Asymmetric gravitational wave functions by retarding attraction between Planck's particles allows a quantum inflationary cosmos

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Abstract

Quantum inflation could be described by a sequence of surging Planck particles and their elongation, cooperatively increasing space. The process shows that inflationary velocity could be reached, without at any time locally exceeding *c*. Predominant conjectures support a universe structure described as a gravitational continuum. A quantum treatment has not been favored, because it is dependent of a mechanism preventing collapse, from the gravitational attraction between primordial particles. Wave trains, as well as energy fields, propagate at velocity *c*. Lowering frequency, results in that each quantum requires a longer space-time of localization. Initially, the four forces are confined within the Planck length $l_P = 1.61\times10^{-35}$ m. The stability of the Planck particle is constrained by the Planck time, $t_P = 5.4 \times 10^{-44}$ s, allowing its energy to be emitted as a wave, and increasing localization length. The Schrödinger equation applied to the gravitational and electromagnetic interactions, acting as mediating forces between two particles, generates wave functions that show longer time of localization than t_P. Henceforth, emerging of both photon as well as gravitational action, as either a wave or as a space-curving events, had fields that propagate at velocity *c*, but the event would manifest as retarded, with regard to the stability or localization times for the particle itself. Two systems of two particles were studied and in both cases the first oscillation, equivalent to a gravitational interaction, has an increase lasting time allowing covering of a longer distance, than the one separating the mass centers of the particles. In the first study, calculation shows that two particles with Planck masses m_P, separated by l_P, required to surge as a gravitational event a wave function length of about 10.5 l_P. The second study was localized within the inflationary period from 10^{-35} to 10^{-33} s. The gravitational interaction was evaluated for masses equivalents to 10^{28} Kelvin separated by 3×10^{-25} m. These were shown that the mediating force required to act the surging of a wave extending over 3×10^{-22} m. Hence, for all purposes there is period when lack of acting gravitational forces, allows the cosmos to increase large enough to prevent a gravitational induced collapse at the mass acquisition event. However, this process may produce a small remnant of Planck particles which, by joining others, could reach longer dissipation times. Thus, allowing their tendency to attract others, to subsist until the time that could function as seeds for galaxies formation process.

Introduction

The Planck particles qualify as mini black holes, whose very short stability leads to the release of their energy in the Planck time. As shown in results, the time required for the convergence of two Planck particles to consolidate as a single black hole, is considerable greater than t_P. Hence, allowing quantum inflation to proceed without gravitational collapse. The primordial state qualifies as the entrance of energy and matter, as Planck particles, in a thermodynamic open system, capable to elude microscopic reversibility.

This process allows a dissipative potential away from equilibrium, as long as not all the resulting lower energy particles, could interact as products to recreate the substrate. The Zero Point Energy fulfills this requirement, because it could be idealized as an incomplete wave. Therefore, lacks properties required to become, in the reverse direction, a thermodynamically reactive product.

Hence, it could exit the system, preventing it to reach equilibrium. Hence, because of the absence of equilibrium, the flow of energy persists. Hence, the system is maintained away from equalizing energy potentials, or the energy state unable to exercise work known as entropy. Accordingly, it facilitates the system to remain in a dissipative state. This one, operate as a system that allows the energy flow, cascading as particles of lower and lower energy, to operate as a thermodynamic continuum.

Conservation of angular momentum implicates that their magnitude could not have changed along the chronology. Therefore, if an early universe were constituted as a continuum structure, critical density could not hold the corresponding angular momentum [1, 2]. On the other hand, a quantum structure could allow the summa of all individual angular momentum of the particles and comply with its conservation law.

Black holes show over 65 % of the maximum speed allowed by general relativity. The ASCA and Suzaku Japanese satellites have shown that, the strong gravity of a hole combines with the velocity of the iron atoms accretion disk, to asymmetrically shift their emission wavelength, spreading it over a spectrum [3, 4].

This study of the origin of the universe and its energy-space-time parameters is restricted to a conjecture of an initial state of the Cosmos evolving through a Quantum Inflation process. In this model, a chain of accumulation from a single Planck particle, to a number of about 1.6×10^{60} particles. From the energy of each Planck particle surges many more of lower energy, increasing the total confinement space, conserving total energy but at lower density [5, 6].

This process can be identified with the inflationary era [4, 7, 8], because it assumes that the space can be expanded at a velocity faster than that of light c [9, 10], as a result of the cooperativity created by the summation of the velocities of emergence of particles and their local elongations [5, 6].

The frequency of radiation could be correlated with space localization. The relationship with localization time could be illustrated by adjusting an optical diaphragm to allow passage of blue light. This setting would not allow the passage of the longer wavelength characteristic of red light.

Particle Physics accepts that initially the fundamental forces could be superimposed at the same magnitude in the primordial state. This corresponds to their integration at the level of the Planck particle.

The decay of the particle releases its constrained forces. Einstein predicted that even if the propagation of the field occurs always at the velocity of light, a mediating event may occur as, in the previously discussed example, with a different oscillatory time. This indicates, that the time required for each force to complete an oscillation, would eventually lead to differentiate these by their emissions times. Conceptually, allowing evaluating the asymmetric properties of mediating forces.

Results

The Schrödinger equation allows characterizing the space-time-energy relation, from the properties of a quantum oscillation. Their joint magnitude could express energy levels or temperature as a function of chronology [11, 12, 13, 14].

Hence, the electromagnetic and gravitational fields acting as forces were examine through the Schrödinger equation, and assessing the relationship of energy to mass by temperature, at different states of inflation.

The interaction between particles is a function of their distance, which relates to the time required for the mediating force to induce changes. Accordingly, the time of localization $t_{loc} = h/E$, becomes equal to that of delocalization, when the stability time of a Planck particle allows complete emission of its energy. The event defines therefore, the parameters for energy-mass associated to a space-time dimensional change.

The initial chronological time, has also associated specific energy levels at different stages and therefore, with magnitudes comparable with that of emission times.

Gravitational wave function for a two particle system within the initial stage shows a delayed gravitational force, characterizing a non-gravity period

Extrapolation of the Lagrangian function [13] towards the Inflationary Era becomes distorted due to the primordial asymmetric state resulting from a one-directional time. A system formed by two Planck particles of Planck mass $m_P = 2.17645\times10^{-8}$ Kg , separated by the initial Planck distance $l_P = 1.61624\times10^{-35}$ m , was study relating total energy E with a gravitational wave function $\psi_{(r)}$.

Analysis with the Schrödinger equation $-\dfrac{\hbar^2}{2m}\dfrac{d^2\psi}{dx^2} + \mathrm{V}\,\psi = E\,\psi$, requires the following considerations. A particle carrying a value of *E*, could be related to a potential V, with kinetic energy E_C: $E = E_C + \mathrm{V}$. This one, as gravitational potential $\Phi_{(|r|)} = -\dfrac{\mathrm{G\,m\,M}}{|r|}$, where $\mathrm{G} = 6.67428\times10^{-11}\ \mathrm{N\,m^2/Kg^2}$ is the gravitational constant and *r* the vector of module radius, which separates masses m and M.

Solving for $\mathrm{m} = \mathrm{M} = m_P$ and for the one-dimension and single axis *x*, becomes $\Phi_{(x)} = -\mathrm{G}\dfrac{{m_P}^2}{|x|}$, defined by limits $\Phi_{(x)} = \begin{cases} \Phi_0 \text{ si } & 0 < x < \mathrm{a} \\ 0 \text{ si } & x = 0 \wedge x = \mathrm{a} \end{cases}$. Hence, by replacing in the Schrödinger equation $-\dfrac{\hbar^2}{2\,m_P}\dfrac{d^2\psi_{(x)}}{dx^2} - \mathrm{G}\dfrac{{m_P}^2}{x}\psi_{(x)} = E\,\psi_{(x)}$. It is equated *E* = 0, taking in account that the result from equal bidirectional forces becomes null.

Because this is a magnitude that allows obtaining a flat geometry of space, reordering the expression $\dfrac{d^2\psi_{(x)}}{dx^2} = -\dfrac{2\mathrm{G}\,{m_P}^3}{\hbar^2 x}\psi_{(x)}$, which becomes $\dfrac{d^2\psi_{(x)}}{dx^2} = -\dfrac{k^2}{x}\psi_{(x)}$ where $k^2 = \dfrac{2\,\mathrm{G}\,{m_P}^3}{\hbar^2}$.

Applying the fundamental constants $m_P = (\hbar c / G)^{1/2}$, has a temperature equivalent $T_P = m_P c^2 / k = \left(\hbar c^5 / G k^2\right)^{1/2}$ $\therefore$ $k^2 = 2\,\dfrac{c^{3/2}}{\hbar^{1/2}\,\mathrm{G}^{1/2}}$, and $k = 3.51771\times10^{17}\, m^{-1/2}$.

The solution to the differential equation $\dfrac{d^2\psi_{(x)}}{dx^2} = -\dfrac{k^2}{x}\psi_{(x)}$ is:

$\psi_{(x)} = k\sqrt{x}\ \mathrm{BesselJ}[1{,}2k\sqrt{x}]\,\mathrm{C}[1] +$
$+\,\mathrm{i}\,2\,k\sqrt{x}\ \mathrm{BesselY}[1,\ 2\,k\sqrt{x}]\,\mathrm{C}[2]$ where C[1] and C[2] are constants.

Normalizing and integrating the probability function $\mathrm{P} = \int_{x_1}^{x_2} \psi^*\psi\ dx = 1$, between values x_1 and x_2, where Ψ^* is the conjugate of the functionΨ.

$$\mathrm{P} = \int_{x_1}^{x_2} \Big[\left(k\sqrt{x}\ \mathrm{BesselJ}[1,\ 2k\sqrt{x}]\,\mathrm{C}[1] \right)^2$$
$$- \left(i\,k\sqrt{x}\mathrm{BesselY}[1,\ 2k\sqrt{x}]\,\mathrm{C}[1] \right)^2 \Big] dx = 1$$

Physically x_1 could not be zero, it is *lp*, and x_2 becomes twice *lp*, providing an equation system that allows to normalize the wave function, knowing that $\mathrm{P} = \int_{l_P}^{2l_P} \psi^*\psi\ dx = 1$

$\psi_{(l_P)} = 0$ and $\psi_{(2\,l_P)} = 0$.

The solution of this equation system $\mathrm{C}[1] = -1.78357\times10^{17}$ and $\mathrm{C}[2] = -1.30674\times10^{17}\ i$. It finally implies that the gravitational wave equation describing a system of two Planck particles each one of 1.22×10^{19} GeV, stable or lasting t_P

$= 5.39121 \times 10^{-44}$ s, which initially are separated by the Planck length $l_P = 1.61624 \times 10^{-35}$ m, emits a mediating force required to complete interaction between two particles:

$$\psi_{(x)} = -6.3 \times 10^{34} \sqrt{x} \, \mathrm{BesselJ}[1, 7.0 \times 10^{17} \sqrt{x}] + $$
$$+ 9.2 \times 10^{34} \sqrt{x} \, \mathrm{BesselY}[1, \; 7.0 \times 10^{17} \sqrt{x}]$$

The result shows that the completion requirement needs a distance extending about 10.5 l_P. In a quantum framework, this value would be the minimum distance required for gravity to be excerpted as a force. Quantum-conceptually, over shorter distance gravity could not become manifested.

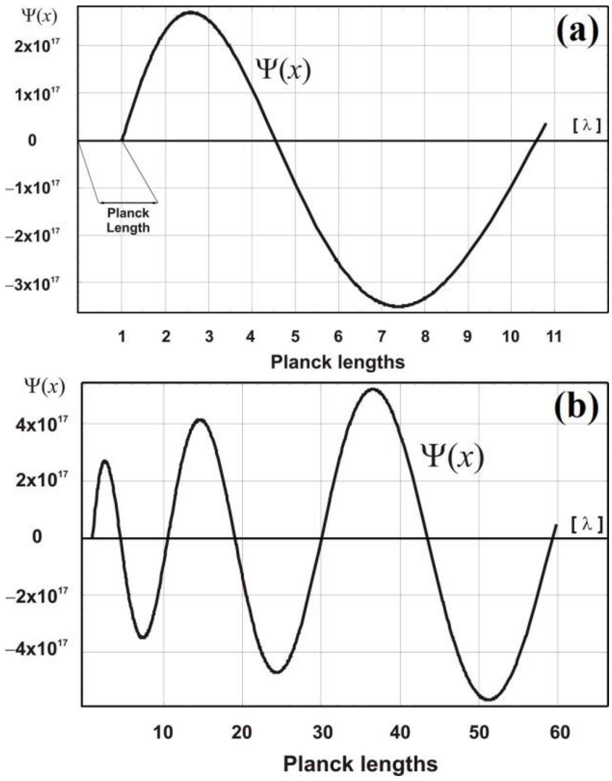

Figure 1: Gravitational waves function for a system of two Planck particles. *The figure a) shows that the first oscillation of the wave function, associating two Planck particles would require an action distance of approximately 10.5 Planck lengths. The figure b) shows that to complete a second oscillation it would be necessary 30 Planck lengths and 60 Planck lengths for the third, and so on. This value would be the minimum space-time distension for gravity to manifest as a mediating gravitational wave force. To describe gravity mediating force capability by its space curving action requires a different treatment not made explicit in this work because the intention hereby is to demonstrate the lagging emerging time properties of gravity which allow for a quantum expansion.*

The wave function of this system requires a time longer than t_P to configure as it is shown in figure 1. This produce gravity retarded effect, which is equivalent to absence in the primordial moment and allows the system to emerge instead of collapsing [15].

Electromagnetic wave function for a system of two particles with Planck charge at the primordial period

It arises the system composed by two Planck particles, electrically charge q_P and $-q_P$, where $|q_P| = 1.8755459 \times 10^{-18}$ C (Coulombs), separated by $l_P = 1.61624 \times 10^{-35}$ m. The electrostatic potential energy $V_{(|r|)} = -\frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{|r|}$, where q_1 and $-q_2$ are two opposite static charges separated by distance $|r|$.

It is assumed again the one-dimension case with x axis, obtaining $V_{(x)} = -\frac{1}{4\pi\varepsilon_0} \frac{q_P q_P}{x}$. The potential is defined as $V_{(x)} = \begin{cases} V_0 \text{ si } & 0 < x < a \\ 0 \text{ si } & x = 0 \wedge x = a \end{cases}$. The Schrödinger equation is now $-\frac{\hbar^2}{2m_P} \frac{d^2\psi}{dx^2} - \frac{1}{4\pi\varepsilon_0} \frac{q_P{}^2}{|\vec{r}|} \psi = E\,\psi$, where we would consider $m = m_P$ and $E = 0$. Therefore,

$$\frac{d^2\psi_{(x)}}{dx^2} = -\frac{1}{4\pi\varepsilon_0} \frac{2m_P \, q_P{}^2}{\hbar^2 x} \psi_{(x)} \;\; \therefore$$

$$\frac{d^2\psi_{(x)}}{dx^2} = -\frac{k^2}{x} \psi_{(x)} \text{ where } k^2 = \frac{1}{4\pi\varepsilon_0} \frac{2m_P \, q_P{}^2}{\hbar^2}.$$

Taking in account that Planck's units are expressed from fundamental constants: $m_P = \frac{\hbar^{1/2}\, c^{1/2}}{G^{1/2}}$ and $q_P = (4\pi\varepsilon_0)^{1/2}\, c^{1/2}\, \hbar^{1/2}$,

so $k^2 = 2\,\frac{c^{3/2}}{\hbar^{1/2}\, G^{1/2}}$, $k = 3.51771\times 10^{17} m^{-1/2}$.

The wave function obtained is:

$$\psi_{(x)} = -6.3\times 10^{34}\sqrt{x}\ \mathrm{BesselJ}[1{,}7.0\times 10^{17}\sqrt{x}] +$$

$$+9.2\times 10^{34}\sqrt{x}\ \mathrm{BesselY}[1,\ 7.0\times 10^{17}\sqrt{x}]$$

This is the same solution obtained for gravitation and it could be explained assuming that both interactions have the same intensity at the universe origin. In this way, this primordial quantification treatment, equivalent to the initial state of cosmos, is concordant to the obtained results by other studies that suggest that, initially all forces converged.

The first electromagnetic oscillation, surging from the dissipation of the Planck particle, also becomes retarded in a similar or equivalent form to that of the mediating gravitational force. Therefore, is the same plot than the one illustrated in figure 1.

Only when the chronology correspond to 3.3×10^{-43} s (figure 1) after Planck time or the physical singularity lasting time, the space increment allows completion of the first oscillation. In the time interval between 5.4×10^{-44} and 3.3×10^{-43} s, space-time support the energy quantum in undefined state similar to that of Zero Point Energy. This process, couples space and energy for distension of the space in a form that do not respond to gravitation. Hence, the pressure *P* would have the characteristic properties than the correspondent to vacuum [sub index v]: $P_v = \omega_v\, \varepsilon_v = -\varepsilon_v$, where ε_v is vacuum density and omega vacuum the scalar $\omega_v = -1$, and would have the properties of expansionary force within vacuum.

Therefore, the functions electromagnetic [16, 17] and gravitation converge in an initial oscillation of equal value of the space-time. Thereafter, each force could evolve according to its particular relationship with space. However, their chronological first frame allows a lagging time for the forces with regard to their fields and the initial expansion state could configure an arrow of time.

Gravitational wave function for a system of two particles at the inflationary period

The inflationary Era, from the perspective of a process of increasing particle number confined as quanta show a respond sigmoid curve with regard to chronology and most the quanta confined energy surging in between 10^{-35} to 10^{-33} s. At the end of the inflationary time the particles number has grown by multiplication and the average energy per particle equals 10^{15} GeV. The temperature of the cosmos 8.62×10^{27} K, the relationship between mass and temperature $m = k_B\, T/c^2$ allows to obtain the equivalent value of average mass for each particle $m = 1.7827\times 10^{-12}\,\mathrm{Kg}$.

The Schrödinger gravitational equation for this case becomes $-\frac{\hbar^2}{2m}\frac{d^2\psi_{(x)}}{dx^2} - G\frac{m^2}{x}\psi_{(x)} = E\,\psi_{(x)}$, where one particle is denominated m and shows equal to the other M, m=M. Hence, because both particles are at a same energy level the energy potential between both particles becomes zero, E=0, introducing this value allows a flat geometry.

Therefore, $\frac{d^2\psi_{(x)}}{dx^2} = -\frac{2G\,m^3}{\hbar^2 x}\psi_{(x)}$, or, $\frac{d^2\psi_{(x)}}{dx^2} = -\frac{k^2}{x}\psi_{(x)}$, where $k^2 = \frac{2G\,m^3}{\hbar^2}$, $k = 2.6077\times 10^{11} m^{-1/2}$.

Solving the differential equation $\frac{d^2\psi_{(x)}}{dx^2} = -\frac{k^2}{x}\psi_{(x)}$, is obtain

$$\psi_{(x)} = k\sqrt{x}\ \mathrm{BesselJ}[1{,}2k\sqrt{x}]\,C[1] +$$

$$+\mathrm{i}\,2\,k\sqrt{x}\ \mathrm{BesselY}[1,\ 2\,k\sqrt{x}]\,C[2]$$

Where C[1] and C[2] are constants.

Normalizing by integrating the probability function $\mathrm{P}=\int_{x_1}^{x_2} \psi^* \psi \; dx=1$, between values x_1 and x_2

$$\mathrm{P}=\int_{x_1}^{x_2} \left[\left(k\sqrt{\mathrm{x}}\ \mathrm{BesselJ}[1,\ 2k\sqrt{\mathrm{x}}]\,\mathrm{C}[1]\right)^2 - \left(i\,k\sqrt{\mathrm{x}}\mathrm{BesselY}[1,\ 2k\sqrt{\mathrm{x}}]\,\mathrm{C}[1]\right)^2\right] dx = 1$$

Allowing a system of equations that normalized the wave function: $\mathrm{P}=\int_{x_1}^{x_2} \psi^* \psi \; dx=1$, $\psi_{(x_1)}=0$ and $\psi_{(x_2)}=0$, where Ψ^* is the conjugate of the function Ψ.

The solutions are $\mathrm{C}[1]=1.5623\times10^{14}$ and $\mathrm{C}[2]=-4.99732\times10^{10}\,i$, with this value was generated the gravitational wave equation under the constrain of the chronological domain at 10^{-35} s for two particles of 10^{15} GeV. The mediating force between particles need to extend over the distance that light would be able to reach in 10^{-33} s, in order to accomplish the event of mutual gravitational attraction.

$$\psi_{(x)} = 3.2\times10^{25}\sqrt{x}\ \mathrm{BesselJ}[1,\ 4.1\times10^{11}\sqrt{x}] + 2.1\times10^{22}\sqrt{x}\ \mathrm{BesselY}[1,\ 4.1\times10^{11}\sqrt{x}]$$

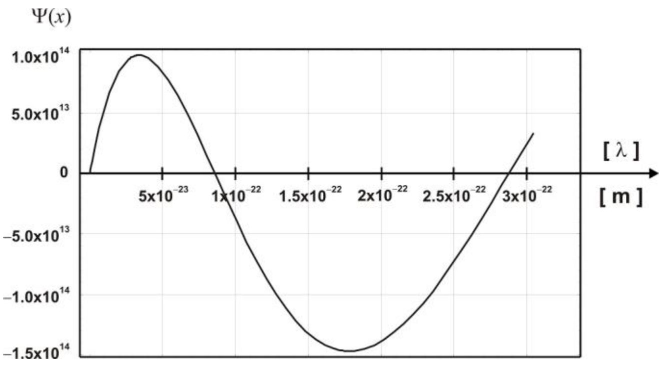

Figure 2: Gravitational wave function for a system of two particles at the ending of the inflationary period. *The figure illustrate that the first oscillation of the wave function, associated to the mediating force, starts at 10^{-35} sec. and needs for reaching interaction the distance equivalent for light to travel during 10^{-33} sec. Hence, completion of the first oscillation requires the distance of 3×10^{-22} m. At that point, the interaction between energy and gravity could appear as a gravity mediating force or action domain. Similar treatment, could be use to determine the energy confinement event, which allows particles to acquire mass.*

Semi wave or incomplete wave-ZPE

Figure 1 show that the mediating oscillation for casual interaction between two Planck particles corresponds to 5.66×10^{-43} s, the time required for light to travel 10.5 *lp*. It can be assumed that a shorter time allows a relationship in which the energy state allows ZPE characteristics, which implies impossibility to extract energy from the Planck particle to participate within an event. However, it allows a state of energy flow, without spatial resistance and leading to uniform ZPE distribution.

Assuming Bose-Einstein condensate properties to a system of two particles at Planck temperature, according to the fundamental constants relationship $\mathrm{T}_P=\sqrt{\frac{\hbar c^5}{\mathrm{G}\,k^2}}$, it could be assume that the result would be the same for a system of a single Planck particle, because both systems would have same density.

To calculate E_0, present energy, for ZPE $E_0 = kT_0$, where T_0 is the condensate temperature. It would be assume that the Planck particle could be confined within the volume generated by the De Broglie-λ : $\mathrm{V}_\lambda=\frac{\pi}{6}\lambda^3$, where $\lambda = l_P$ is considered as a diameter. Therefore, $E_0 = kT_0 = \frac{1}{Z\,[3/2]^{2/3}}\frac{h^2}{2\pi\,m}\left(\frac{N}{V}\right)^{2/3}$

$$\Rightarrow \qquad E_0 = kT_0 = \frac{1}{Z\,[3/2]^{2/3}}\frac{h^2}{2\pi\,m}\left(\frac{6}{\pi}\frac{1}{\lambda^3}\right)^{2/3}$$

$$E_0 = kT_0 = \frac{1}{Z\,[3/2]^{2/3}}\frac{h^2}{2\pi\,m}\left(\frac{6}{\pi}\frac{k_B{}^3 T_P{}^3}{h^3c^3}\right)^{2/3},$$

which simplifies :

$$E_0 = kT_0 = \frac{3^{2/3} k^2 \mathrm{T}^2 N^{2/3}}{Z\,[3/2]^{2/3} 2^{1/3} c^2 m \pi^{5/3}},$$ obtaining: $T_0 = 1.829 \times 10^{31}\mathrm{K}$.

In this equation T_0 is the temperature of the zero point of a Planck system, in order to express the non-extractable energy, between two non-quanta structured levels. The iterative treatment could show this in a decreasing relation, maintaining said property during a non-quantum definable lapse of time.

The ZPE behavior as a semi wave of the system, non-quantum configurable, is not subject to certain thermodynamic interactions. This behavior allows characterization like vacuum energy capable to contribute with a pressure P within volume $P_{\mathrm{V}} = \omega_{\mathrm{V}}\,\varepsilon_{\mathrm{V}} = -\varepsilon_{\mathrm{V}}$, where ε_{V} is vacuum density and $\omega_{\mathrm{V}} = -1$ is a scalar, with tension properties expanding space rather independently of gravitation.

Discussion

The uniform emergence of Planck particles, within all the Big-Bang created space, allows sizing the universe as an integrative property conformed by the summa of the generated space, by all particles. The space-time energy relationship confined in the dimension of a single Planck could be regarded as a physical singularity. On the other hand, critical energy could not be constituted in a singularity without violating physical laws. Energy transitions from one state to another could not be instantaneous and, since not all quanta are at the same stage, this event requires a temporal sequence of bottle-neck kinetics. This one involves that the undetermined state of energy, acquires sequentially individualized Planck confinement dimensions. Hence, the process of inflation has to be delineated as a progression curve, plotted over the axis of inflation chronology.

Therefore, the universe without locally violating c can integrate expansion at a greater velocity than c, preventing gravitational collapse. Hence, all over the universe local expansions multiply supporting uniform grow. Geometrical curving of expanding space is prevented because in the space between particles surge new particles. An equal local distribution of particles and equal local space distension, support an initial plane geometry of the universe density of the universe to remain below a collapsing density [9]. This is because each Planck particle dissipates at the Planck time, which prevents any attraction with the still emerging ones. The enormous number of Planck particles 1.6×10^{60}, evolving from the same energy step, could be plotted as a very steep sigmoid curve flattening when reaching particle number 1.6×10^{60} at 10^{-33} s.

This delineates a very narrow critical density value. The very very small particle number which, by their aggregation, prolong their stability time and could become seeds for the slow growing of black holes. This in term becomes seeds to sustain accretion disks to form galaxies. The resulting number, 100.000 millions, is a very small number with regard to the original number of mini black holes, or Planck. This, as a deviation value, may predict the very little statistical deviation allowed to the value of critical density supporting a flat geometry.

Localization time is an individual property of each particle, and therefore, the joint space localization for all particles has the dimension of expansionary space. Hence, each particle, at an individual time, generates others distending local space. The Planck particle, through energy emission, tends to increase the energy localization volume. Hence, could be evaluated the emission time, calculating the distance reached by λ of the surging photon.

According to Einstein energy fields propagate at light velocity, but within these events may occur more slowly. In order to discern, at the primordial level, how the separation of forces manifests themselves, it was resorted to the Schrödinger equation. This one can characterize events, according to the specific frequency of the implicated wave function. These frequencies are configured by the minimum time of localization, valued according to the time required for a complete oscillation as a mediating force.

When evaluating elongation, event where the reactant and product are photons of different energy levels, reversal becomes thermodynamic and kinetically dependent. Symmetry becomes broken because the event is couple to the chronology of time. By definition time evolves in a single direction, which forces the event to maintain the thermodynamic flow in the elongation direction. Not only causality is hereby implicated, but also a coupling relationship constrains to a single direction because elongation implies an associated distension of space-time. Causality or lack of reversal may be explained in cosmological terms as a time-space-energy relation, in which the preceding space-time reactant is no longer available. Elongation implies emission times progressively longer.

The reactant time, even if available, could not be utilized for reversal, because it has the dimensions pertinent to the shorter reactant photons, and therefore, it lacks the dimension required for interaction with the longer photon product. Thermodynamically, a reversal event would also be unfavorable because of the uphill direction required to recreate from the less to the more energetic photon.

Summing up, the earlier chronology is associated to the evolution of the space-time to configure the arrow of time, as a determinant of the direction of energy flow. Accordingly, the events mediated by transitions could not be reversible, if the first transition is framed into a surrounding space-time which dissipates after formation of products. Therefore, a sequence of substrate to product needs of the preceding space-time environment and the presence of all products, in order to express a mass action potential. Inflation events follow the thermodynamically dissipative arrow created by coupling to a source of energy, which opens the system to the incoming of Planck particles, with energy far exceeding the inflation dissipated potential. An example of how product emission from the event contexts prevents reversal could be found in neutrino emission, during events of particle and antiparticle disintegration.

This proposal provides a solution which could be used to explain of how annihilation was prevented. Transfer of the antimatter characteristic to neutrino and antineutrinos preserve symmetry but, since these particles lack reactivity to interact, could not return to context of the reverse direction.

Hence, chronology relate causality to the evolution of energy-space-time, which could be evaluated by the decrease of energy density which relate the space increment and the time required by wave localization and emission t_{loc}.

Radiation density could be treated as a function of the De Broglie thermal wave. Hence, the hot Big Bang could be provided with an additional parameter the minimum time for localization and/or emission according to $t_{loc} = h / E$. This treatment allows preserving the chronology of hot Big Bang under quantum parameter. This allows developing wave functions relating mass-energy as a function of stretching space-time. The initial chronology has associated energy states, with values corresponding to quantum emission times. This allows differentiating between the waves functions of each of their interaction mediating forces.

Chronology imposes that initial transition occur in a shorter time or there are less stable that subsequent ones. The relationship between events with generation of ZPE, configure an arrow of time, which prevents equilibrium because ZPE unable to complete an oscillation becomes uncoupled from the system.

ZPE tends to occupied a “vacuum state” that allows the surging of the distended space-time. A geometric expression: is that completion of oscillation of a wave function, product of a transition, will always of less energy that it’s previous state. Hence, in a Schrödinger’s box, ZPE appears distending and without superposition with a substrate that because of its higher energy could be confined in smaller box than ZPE.

The Planck wave function allows defining a constant k, according to the relationship between the fundamental constants $k^2 = \frac{2\mathrm{G}}{\hbar^2} \mathrm{m}_P{}^3$, representing a value for the primordial wave function. If m ≠ M means that one could have the value of a Planck particle and the other smaller, which indicate an asymmetric space relationship because the sum of their volumes should be larger than that of two Planck particles. This allows that the relationship cause-effect could be kinetically configures as irreversible.

Emission gravitational wave could be retarded and a gravity dependent space curving would not become manifest until the appearance of mass. Accordingly, we obtained for this event a dating close to that of the Boson Higgs Era, 10^{-27} s after the Big Bang. The mass acquisition process would allow the conformation of quarks plasma. The radiation leftover 1/25000 could be detected as CMB.

The retarded manifestation of gravity, during this lapse of time, prevents that the energy present as primordial radiation could collapse. Hence, as long as the process of mass accumulation does not become dominant the Big Bang would not be under gravitational influence. This made possible the initial dominant state of radiation, consequence of a first photon induced the manifestation of space-time asymmetry. Property that could not be predicted from an initial singularity, mathematically described as a point.

Conclusions

The wave functions associated to electromagnetism and gravity, obtained through the Schrodinger equation, naturally shows a localization time for interaction between Planck particles greater than the chronological one. Hence, suggesting a retarded effect for the manifestation of the mediating forces. These ones, as has been publish by other investigations shows within the confinement state of Planck initially equal magnitudes.

The energy release or emission $t_{loc} = h/E$ of each force is related to mass-energy and conditions by the chronological distension state of the space-time. This could be exemplified by a shutter time-adjusted to allow exit of blue photons, red ones would not exit because the oscillation time associated exceeds that of the much more energetic blue one. The chronological time should be initiated by the higher energy photons that required a shorter emission time. Hence, even force fields propagated at velocity of c, the difference of quantum energy for mediating forces would determine the emission time, the larger for the less energetic one.

The results shows than when a system of two Planck particles interact across l_P the resulting gravitational wave require 10.5 Planck length, the 2nd wave 30, and the 3rd 60. The space expansion that configure energy quantum initially constrained within a same space the four fields. Since gravity is the weaker forces it would be retarded during the primordial Era allowing energy to expand space without collapsing into giant black hole.

The system constituted by two particles of 10^{15} GeV of mass, at 10^{-35} which are apart by the distance that light transits during 10^{-33} s would shows that the mediating force required by 3×10^{-22} m to consolidate the attraction event. Hence, because of gravity is the weaker force, it would take longer to exert its mediating forces for gravitational effects.

Hence, radiation escape the surging gravitational configuration delayed to the emerging of mass either by the Higgs field or by transformation of the angular momentum of Boson in the intrinsic orbital momentum or spin of fermions.

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