}/E_s-1)$ . The sign in this formula changes (such as quantum mechanic’s fermions’ number, which changes from  $n=-1$  to  $n=+1$ ) right-handed particles to the left handed.

The uncertainty of a position and the future motion of a particle can be accepted classically obvious, because position is not a static quantity. It is known that measurement of the particle position involves the scattering of light, which can give only probabilistic exchange of energy and cannot be described by known classic physics. Quantum mechanics explains, “If scattering energy is not uniform the measurement devices has no possibility to measure the position and momentum”.

The problem is we cannot measure position with instant of time only and measurement should involve instant of time and its change in the form of time phase  $\Delta t/t_1$ . In accordance with the model (6), the change of time in relation to the instant may describe the change of a position and velocity. The change of time phase has no independent existence and its changes in correlation with the change of space phase. That is why measurement of the space and time as the independent coordinates leads to the uncertainty. Therefore, the mathematics of the description of the position and velocity should involve them not as an independent coordinates but correlated phases.

Therefore, the statement that classic concept does not fit at the quantum level is not true. If time will involve two parameters as an instant and duration, the ratio of this parameters may describe any level of an event: at small scale the duration is small and instant has high frequency while at high scale instant is small duration of an even is long. At “quantum level”, the high frequency instants are not quantum jumps and they are discrete phases, appearing in space phase and disappearing in time phases. The alternation of these phases and exchange of energy between these phases can not be described by probabilistic energy distribution, because discrete exchange of energy is very causal deterministic process.

Heisenberg uncertainty implies that “any two variables that do not commute can not be measured simultaneously”. It is possible to give classic explanation to this phenomenon. Two variables that have no independent existence cannot be measured simultaneously. The position and velocity have no independent existence similarly as change of energy is not independent of time. Therefore, uncertainty of quantum mechanics is the non-conservation of energy in the formulations of classic physics. That is why “uncertainty of non-commuted variables” is the uncertainty in conservation of energy in the farme of classic physics.

The question is how to describe displacement of space boundary within certain time interval or displacement of time boundary within certain space boundary. On this basis, the main concept of quantum mechanics is the “quantization” of space-space period.

In accordance of our concept, quantization of space-time frame is the classic phenomenon and it is related to the discrete conservation of energy, mapped within two opposite phases. “Quantization” of space-time frame requires correlation of space-time variables, appearing as a field, realizing the dynamic state of energy conservation. Model (6) shows that connection of space and time together in one unit, is the quantization of space-time, which puts limitation to the boundary of space-time. However, for connection of space and time in space-time unit, free coordinates cannot present these variables.

The non-independent change of space-time variables leads to the displacement of space and time phases by the alternation, which generates a wave function carrying the portions of conserved energy in different phases.

In the case of discrete conservation of energy, the particle-antiparticle annihilation is not a symmetric event and cannot be described by symmetric model. Therefore, the symmetric model leads to the continuous energy conservation which results “Ultraviolet Catastrophic” phenomenon of the background energy. Due to this problem, renormalization is an open question in the quantum field theory where the total energy becomes infinite.

By quantum mechanics, the zero point energy is the “lowest” quantized energy level of a quantum mechanical system. The zero point energy is “the energy which remains when all the energy is removed from a system”. The common opinion is that the origin of the zero point energy is the uncertainty principle. By quantum physics a quantum fluctuations is the temporary change for energy in a point in space, arising from Heisenberg’s uncertainty principle, “such as temporary change of amount of energy in a point in space without certain time”. The uncertainty accepts that conservation of energy can be violated but for small times. In accordance with the energy-time uncertainty, with the decrease of time, violation of energy conservation increases. Therefore, the uncertainty principle allows existence of a virtual particle with the borrowed energy, but the sources of the borrowed energy are not clear.

Quantum mechanics suggests that pair production appears as a pop into existence and then annihilation each other. On this basis there is suggestion that [8] energy in classic physics is conserved properly but in the quantum micro world energy can appear and disappear in a spontaneous fashion. The uncertainty principle implies that particles came into existence for short periods even when there is not enough energy to create them. They borrow energy for a short time and then they return and disappear again. In vacuum, pair of virtual particles is constantly being created and destroyed. The energy of matter is positive which appears spontaneously out of empty space while the energy of anti matter is negative. The matter made of positive energy and matter particles has attracting gravitational energy, which is negative. The total energy is zero. By quantum mechanics, fluctuations are random and have no causal nature.

Quantum theory of the vacuum suggests that the zero state of vacuum energy is negative. Based on expansion of the space it concludes that vacuum ground state has non-zero energy. The vacuum energy, described by quantum field theory without renormalization is mathematically infinite.

It can be thought that discrete energy conservation is obvious concept due to the discrete dynamics of quantum mechanics and discrete energy radiation. But the question is how to describe the discrete energy conservation in mathematical formulation. In accordance with our model (6), without correlation of space-time variables, it is impossible to describe discrete conservation of energy. With the frame of discrete energy conservation, it is impossible to describe spatial or temporal inversion without boundary space-time framework. In accordance with the discrete energy conservation, the space-time dynamics appears as the particle-antiparticle pair, which carries a conserved quantity of energy within these phases.

Quantum mechanic’s theories suggest that zero point energy has positive sign for bosons and negative for fermions, which cancel each other for perfect symmetry. The model (6) describes the energy of bosons and fermions with the similar way but shows that they cancel each other at  $E_{act}=2E_s$ .

For uniform speed of light, the change of space ( $\Delta S$ ) and time ( $\Delta t$ ) have to be correlated, generating invariance of these intervals from the boundary of space-time frame and uniform change of these variables. The energy of light at uniform speed should follow the Noether’s

theorem of symmetry. It is known that Maxwell equation is not independent from the property of distance and the speed of light is a function of properties of space. Model (6) shows that property of space ( $\Delta S$ ) and time ( $\Delta t$ ) intervals changes with the change of boundary of these variables.

In accordance with the quantum mechanics when matter and antimatter collide, they annihilate in a flash of energy. In accordance with our model, the energy, produced during interaction of asymmetric space-time phases has to be conserved in space phase to form “particle” which disappears in the opposite time phase, forming “virtual particles”. The observance of these particles depends from frequency of the discrete energy conservation.

## 7. The singularity problem of relativity and uncertainty of the quantum measurements

Due to the lost of the initial boundary frame, all space-time models break down at the singularity. To eliminate the singularity, the space-time should have internal constraint holding the dynamics at boundary, because the initial position is not an independent free coordinate. The initial state of minimum space-time identity is the internal constraint of the space-time, which determines how to go from contraction phase to the expansion phase without singularity. General relativity has fused discrete space-time frame to the continuous “geometrical manifold” which with the decrease of space has to move to the infinite space-time curvature. The space-time frame by this concept has no internal constraint therefore has to move to the singularity and the initial state of universe should start from a single point having infinite density. This is the unproved conjecture of general relativity.

At continuous energy conservation, an event with any size has a trend to move to the equilibrium: to remove a system from the equilibrium one additional parameter is needed which can be the application of an external energy. With the continuous energy conservation law a system, consuming any amount of external energy has to move to the equilibrium of “infinite black hole”.

The asymmetry of space-time boundaries is the fundamental basis for discrete existence of universe. In some theories, dynamical space-time has been discussed but there was not shown that this dynamics is due to the asymmetry of boundaries. The discrete coupling constant  $E_{act}$  (magnitude is finite) is the boundary constraint of space-time which at  $E_{act}=0$  is different from Einstein’s  $R_{ab}=0$  constraint of empty space. The discrete conservation of matter and energy within discrete space-time frame gives a non-geometrical status to the space –time phenomenon.

In accordance with the model (6), inverse transformation appears when all the energy of space-time is consumed by space (“black hole phase”) and all the events have the same dynamic characteristics of “free fall “to the state of energy generation”.

## 8. Particle physics based on discrete energy conservation

Presently why the particles acquire the mass is not known. The mass –energy relation which first time has been introduced by Einstein in the form  $m=E/c^2$  does not describe mechanism of mass generation. The problem of this formulation is invariance of mass-energy relation, fixed by speed of light.

As follows from the model (6), conservation of mass cannot be separated from the discrete energy/momentum conservation. Therefore, in discrete conservation of energy there is no invariant rest mass, mapped within discrete space-time frame. The problem of mass appears with the Newton's force. Newtonian law does not explain the origin of force that is why the nature of mass remains unanswered. Newton's invariant mass during change of velocity leads to the approximate energy conservation. If force is needed to change the velocity, then Newtonian inertia appears to describe the magnitude of change in the form of mass. If the action of force, as is shown in (6), is needed to hold the initial state of a body then it is needed to hold the existence of matter in space-time frame in the form of mass. The problem of Newtonian law is that mass, which is invariant during velocity differentiation but affects to the acceleration.

In accordance with the model (6), the entity called mass is the resulting quantity, generated from discrete energy conservation. This feature seems makes it as the "electromagnetic mass". With cyclic discrete energy conservation there is no any preferred reference frame, which could display inertial or relativistic mass. The non-virtual matter particle is created simultaneously with the generation of non-virtual space-time frame: mass is the part of energy to be conserved in space phase: the dense space phase, formed through change of frequency of correlation of space-time variables leads to the generation of different masses responsible for different particles. The density of space phase is determined by the Eigen value (6), therefore mass is not constant, it changes with the change of frequency. Due to this phenomenon electron has no constant mass, it transforms to other families as it moves through space.

Discrete energy conservation mapped within discrete space-time phases has two consecutive steps: a) re-alignment of minimum space phase, "b) accumulation of mass in space phase.

Discrete energy conservation eliminates the infinity of the energy, produced during contraction of space phase to minimum size (6) through re-alignment and coupling with the time phase. The time reversal asymmetry of space-time boundaries arises from discrete energy conservation where forward and backward directions have different initial energetic conditions. Fraction of time is needed to complete a full cycle when the minimum portion of the space phase passes through inversion frame from negative to the positive direction. The time reversal transformation of matter/antimatter particles can be described as follows:

$$\gamma/\gamma = - (e^+ / e^- + v_e / v_e^-) \quad (9)$$

Formation of two pairs of particles from one pair (9) is due to the "three body" identity conservation, described by condition (9). The equation (9) describes total spin symmetry of



matter-antimatter interactions. The spin of right-handed photons is equal to the sum of the two half spins of left-handed particles which hold conservation of energy, charge and momentum. The super partner of gamma rays is two pair of (four) fermions (9) which generates re-alignment of the particles in space-time reversal cycles. The ingredients of the equation (9) form the triplet spectrum generating re-alignment of light and dark photons on intermediate  $e^+/e^-$  frame.

As can be seen, without composite photon it is impossible to describe generation of mass. When neutrinos interact with the charged particles, fermions are generated but when they interact with each other "gamma ray bosons" are formed. The three families of particles participate in generations of right side "pseudo-bosons" and left side composite photons.

The mechanism of equation (9) is in agreement with the results of Stefano Profumo[9], who found that electron, reacting with the surrounding dark matter could fuse into a heavy version of electron and when it returns to the initial state radiates gamma rays.

It is necessary to note that the quantum mechanics concept of transformation between photons and  $e^+/e^-$  does not preserve energy conservation due to the non-locality of energy transformation. Light quanta do not have independent existence and cannot hold fixed amount of energy without space-time structure.

In accordance with the scheme (9), discrete inversion between light photons and neutrinos (dark photons) is to be realized through electron/positron pair playing a role of "intermediate mixing space-time frame of matter-antimatter pairs" which leads to the generation of charges. On this basis, it is clear why matter-carrying ingredient of Eigen value is negatively charged. In accordance with the scheme (9), merging and co-vibration of light and dark (neutrino) photons in mixed frame produces charges  $e^-/e^+$ . On this basis, photons and  $e^-/e^+$  pair show behavior in a similar fashion being origin of each other and light photons have no motion without alignment of electrons with the neutrinos. The inversion model (9) of the matter/antimatter transformation is different from Dirac vacuum, containing only electron/positron "see".

The scheme (9) involving inversion operations describe charge and spin conservations. In accordance with the equation (9), electrons are the light photons, localized in the virtual space-time frame that is why all electrons have the same charge. When a particle form non-virtual space-time frame it became a different particle.

In accordance with the condition (9), photon has a virtual leptonic structure and the same time the pair of leptons  $e^-/e^+ + \nu_e / \bar{\nu}_e$  has a performance of virtual bosons (called Nambu Goldstone bosons). The sum of  $e^-/e^+ + \nu_e / \bar{\nu}_e$  (9) in the form of four fermions describes the "fermionic quanta". Due to the discrete energy conservation, the amount of "bosons", distributed in space-time condensate is not unlimited and the condensate should radiate photons, similar to the "black hole" radiation of space energy.

When  $E_s$  increases, it absorbs more gamma rays and leads to the formation of "black hole structure" which cannot settle to the stationary state. From model (6) follows that at  $E_{act}=0$  "black hole" has to radiate its energy back to the minimum space state. The radiation of black

hole energy happens with transformation of  $e^+/\nu_e + e^-/\nu_e$  to the longitudinal wave of neutral ingredients  $\nu_e/\nu_e + e^+/e^-$ .

From model (6) and scheme (9) follows, that removal of last portion of matter from vacuum needs more energy than background state. Therefore, the boundary space-time unit participates in the coordinate inversion and grows of particles, which leads to the expansion of space.

In discrete energy conservation concept the initial and end states are vector fields. Absorption of photons by  $e^-/e^+ + \nu_e/\nu_e$  pairs leads to the transition of “bosonic” structure to the frame of  $e^-/\nu_e + e^+/\nu_e$  virtual quarks with transformation of photons to “gluons” existing in the form of meson field (pions). We suggest that the phenomenon called “spontaneous symmetry breaking” is the change of space-time structure with transition of energy within asymmetric space-time boundaries while symmetry is the derivative of energy conservation. The consumed energy is not equivalent to the scattered energy, which leads to the asymmetric space-time boundaries. The space phase (virtual fermions) is less symmetric than time phase, therefore energy conservation has handiness in direction of energy consumption and the consumption of energy is accelerated.

The interference of space-time phases at background state (9) is not linear and coupling of the matter-anti matter particles forms intermediate loop boundary of mixed matter-anti matter frame: electron is produced from neutrino side while positron is generated from photonic side. Spin of the matter-antimatter loop to the minimum size leads to the re-alignment of the phases with generation of  $e^-/\nu_e + e^+/\nu_e$  quark/antiquark structure. Due to the different spin for bosons and fermions, the alignment is directed to the matter side with the shift of handiness from the left to the right (consumption of energy in space phase). This is the origin why matter spin has to be twice less than bosons. Therefore, the asymmetry in spin and in the boundary of space-time variables is the origin of the matter of universe. The transformation from spin one to half spin has to lead to the energy loss but this energy is accumulated in the pion and kaon fields.

Leptons are products of virtual space-time while baryons are location of quarks in the non-virtual space-time frame, which makes radiation of matter and energy non-invariant. The quantum theories treat right and left-handed particles symmetrically which leads to the invariance of Lagrangian action. This is the problem all of physical theories. Background state (9) connects all conservation laws except asymmetry of space-time boundaries. The general principle of super symmetry and action invariance can be realized when the change of the energy of bosons, relative to its initial state, is equal to the change of the energy of under action fermions relative to the applied energy. In this case, the laws can remain the same for both systems.

Quantum mechanics considers that empty space is a dynamic medium, which is full of virtual particles where “lowest energy state of the system is not zero and an isolated particles traveling in empty space interacts with the vacuum and produces virtual particles/antiparticles pair, coming from the vacuum itself. The original particle then reappears when the particle and antiparticle meet and annihilate each other”. Uncertainty principle suggests that particle/antiparticle pair live on borrowed energy within short time therefore violation of energy conservation takes place only in a short time. The question, which has to be answered here, is

the nature and origin of the borrowed energy. The unanswered question of quantum physics is how to describe energy of empty space if contains any kind of energy.

In accordance with the model (6), the space-time can exist only through interaction with other space-time field. The baryonic space-time structure of matter exists in interaction with the non-baryonic matter field forming leptonic matter. Light photons move through sea of  $e^-/v \dots e^+/v$  waves with constant speed and expand this boundary through generation of new portions of dark energy. When it expands the boundary of space,  $(e^-/v \dots e^+/v)$  it leads to the formation of red shift.

The existence of neutrinos in three flavors requires the existence of light photons also in three flavors similar to the equation (9):

$$G/G = - (\mu^+ / \mu^- + \nu_\mu / \nu_\mu^-) \quad (10)$$

$$Z/Z = - (\tau^+ / \tau^- + \nu_\tau / \nu_\tau^-) \quad (11)$$

The **Y**, **G** and **Z** describe different flavors of photons having different frequency. At this state, the energy is not dispersive (Eigen value is minus one) and the virtual photon particles are indistinguishable.

Based on scheme (9-11) we may extend our analysis on the wave –particle duality of the light. Light is wave, but presently it is not known how it is waving. In accordance with the special relativity light travels through vacuum with constant speed but this concept does not explain what medium has a vacuum, which carries the light with the constant speed. Maxwell equations also do not involve any medium to carry light waves.

Due to the discrete energy conservation, light travels in space-time phases through polarization of wave and particle properties. In accordance with the equations (6) and (7), light does not propagate without momentum which constraints propagation of light wave in space. The space-time frame and light energy radiation are symmetric in discrete mode. In accordance with the scheme (7-9), light has virtual quark's structure and does not travel in empty space.

Connection of discrete energy conservation with the boundary mapped space-time frame explains the mystery of "increase of mass with the velocity": increase of mass with the velocity was suggested by Einstein to hold constant speed of light. Discrete energy conservation and boundary mapped space-time concept describe this problem differently: light is the discrete identity, which produces its derivative space-time frame, and any observable identity is the interaction with this frame. Therefore, light does not exist independent of space-time frame.

In accordance with the discrete energy conservation concept, it is impossible to shift space-time phases of a particle having the same spin unit of its constituents. Spin is the result of energy conservation in different phases, which leads to the generation of direction.

At discrete conservation of energy, the background state of annihilation (9) does not lead to the divergence due to the conservation of finite amount of energy within asymmetric boundary

of space and time phases. The alignment of the ingredients of the scheme (9) is the polarization of neutral leptons to fermions. Coupling of  $\gamma/\gamma$  rays with the  $e^-/e^+ + \nu_e^-/\nu_e^+$  pairs leads to the alignment of scalar field to the vector bosons which conjugates left handed neutrino with the left handed electron and right handed antineutrino with the right handed positron with formation of  $e^-/\nu_e^-$  and  $e^+/\nu_e^+$  quark/anti quark pairs. The alignment of three  $e^-/\nu_e^-$  and  $e^+/\nu_e^+$  quark/anti quark pairs in 2:1 ( $\lambda=1$ ) mode leads to the non-integer electric charge carrying baryon's space-time structure. The energy of gamma rays in the form of "gluons" connects quark/anti quark pairs within meson field of pions. The electric charge keeps photon in the form of gluon, when charge is annihilated gluon also disappears. At decay process ( $E_{act}=0$ ), the energy of gluons is consumed for re-alignment of  $e^-/\nu_e^-$ , that is why electron in the resulting process appears with less energy. The continuous spectrum of beta decay is due to the absence of correlation which generates left handed helicity of neutrinos. In real world due to the discrete correlation with the applied energy, the anti neutrino has right handed helicity.

Coupling of ingredients of the equation (9) at boundary loop leads to the formation of dense space particle-top quark/anti quark pair which in accordance with the model (6) leads to the energy-matter interaction with generation of virtual ingredients of baryons ( $tt + e^-/e^+ + \nu_e^-/\nu_e^+ \rightarrow bb + uu$ ). This is the reason why top quark's mass is very close to the energy scale of alignment (symmetry breaking). Coupling of top quark with up quark takes place at  $\lambda=1$ . In this exchange interaction, the top quark is conjugated with its weak isospin partner of bottom quark. The boundary energy of top quark does not limit frequency of decay during its coupling with the up quark. Due to this function, top quark does not form baryon's space-time frame. In accordance with the scheme (9), without boundary space the alignment  $\gamma/\gamma \rightarrow W^-/W^+ \rightarrow TT$  is not possible. Generation in the mixing loop (9) gives to the electron mass more than neutrino where the absorbed neutrino became the space locality of the mass-carrying electron  $e^-/\nu_e^-$ .

Therefore, particles, which exchange energy, are bosons while particles exchanging momentum are fermions. With other definition particles carrying energy in time phase are bosons but conserving energy in space phase are fermions. The exchange of energy does not affect the wave function (Eigen state) while exchange of momentum changes the sign of the wave function. The phenomenon, which make light to move and generate discrete radiation is the discrete energy conservation within space and time phases.

## 9. Generation of quarks — Why the top quark does not form baryon?

The space-time frame (6) at  $E_{act}=0$  transforms to the virtual space-time frame which by radiation of matter contracts to the minimum space size :

$$\frac{dS}{dt} = \frac{S_1}{t_1(-E_s/E_s)} \quad (12)$$

At ( $E_{act}=0$ ,  $\lambda=-1$ ) re-alignment of matter ingredients leads to the radiation of mass, consumed in the space giving the same "Femi weak coupling constant  $G_v$ " of neutron and muon decay.

The “non-correlated” space matter decay (Kaon and other mesons) generates neutral current similar to the photons. The model (6) in this case explains why correlated electromagnetic interaction of proton with electron is stronger than the reverse weak force of neutron decay to proton and electron. The alignment of the fermionic super partners  $e^+/\nu_e + e^-/\nu_e$  to the bosonic super partners  $\nu_e/\nu_e + e^+/e^-$  leads to the formation of neutral current of decay

$$\gamma^* (\text{Gluons}) + e^+/\nu_e + e^-/\nu_e = -\gamma/\gamma + (e^+/e^-) + \nu_e/\nu_e \quad (13)$$

which correlates the helicity of elementary particles with the negative Eigen value.

In classic way, a matter is the quadratic product of the two fields and coupling of space and time phases gives the potential of the observable frame. This principle is similar to the quantum mechanics concept that the square modulus of wave function is associated with the probability of observing the object.

In quantum field theory, the energy of vacuum is zero, but formation of mass requires the positive sign of energy between the vacuum and the next lowest energy state.

The generation of energy as a quadratic product of coupling of opposite space-time vector fields can be described as follows

$$\left(\frac{dS}{S_1}\right)^2 = \left(-\frac{dt}{t_1}\right)^2 \quad (14)$$

The quadratic quantity of space phase describes the energy density in space while the quadratic quantity of time phase describes frequency of the change of this phase. Coupling of opposite charge carrying space-time vector fields is similar to the coupling of matter-antimatter particles (6):

$$(\gamma/\gamma)^2 = [-(e^+/e^- + \nu_e/\nu_e)]^2 \longleftrightarrow (\gamma^* + e^+/\nu_e + e^-/\nu_e)^2 \ll (t/t - \mathbf{b}\mathbf{b}^-) \quad (15)$$

Coupling of matter-antimatter particles of the equations (9) is similar to the scheme (13). Here arises very important question why background space-time coupling should leads to the generation of top-bottom quarks. The top-bottom quarks are similar to other quarks but due to the high energy, they decay fast and do not form non-virtual space-time structure of baryons. Therefore,  $t/t - \mathbf{b}\mathbf{b}^-$  interactions may exist within high frequency annihilations generating in time phase  $t/t$  particles and in space phase  $\mathbf{b}\mathbf{b}^-$  particles with the realization of  $t/t - \mathbf{b}\mathbf{b}^-$  meson structure. But energy-momentum frame in simple background  $t/t - \mathbf{b}\mathbf{b}^-$  transitions is not invariant, therefore coupling of this pair leads to the formation of another pair of quarks, for example  $u/u - \mathbf{d}\mathbf{d}^-$  interactions with exchange of vector bosons. The magnitude of the background energy (9) is fixed within boundary of space-time that is why top quark mass does not move to the infinity.



In accordance with the energy conservation (9), **d-u** transformation of quarks cannot be realized by simple emission of the **W<sup>-</sup>** bosons because in this case the energy is not conserved. Therefore, energy and identity conservations in quarks transformations have to be realized through coupling of **t-b** transformations with one side with **u-d**, from other side with **s-c** quarks where the total energy and momentum are discretely conserved:

$$\mathbf{tt}^{\bar{}} + \mathbf{uu}^{\bar{}} \rightarrow \mathbf{dd}^{\bar{}} + \mathbf{bb}^{\bar{}} \quad (16)$$

$$\mathbf{ss}^{\bar{}} + \mathbf{bb}^{\bar{}} \rightarrow \mathbf{tt}^{\bar{}} + \mathbf{cc}^{\bar{}} \quad (17)$$

$$\mathbf{dd}^{\bar{}} + \mathbf{cc}^{\bar{}} \rightarrow \mathbf{uu}^{\bar{}} + \mathbf{ss}^{\bar{}} \quad (18)$$

In accordance with the equation (9), the identity of a particle can be determined with the charged particles but electromagnetism is carried by neutral photons. On this basis the particle performance of baryon in space-time frame, is carried by charged particle that is why the electromagnetic force cannot hold alone the identity conservation of baryons.

During energy transfer (16-18), the bottom quark travels as a part of jet stream but then returns back to generate cycle as “the Feynman loop”. In accordance with the conditions (16-18), conservation of causality of action is realized with correlation of end and initial states through **[T-B]** bi-mesons **[(ss<sup>-</sup>bb<sup>-</sup>) – (tt<sup>-</sup>uu<sup>-</sup>)]** which regulates discrete exchange of energy within nucleons and background polarization state.

Top meson has to be created from anti top and up quark while anti top meson forms from top quark and anti up quark. **B** meson simultaneously is produced from b-anti quark (**b-bar**) and **d**-quark. Its antiparticle **B**-anti meson is formed from **b**-quark and anti **d**-anti quark. These transformations take place at  $(E_{\text{act}} - E_s)/E_s = 1$ . The discrete performance of two nuclear frames is the requirement of discrete identity conservation of nuclear within **uud-udd** and **ssc-ccs** nucleons coupled with the **t-b** transformations. The **ssc-ccs** play a role of isotopic nucleon.

The exchange of the two nucleons generates a field in direction  $\pi \rightarrow \text{Kaon} \rightarrow \mathbf{B}$  mesons, which decays back at  $E_{\text{act}} = 0$ . This is the inverse spontaneous symmetry breaking. The stability of nuclear against to the repulsion by electromagnetic force is due to the discrete coupling of the recycled energy ( $\lambda = 1$ ). This is the explanation why nuclear force is short ranged. Depending from Eigen value, meson field can be real or virtual particle. At none zero  $E_{\text{act}}$ , pion is a particle, but at  $E_{\text{act}} = 0$  it became field of gamma rays. At this condition, there is no difference between electromagnetic force and gravitation. The heavier the meson the shorter is time allowed for the exchange process therefore only asymmetry of space-time boundaries allows existing of heavy top mesons. The mystery of conventional physics why the pion should have mass is explained with the discrete energy conservation within matter-antimatter particles, located within space-time phases.

The constant coupling with the background energy resources leads to the internal isospin symmetry SU of baryon quarks existing in three flavor of space-time structure  $E_{act}=2 E_s$ . The baryon alone is not stable therefore cannot be the fundamental matter: two nucleons are coupled with the background bi-meson field [T-B] to form three flavor of space-time structure  $E_{act}=2 E_s$ . The spin of quarks within baryons is aligned to conserve the condition  $E_{act}=2 E_s$  through quark/anti quark mesons. Separation of quark-anti quark pair is impossible due to the impossibility of separation of energy, distributed within space and time phases.

It is very interesting that the identical quarks do not obey the normal rules of quantum statistics as spin  $\frac{1}{2}$  particles: quarks should be fermions with anti symmetric wave functions but the pattern of observed baryons shows that they have symmetric wave function. In accordance with the quantum principles, quarks would radiate energy of interaction and dissipate their motion. Model (6) explains this phenomenon: the constant motion of quarks in baryons is in invariant coupling with the background state: at constant coupling with the background, state uniform transformation within  $p-n$  pairs gives to the quarks identity conservation with the symmetric wave function. At these conditions, the quarks have the same symmetric performance with the particles of background photons.

By quantum physics, it is hard to keep electric charge in a small pack because it repels itself. The problem of this concept is that electron /positron pair cannot be created from photons by two body reverse interactions  $2Y=e^-/e^+$  due to the violation of energy conservation. The three-body model shows that the mixed "electron /positron bubble" is a composite frame (9) where the energy, momentum and spin are balanced properly. In the mixed frame the three components form the "bubble space-time" with generation of electron with negative sign while anti particle gets positive charge. Photon and electron ingredients of the background state (9) are the dynamic products of the geometric object – space-time vectors where generation of space  $S_1$  transforms antiparticle to particle while generation of time instant  $t_1$  transforms particle to antiparticle. The three body flavor interaction  $E_{act}=2 E_s$  with the discrete non-Noether's symmetry leads to the generation of ordered structure of baryons.

The momentum of an electron is generated from  $E_{act}/E_s$  interactions therefore there is no static mass and photon alone is not the electrodynamics force mediator.

## 10. Why the weak force is needed?

In accordance with the model (6), the phenomenon called parity does not describe inversion of a position of a static body through spatial coordinate but the parity of two dynamical space-time systems. Violation of parity is the result of non-invariance of the action-response of two systems, which generates direction of time: without local violation of parity, the global symmetry is not conserved and there cannot be energy conservation and direction of time. That is why P violation is associated with the CP violation. When the energy of the initial state is completely consumed in space phase ( $E_{act}=0$ ), parity transformation changes the algebraic sign of the space coordinate to return the system back to the energy generation state.

In accordance with the gauge field theory, the gauge bosons have a parity  $P=-1$ , but spin  $\frac{1}{2}$  particles have  $P=+1$ . The vector bosons and fermions to acquire masses the gauge invariance Lagrangian and new scalar boson Higgs field is predicted to exist. We suggest that with the non-invariance Lagrangian the intermediate  $W$  bosons participates in decay process and decay leptonically when  $\lambda=-1$ .

The model (6) connects strong and with weak interactions as the resulting quantity from action–response parity while Yukawa formula [10] of the strong force does not reveals the resulting quantity. Yukawa suggested that nuclear force could not be reduced to the electromagnetic interactions between charged particles. The same conclusion follows from Gell-Mann mechanism of quark interactions locating quarks in baryon octets within certain quantum numbers. The important conclusion of Gell-Mann [11] is that the strong force between quarks will degenerate if the strong force is the only force holding the quarks within nucleons.

In accordance with the model (4), one force cannot conserve the strong nuclear force and this force has to be uniformly coupled with the energy, recycled to the nucleons. In this case, the coupling constant does not diminish with the change of the space within the meson field.

By quantum field theory “when coupling constant is much smaller than one ( $g < 1$ ) then the theory is said is weakly coupled. If the coupling constant is of order of one or larger the theory is said to be strongly coupled”. The model (4) meets this statement of quantum field theory. When the Eigen value is equal to one the system is strongly coupled with the action. If  $E_{act}$  is smaller than  $E_s$ , the system has a trend to undergo to the  $\beta$ -decay. This condition corresponds to the negative value of Eigen value. When Eigen value is plus one the particle’s momentum, spin is aligned, and a particle is right handed. If the Eigen value is minus one the spin and momentum counter aligned, therefore the particle is left handed.

The important question here is why fermions are half integer particles and should obey Pauli principle. In accordance with the model (6), this question is related to the realization of constant action in three jet events and formation of space-time frame:  $E_{act}=2E_s$ . The three jet events are the result of space-time frame and one of the three jets has unique property under the strong interactions to realize coupling with the constant energy. Therefore, coupling holds the hadronization of quarks and without coupling hadrons’ space-time frame transforms to the virtual manifold. That is why strangeness is conserved during creation but is not conserved in decay process. Based on the mathematical structure of the model (6), at constant coupling the quarks can never be liberated from the hadrons.

As follows from the equation (6), four fermion ingredients at  $E_{act}=0$  transforms to the neutral bosonic particle with total spin 2 which in the form of “graviton” leads to the conservation of the background energy.

## 11. Strong interactions and behind the standard model

Standard Model describes the origin of forces in term of local symmetries. But energetic field has to change discretely which leads to the discrete change of local space-time frame where

the energetic radiation field ( $E_{act}/E_s$ ) is associated with the asymmetric local space-time field. Model (6) shows that every local space-time frame is commuted with the energetic field, which constrains each other from the linear displacement. On this basis, the space-time frame and energy field have no independent existence and their distribution is determined by discrete energy conservation through background state. This eliminates the linear effect of the Newton's force and leads to the rotational dynamical motion (spin) of a particle around its generation frame. Model (6) shows that radiation field ( $E_{act}/E_s$ ) and particle can be classic commutative variables which by Dirac were accepted as a commutation of quantum variables.

The space-time model based on discrete energy conservation produces symmetric and anti-symmetric dynamical functions describing the direction of decay and the nature of produced particles. In accordance with the model (6), the symmetric and anti-symmetric functions can be transformed to each other depending from energy and identity conservation laws: when the Eigen value is positive, the function leads to the hadronic transformations. When the  $E_{act}=0$ , the function (6) being anti symmetric leads to the leptonic decay.

In accordance with the scheme (9), the alignment of the photons with the  $\frac{1}{2}$  spin particles ( $e^+ / e^+v_e / v_e^-$ ) moves the resulting energetic field in direction of space expansion with formation of hadronic ingredients. The resulting hadrons form "jet" along the direction of parent "electron particles".

The action-response parity of the model (6) shows that all the interactions (four forces) can be divided into two groups: two dimensional two body performance (matter –anti matter annihilation) with **SU (2)** symmetry group and three body interactions with commutation of **SU (2)** symmetry with **U(1)** group giving three body **2:1** confined resonance particles. The "two body" performance with  $\lambda=-1$  describes the interaction of virtual space-time annihilations (11) where the input function produces the opposite outcome. The total energy, distributed in **2:1** and **1:2** combinations of space-time waves generates  $1/3$  and  $2/3$  fractional frequency of waves which is displayed in the form of charges. Due to the operation of space-time waves within discrete symmetry, all electric charges have the symmetry in their unit.

Very important question, which may arise from three family 2:1 resonance performance, is Pauli Exclusion Principle, which states that two fermions such as quarks cannot occupy a quantum state at a given time. Model (6) shows that the existence of the two quarks with the symmetric wave function in classic way requires discrete correlation one of the quarks in proton-neutron baryons with the discrete conservation of the action.

Yukawa showed that [10] for some reason nuclear forces are saturated which lead to the appearance of different concepts for explanation of this phenomenon. Particularly Yukawa's meson theory appeared to explain this problem.

By prediction of the model (6), the symmetry between different spin particles such as bosons and fermions is possible if to accept that the force-carrying particle is not the single boson but is a complex "particle" having the sum of two half-order particles. On this basis the **SU (2)** discrete symmetry of proton-neutron transition (kaon meson field) is coherent with the **SU (2)** symmetry of background transitions. The mechanism of commutation of left handed doublets

and right handed singlet  $2E_s=E_{act}$  (6) is similar to the  $SU(2) \times U(1)$  symmetry group of fermions. At Eigen value, one the strong interaction of the quarks is confined.

The 2:1 flavor interactions (9) show that the kaon field is necessary to realize  $SU(2)$  symmetry and parity conservation within proton-neutron discrete transformations to realize discrete parity conservation within **uud-duu** and **ssc-ccs** nucleons.

Here is necessary to explain why three generation of particles, particularly strange (**s**) and charm (**c**) quarks are needed in particle physics[11]. Before we showed that if, correlation of different events with the energy resources has the same coupling they are simultaneous in time having different space phase. The invariance of Eigen value needs simultaneity in different phases. Therefore, identity conservation of the nuclear requires its discrete invariance within different space phases, formed by discrete existence of **uud-duu** and **ssc-ccs** frames.

Recently was observed that quarks treat the right and left hand differently and pick out a direction in space while in empty space they treat the left and right hand without any difference. On this basis, the strong interaction should violate the parity as well. Model (6) explains this phenomenon and shows that strong interactions can hold the parity only through discrete energy conservation while in the absence of constant coupling the strong interaction has to select one-handed direction.

The discrete energy conservation and action-response parity are the necessary laws of nature to give different shapes to the different events: without discrete conservation of energy and non-invariant action all the events and bodies would form non separable mass without any shape and structure.

The action principle (6) shows that the certain frame to be stable its outcome after the change should be the same (Eigen value  $\lambda=1$ ). Therefore, formation of stable non-virtual matter frame needs application of additional intermediate force. Due to the conservation of energy in discrete mode, the intermediate force is necessary to recycle the energy to the nuclear.

It is known that the square of the parity transformation is the identity conservation. Applying two parity transformations is equivalent to no transformation. Therefore, the condition (6) meets the requirement of identity conservation generating discrete invariance of action-response parity. Model (6) involves non-invariance action instead of Yang-Mills gauge Lagrangian.

Model (6) shows that at constant Eigen value quark cannot radiate energy ( $E_s < E_{act}$ ). Decay of proton by radiation of energy can be realized at inversion of the universe back to the initial state ( $\lambda=-1$ ). In accordance with the model (6) proton decay has to be observed globally when  $E_{act}=0$ . This is the mathematical proof why quarks can never be elaborated from the hadrons.

By conventional particle theory when matter and antimatter collides, they should destroy each other, leaving behind nothing but only energy. In this concept energy as the resulting quantity is not localized with the lost of matter carrying momentum. That is why matter/antimatter annihilation should produce again other matter/antimatter couples to conserve momentum and space-time frame.



In accordance with discrete energy conservation, the anti-quark is the discrete partner of the quark and they exist with asymmetric boundaries. At small scale, the asymmetry is close to the antimatter structure, while for high space scale it is asymmetric structure of matter. The top quark's frame is close to the antimatter and it has no baryon structure. Due to the mechanism (7-16), during coupling of top-anti top quarks, individual bottom and anti bottom and vector bosons have not been observed [12]. The excess jet during proton-antiproton annihilation is due to the exchange of quarks. It is interesting that the possibility of generation of mass through top quark was suggested also by Liss and Tipton [12]. By their opinion Higgs can be replaced by top-anti top quarks and there may be some heavy particle that decay to top-anti top pairs and excess jet is caused by collision of small particle with the top quarks.

By our model this heavy particle is not-yet described **[T-B]** bi-meson which in accordance with the mechanism (9-11) leads to the realization of **2:1** space-time performance of nucleons.

Model (6) predicts the non-symmetrical decay of top-anti top quarks. During correlation of top quark with up quark, it prefers to travel in direction of proton while anti top quark moves backward to the initial background state. One quark of baryonic 2:1 structure has different position in matrix ( $E_{act}/E_s \cdot E_s/E_s$ ) due to the correlation and insertion of energy to the baryonic structure.

At free state, photons themselves do not carry charge, while coupling with the charges makes them "color" force mediators (called gluons) which interact among themselves. Gluons carry the colors of their original photons. The color is the flavor of gluons while leptons carry the flavor of merged particles. The meson field of baryon having zero spin follows to the condition  $E_{act}=E_s$  which keeps the color force constant as the quarks within baryon are pulled apart.

## 12. Does weak interaction violate the CP symmetry?

Landau [13] considered that parity violation is impossible because space is mirror symmetric and homogenous. In accordance with the discrete energy conservation, the spatial coordinate transformation is associated with the inversion of time and asymmetry of boundaries of space-time variables leads to the CP violation. The non-invariance of action –response generates discrete reflection.

W bosons as the intermediate products participate in the exchange of quarks within more massive top-bottom meson field. Therefore W bosons during coupling carry strong force while in the absence of  $E_{act}$  undergoes to the left-handed weak decay. When  $E_{act}=0$ , takes place back re-alignment of  $e^+/\nu_e \rightarrow e^-/\nu_e$  to  $e^-/e^+ + \nu_e/\nu_e$  where the negative pressure dissolves  $e^-/e^+$  within  $\nu_e/\nu_e$ . That is why electron can behave in both left handed and right handed states.

One of the problems of Standard model is the CP invariance of strong interactions while quantum mechanics Lagrangian involves a term, which should break this symmetry.

Kobayashi and Maskawa's mechanism of CP violation [14], based on mathematical structure of quark matrix mixing, does not explain the physical nature of this violation. But quarks matrix mixing in reality is the change of space-time structure of the quarks in baryons.

In accordance with the discrete energy conservation concept the CP violation observed first time in Chui experiments [15] and repeated in beta decay, is due to the non-invariance of the action correlated with of the non-virtual space-time frame, therefore would result the CP violation.

As follows from the action-effect non-invariance parity (6), the left-right invariance can be realized only within discrete dynamics. The interaction described by  $(\mathbf{V}-\mathbf{A})/\mathbf{A}$  coupling is invariant only at  $\lambda=1$ . Therefore, parity cannot be conserved in the continuous symmetry.

### 13. Merging of quantum mechanics to the frame of classic physics

In accordance with the discrete energy conservation, model (6) as a quantum wave function may have a feature of deterministic classic physics and describe present existence of a particle in space-time frame through wave function connecting discrete squared appearance-disappearance phases. The probability of existence of a particle in one position is its discrete appearance in the space phase, while the non-existence describes its appearance within opposite time phase. Coupling of these phases in the wave function of probability is the “quantum analog” of the Eigen value. Therefore, with the discrete energy conservation concept there is no difference in the features of classic physics and quantum mechanics. Problem of quantum mechanics is that the wave function involves Hamiltonian of a single system having independent existence. On this basis, position and momentum are related to the system having an independent existence while in the case of discrete energy conservation concept position and momentum are derivatives of energetic existence. Description of existence of a single free particle makes the Hamiltonian linear operator eliminating its feature being the resulting quantity. Due to the independent existence of a system, Hamiltonian leads to the approximate solutions.

The non-independent existence differentiates small and high scale systems connecting them with the discrete energy conservation principle. At  $E_{act} \neq 0$  there is an existence of a particle in space-time frame displayed by its position and momentum while at  $E_{act}=0$  there is no position and momentum to be determined. Similar to our model (6), Hamiltonian as the Eigen value of the energy operator, in relation to the energy resources may present unification of relativity and quantum mechanics in function of discretely conserved field.

### 14. What special features has discrete energy conservation concept?

Our concept shows that the mathematical behavior of the non-continuous dynamical systems, described presently by ordinary differential equations, should be determined by the function involving commutation of the differential operator with the input function itself to cover the boundary of the phase of the function and identity conservation. Due to the discrete energy conservation mapped within discrete space-time boundary, all physical parameters are the resulting quantities.

The description of the "change" phenomenon by independent intervals of classic differentiation in the form of "continuous move from one point to another" gives only positive sign (such as Fermi's golden rule) and leads to the lost of discreteness and reversibility of dynamical events due to the elimination of the boundary of the initial function from the commutation. In this case, the identity conservation also is smeared out due to the absence of conjugation of the "energetic jump" with the dynamic boundary of space-time variables.

With the similar way, the second law of thermodynamics smeared out the discrete energy conservation by replacing discrete space-time dynamics by the one parametric thermodynamic arrow.

## 15. Conclusion

The analysis presented in our chapter shows that the concept of discrete energy/momentum conservation and their commutation within boundary mapped discrete space-time phases allow unification of the forces and interactions within unified classic field theory which completely changes our views on the fundamental interactions and symmetrical laws of nature.

The space and time are the products of discrete energy/momentum conservation and in reverse order, energy/momentum identities of antimatter/matter are the inner products of space-time discrete dynamics [16-18].

Unification of discrete energy conservation and discrete space-time dynamics has the same basis as electromagnetic unification of light as the coupling product of the space-time phases.

The principles that everything is "relative" or "uncertain" are getting different look with the concept that "every space-time identity is the discretely conserved energy/momentum packet within space and time phases" which became a new fundamental concept for description of nature and its physical laws regardless of dimensions and scale.

Model (6) shows that the non-conservation of parity is the result of non-arbitrary process of discrete energy conservation therefore the local CPT non-invariance is to be the fundamental deterministic law of nature. The discrete energy conservation treats its ordered outcomes-space and time through correlation of their asymmetric boundaries which allows energy to perform its discrete conservation within dynamic space-time framework. The non-invariance of action-response parity is more fundamental concept than unification of forces due to the generation of all the forces and events from discrete commutation of this relation.

The reality is not created by observation, as quantum mechanics suggests, but as the resulting quantity, it is created from exchange action-response interactions of space-time frame with the discrete energetic action.

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