

A Law of Energy Creation

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ABSTRACT—The energy density of free space is constant and negative. Energy, which comes from free space according to the law of energy creation, is created at a constant rate. Matter or energy that is created contains equal amounts of positive and negative energy. Therefore, the total energy of the body is zero. This law offers insights on the beginning and end of the universe, as well as how this cycle continues.

1. INTRODUCTION

Energy is equivalent to mass and vice versa. Where does this energy comes from? This quest to identify the source of energy is related to the origin of the universe [1][2][3]. The general theory of relativity [4] predicts that the universe is not static, but either expands or contracts. The theory also leads to three possible geometries of the universe [5]. The theory predicts that the universe started off with infinite density at the big bang singularity [6]. Therefore, it does not explain the origin of the universe, why it is smooth and uniform on large scale [7], or why it expands at just the critical rate to avoid recollapse [8]. Here, a law of energy creation that offers an answer to these questions is postulated. This law also provides a new

framework for understanding gravitational force and its underlying energy mechanisms.

The notion of space-time implies that space either expands or contracts in association with time. The present theory is formulated based on three assumptions: i) energy is created at a constant rate, ii) the universe has a centre, and iii) the energy density of free space is constant and negative. The third assumption is essential for explaining the existence of a force field in space, which depends on the nature of the energy density of the space. Energy comes from free space. That is, energy is created from free space according to the law of energy

creation: $E = \pm \frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt}$. This law states that the amount of energy created in

space is directly proportional to the rate of change in the velocity flux, and that a body (matter or energy) created contains equal amounts of positive and negative energy. However, this law does not violate the law of conservation of energy [9]. By the law of energy creation, we can show that a body (matter or energy) contains negative energy $-mc^2$, which does not exist in the form of mass. As a result, the total energy of the body is zero. This law does not explain how energy is created out of nothing. It only gives the amount of energy created by the rate of change in the velocity flux. The creation of energy may involve matter, energy, or both. The body that is created generates two equal and opposite forces. The net effect of the force on the rate of change in the velocity flux is zero. Therefore, the expansion rate of space is constant.

We can derive Gauss' law of gravitation, which states that the force of attraction between two bodies is due to their negative energies. Negative energy opposes the expansion of the universe. Given that the universe expands at a constant rate, concentric spheres with origins at the centre of the universe have different expansion rates according to the law $v = r/k$, where r is the radius of the sphere or distance of the body from the centre of the universe and k is the time associated with the universe. This shows that the body is moving at a constant velocity. However, negative energy acts as a force on the body directed towards the centre of the universe. That is, it is directed radially inwards and opposes the motion of the body. As the body is moving with constant velocity, this means that an equal force due to negative energy (i.e. gravitational force) is acting in the direction opposite to the radially outward force due to positive energy (i.e. repulsive force).

However, the law of energy creation does not explain the origin of space-time. It predicts that the geometry of the universe is flat, as confirmed by data from the WMAP (Wilkinson Microwave Anisotropy Probe) [8].

2. THEORY AND PROOFS

The theory is formulated on three assumptions: i) energy is created at a constant rate, ii) the universe has a centre, and iii) the energy density of free space is constant and negative. However, positive energy is equivalent to mass. Therefore, the rate of mass creation, which is denoted by m_α , is also constant. Here, the unit for the subscript alpha is kg/s.

1) @Law of Energy Creation@

The law states that the amount of energy created is directly proportional to the rate of change in the velocity flux, and that the body created contains equal amounts of positive and negative energy: $E = \pm \frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt}$, where ϕ is the velocity flux with the unit m^3 / s . That is, $\phi = \oint_S v \cdot ds$. At any moment in time, the amount of positive energy (or mass) created is $E = m_\alpha t C^2$ or $E = m C^2$.

2) @Concept of Velocity Flux@

The velocity flux is given by $\phi = \oint_S v \cdot ds$, where v is the velocity field and ds is an infinitesimal surface element.

i) Meaning of the velocity field

Let O be a fixed point (i.e. the centre of the universe). Suppose that when a body is created at point A at a distance r from the fixed point, the velocity of the body depends on the distance r , i.e. $v = f(r)$. The velocity field at distance r from the fixed point O has the same value in all directions. Space may either expand or contract. It

is impossible to reduce the momentum of the body to zero with respect to the centre of the universe.

ii) Meaning of the velocity flux

Let O be the centre of the universe. Given that $v = f(r)$, the v.ds calculated for all small surface elements gives the velocity flux over a closed surface. The amount of velocity flux over a closed surface is thus equal to the total energy present in the volume of the closed surface at that moment in time. Proof of this statement is given below. By the law of energy creation, for positive energy

$$E = \frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt} \quad (1)$$

The total energy present in the closed surface at any moment in time is $E = mC^2$ or

$$E = m_{\alpha}tC^2 \quad (2)$$

From Eqs. (1) and (2), $d\phi = 8\pi Gm_{\alpha}tdt$. Integrating, we obtain

$$\phi = 4\pi Gm_{\alpha}t^2 + K \quad (3)$$

At time $t = 0$, $E = 0$ according to Eq. (2). From Eq. (1), $d\phi/dt = 0$. This implies that either $\phi = 0$ or $\phi = \text{const}$. We assume $\phi = 0$ at time $t = 0$. The reason is that if we consider $\phi = \text{const}$, then the value of ϕ is v.s = const, because the velocity field is radial and identical for a spherical surface $s = 4\pi r^2$. That is, $v \cdot 4\pi r^2 = \text{const}$. Given that $v = f(r)$, $f(r) \cdot 4\pi r^2 = \text{const}$. This equation gives a certain value for r at corresponding time t , such that the energy is non-zero. However, energy is zero at time $t = 0$. Thus $\phi = \text{const}$ is not considered. Hence, we assume $\phi = 0$ at time $t = 0$.

From Eq. (3), we obtain $\phi = 4\pi Gm_{\alpha}t^2$ or $\phi = 4\pi Gmt$. This shows that the amount of velocity flux over the closed surface is equal to the total energy present in the volume enclosed by the surface at that moment in time.

3) @Existence of Negative Energy and Attractive Force@

We can show that a body contains negative energy $-mC^2$. By the law of energy conservation, equal amounts of positive and negative energy are created. For a given closed surface, the negative energy is $E = -\frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt}$. However, $E = mC^2$ where $m = m_\alpha t$. Here, $m < 0$ for negative energy. Therefore, $m_\alpha t C^2 = -\frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt}$. Integrating for negative energy, we obtain $\phi = -4\pi G m t$ where $m < 0$. Similarly, for positive energy we obtain $\phi = 4\pi G m t$ where $m > 0$. This indicates that the body contains negative energy $-mC^2$. Therefore, the total energy of the body is zero.

The negative sign in equation $E = -\frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt}$ indicates that the negative energy opposes the rate of change in the velocity flux. This means that a force generated by negative energy opposes the expansion of the universe and is directed towards its centre. In other words, the force is directed radially inwards. Later, we show that the law underlying this force is Newton's law of gravitation, and that the force of attraction between two bodies depends not on their positive energies but on their negative energies.

4) The universe expands at a constant rate. That is, concentric spheres with the centre of the universe as their origin have different constant expansion rates, i.e. $v = r/k$.

Proof: We have already shown that for positive energy

$$\phi = 4\pi G m t \quad (4).$$

However, as $\phi = \oint_S v \cdot ds$ and $m = \int_V \rho \cdot dV$, Eq. (4) becomes $\oint_S v \cdot ds = \int_V 4\pi G t \rho \cdot dV$.

Gauss' divergence theorem $\oint_S v \cdot ds = \int_V \nabla \cdot v \cdot dV$ implies that $\nabla \cdot v = 4\pi G t \rho$. Given that $\nabla \cdot v$ is positive, this shows that the universe expands and that the divergence of the velocity flux gives the total energy present in an infinitesimal volume at that moment in time.

We now find the relation between v and r . Let O be the centre of the universe. Consider an imaginary sphere of radius r . As the velocity field at distance r from the origin has the same value in all directions, the imaginary sphere expands. Let P be any point on the sphere. Its position vector is $r = xi + yj + zk$. Any point on line OP is given by the coordinates $x = l.r$, $y = m.r$, and $z = n.r$. The velocity component of point P is then given by $v_x = l.v$, $v_y = m.v$, and $v_z = n.v$. We know that $\nabla \cdot v = 4\pi Gt\rho$. Substituting the velocity component and coordinates, we obtain $3.dv/dr = 4\pi Gt\rho$, as v is a function of a single variable r . Therefore, replacing the partial derivative $\partial v / \partial r$ by dv/dr and substituting the density of a sphere and $m = m_\alpha t$ yields

$$dv/dr = (Gm_\alpha t^2) / r^3 \quad (5)$$

Substituting $Gm_\alpha t^2 = \phi / 4\pi$ in Eq. (5), we obtain $dv/dr = \phi / (4\pi r^3)$. As the velocity field is radial and identical at distance r , i.e. $dv/dr = v/r$, by integrating we obtain

$$v = r/k \quad (6)$$

where k is an integration constant whose dimension is time. This equation shows that the velocity of point P (or body) is directly proportional to the distance from the centre of the universe. The expansion rate of concentric spheres is constant, i.e. the body is moving with constant velocity. Another body moving in space with the same constant velocity v can be expressed as $v = s/t$. Comparing this equation with Eq. (6) gives $s = r$ and $k = t$. The latter states that the constant k is equal to the time variable t , which contradicts the constancy of k . This inconsistency can be resolved. Both bodies cover a distance of $s = r$ during time $t = k$ because both are moving with equal and constant velocity. The constancy of k in the Eq. (6) indicates that the body is not moving in space, and hence space expands. Therefore the result $k = t$ implies that the constant k is changing independently and uniformly. This means that time flows independently and uniformly. We can determine time (i.e. the age of the universe) by measuring the constant k . Hence, the universe has its own cosmic clock.

5) The Universe is Finite and Bounded

Proof: If the universe is infinite, the radius of the universe is infinite. Therefore, from equation $v = r/k$, $v \rightarrow \infty$ as $r \rightarrow \infty$. This means that at an infinite radius the body covers an finite distance instantaneously. This is an absurd result. We now prove this generally by considering a sphere expanding with velocity v . The velocity

field is given by $v = r/k$. Taking the divergence on both sides yields $\nabla \cdot v = 3/k$. As k flows, we replace k with t to obtain $\nabla \cdot v = 3/t$.

This equation indicates that the concentric spheres are expanding with finite velocity. The divergence of velocity flux is then a measure of the time (or age) of the universe. If $r = \infty$, then $v = \infty$. Therefore, $\nabla \cdot v = \infty$ implies that $t = 0$. This means that a sphere expanding with infinite velocity is associated with zero time. This absurd result indicates that space-time exists for a finite velocity of the sphere. Therefore, the rate of expansion of concentric spheres must have some maximum value $v = u$. For material particles and radiation, the maximum velocity is the velocity of light. Therefore, $v = u = C$. Thus the creation of energy and the rate of expansion of concentric spheres exist in the range $0 \leq v \leq C$. Hence the universe is finite and bounded.

6) Relation between v and m_α

Proof: Consider a sphere expanding with velocity v . The velocity field for a sphere is radial and identical. The value of the velocity flux is $\phi = v \cdot s$. Substituting this into Eq. (1), we obtain $E = (C^2 v^3 t) / G$. At any moment in time, the total energy present in the sphere is given by Eq. (2). From Eqs. (1) and (2), we obtain $m_\alpha = v^3 / G$. This shows that the rate of energy creation is different in concentric spheres expanding with velocity v . At the velocity of light, the corresponding radius of the universe is $r = C \cdot t$. The rate of energy creation in the universe is $m_\alpha = C^3 / G$, where m_α is a universal constant.

7) @The Density of the Universe is Homogeneous@

Proof: Consider a sphere of density $\rho = 3m / 4\pi r^3$, with its origin at the centre of the universe, expanding with velocity v . Substituting $r = v \cdot t$, $m = m_\alpha t$, and $m_\alpha = v^3 / G$ yields $\rho = \frac{3}{4\pi G t^2}$. This equation shows that the density of the universe is independent of the mass and shape of the closed surface, and is hence homogeneous. It also indicates that the density decreases with time. The value is twice as large as that predicted by the Big bang theory [5][6].

8) i) Space-time does not break down. ii) Time has a beginning [3]. iii) Energy creation began with the smallest time t_s . iv) The universe starts to expand with the smallest value of radius r_s .

Proof: When there is no energy in the universe (i.e. $E = 0$), Eq. (1) becomes $d\phi/dt = 0$. This implies that either $\phi = 0$ or $\phi = \text{const} = a$. As the velocity field is radial and identical in all directions, the value of ϕ is

$$v \cdot s = a \quad (7)$$

The universe is a sphere with radius $r = C \cdot t$ and $s = 4\pi r^2$. Therefore, Eq. (7) becomes $t = \sqrt{a/4\pi C^3} = t_s$. This shows that the energy is zero at $\phi = 0$ or $\phi = a$. Therefore, in the interval $0 \leq t \leq t_s$ there is no energy in the universe. $\phi = 0$ is not considered because $v = 0$. That is, concentric spheres have zero velocity so time is irrelevant. Therefore, space-time breaks down. For this reason, we assume $\phi = a$.

For $t = t_s$, Eq. (2) implies that $E \neq 0$. However, the energy is zero at $\phi = a$. This means that the value $\phi = a$, which corresponds to time $t = t_s$ is the minimum value of the velocity flux. Therefore, $d\phi/dt = 0$, and hence by the law of energy creation, $E = 0$. In other words, energy creation starts at the minimum velocity flux. Thus, by the law of energy creation, we obtain $E = 0$ for the minimum velocity flux.

During the forward flow of time, $t > 0$. We now consider the positive energy $\nabla \cdot v = 4\pi G t \rho$. Substituting $\rho = \frac{3}{4\pi G t^2}$ gives $\nabla \cdot v = 3/t$, where $t > 0$. $(\nabla \cdot v) > 0$ indicates that during the forward flow of time, the velocity flux increases with time. This means that the universe expands and positive energy is created at a constant rate m_α . By the law of conservation of energy, an identical amount of negative energy is created. Therefore, the universe starts to expand from a minimum velocity flux at a time corresponding to the smallest time t_s . Thus, space-time exists from the smallest time t_s , and time flows from this point onwards (i.e. time has a beginning). We conclude that the creation of energy and expansion of the universe started at the smallest time t_s , i.e. the time at which the radius of the universe $r_s =$

C. t_s was smallest. Therefore, the universe does not start with a zero radius. Rather, it starts with a minimum radius of r_s . Hence, space-time does not break down.

9)i) The universe has a maximum age of T. ii) When the age of the universe becomes equal to T, energy disappears. iii) Time can run backwards [3] while no energy is created.

Proof:

i) Recall that from Gauss' divergence theorem we obtain

$$\nabla \cdot \mathbf{v} = 4\pi G t \rho \quad (8)$$

Substituting $\rho = \frac{3}{4\pi G t^2}$ gives

$$\nabla \cdot \mathbf{v} = 3/t \quad (9)$$

If the age of the universe is infinite, then by substituting $t = \infty$ in Eq. (9), we obtain $\nabla \cdot \mathbf{v} = 0$. Thus, either $\mathbf{v} = 0$, or $d\mathbf{v} = 0$ and $\mathbf{v} = \text{const}$. This shows that concentric spheres with the centre of the universe as the origin expand with either zero or constant velocity. During the forward flow of time, energy is created at a constant rate. If concentric spheres expand at the same velocity at time $t = \infty$, bodies located at different radii would move with the same velocity at time $t = \infty$, which is an awkward result. Therefore, time cannot flow from $t = t_s$ to $t = \infty$. This suggests that time flows from the smallest value $t = t_s$ to some maximum value $t = T$. Stated another way, if time flows independently from the smallest value t_s , it cannot reach infinity. Thus, the universe must have a maximum age T.

ii) At time $t = T$, the velocity flux has a maximum value of $\phi = 4\pi G m_\alpha T^2$. Therefore, $d\phi/dt = 0$ implies that $E = 0$. This means that at time $t = T$, energy disappears.

iii) At time $t = T$, $E = 0$. That is, energy disappears at time T. Therefore, from Eq. (8), $\rho = 0$. Eq. (8) then becomes $\nabla \cdot \mathbf{v} = 0$. Thus, either $\mathbf{v} = 0$, or $d\mathbf{v} = 0$ and $\mathbf{v} = \text{const}$. We exclude $\mathbf{v} = 0$ because space-time breaks down, and thus assume $\mathbf{v} = \text{const}$. Here, \mathbf{v} must be negative because a positive value would imply that the radius of the

universe is greater than $r = C.T$ (the maximum radius of the universe at time T). Thus, v must be negative because the time flow exceeds T . Therefore, $v = \text{const} = -u$. This shows that concentric spheres start to contract at a rate of $v = -u$. Thus, time runs backwards. Time starts to decrease from the maximum value T to the smallest value t_s because space-time exists at this smallest time t_s . Given that $\nabla \cdot v = 0$, positive energy is not created when the universe contracts.

Next, we find the rate of contraction of concentric spheres. Consider $v = -u$ or $dr'/dt = -u$. Integrating, we obtain $r' = -u.t + K$ at time $t = 0$, $r' = 0$. Therefore,

$$r' = -u.t \quad (10).$$

During the forward flow of time, the instantaneous radius of the universe is

$$r = C.t \quad (11)$$

At time $t = T$, energy disappears and the universe starts to contract at a rate of $v = -u$. The radius of the universe should be the same whether it is obtained by Eq. (10) or (11). Therefore, setting $r' = r$, we obtain $u = C$ and $v = -C$. The concentric spheres contract at a rate equal to the velocity of light.

We now prove that when the universe contracts, negative energy decreases at a constant rate of $m_\alpha = C^3 / G$. Consider a sphere of radius $r = -C.t$, which is the radius of the universe during contraction at time t . Concentric spheres contract at a rate equal to the velocity of light. The velocity field of a sphere is radial and identical in all directions. However, C and the infinitesimal surface element ds face opposite directions. Thus, the velocity flux is $\phi = -C.S$ where $S = 4\pi r^2$, and $\phi = -4\pi C^3 t^2$ otherwise. Therefore, $d\phi/dt = -8\pi C^3 t$. The negative sign indicates that the velocity flux decreases with time. This means that the universe contracts.

Substituting $d\phi/dt$ in the law of energy creation, we obtain $E = \pm \frac{C^5 t}{G}$ or $E = \pm m_\alpha t C^2$. $\nabla \cdot v = 0$ indicates that during contraction of the universe, no positive energy is created. Therefore, we consider only negative energy. Thus, $E = -m_\alpha t C^2$ or $E = m C^2$, where $m = -m_\alpha t$. During contraction of the universe, time runs

backward from the maximum value T to the smallest value t_s . Therefore, negative energy decreases at a constant rate of $m_\alpha = C^3 / G$. Thus, during the backward flow of time when the time becomes equal to t_s , time runs forward again because the velocity flux is minimum at $t = t_s$. Hence, the universe starts to expand from the minimum velocity flux with the creation of equal amounts of positive and negative energy.

As to the meaning of $(\nabla \cdot v) < 0$, consider the negative energy from Eq. (8) where $\rho < 0$ and $t < 0$. Here, $t < 0$ means that time runs backward from T to t_s . The negative energy density of the sphere is

$$\rho = \frac{3m}{4\pi r^3} \quad (12)$$

where $m < 0$. Given that concentric spheres contract at the same rate as the velocity of light, the radius $r = C.t$ is the radius of the universe. For a sphere of radius $r = C.t$, the rate of negative energy reduction is $m_\alpha = C^3 / G$ during contraction of the universe. Substituting $r = C.t$, $m = -m_\alpha t$, and $m_\alpha = C^3 / G$ in Eq.

(12), we obtain $\rho = -\frac{3}{4\pi G t^2}$. Substituting for ρ in Eq. (8), we obtain $\nabla \cdot v = 3/t$

where $t < 0$. Here, $t < 0$ means that time runs backward from the T to t_s . Thus, we replace t by $-t$, which yields $\nabla \cdot v = -3/t$. $(\nabla \cdot v) < 0$ indicates that during the backward flow of time, the velocity flux decreases with time. This means that the universe contracts. It is also shown that during contraction of the universe, negative energy decreases at a constant rate of $m_\alpha = C^3 / G$.

10) @Law of Force Due to Negative Energy (or Gauss' Law of Gravitation)@

According to the law of negative energy creation, $E = mC^2 = -\frac{C^2}{8\pi G} \cdot \frac{d\phi}{dt}$. Here, $m <$

0 for negative energy because the universe expands such that $\frac{d\phi}{dt}$ is positive. We

know that for negative energy, $\phi = -4\pi G m t$. From this equation, we obtain $\nabla \cdot v = -4\pi G t \rho$. Here, $\rho < 0$ because $m < 0$ for negative energy. As noted previously, a body at a distance of r from the centre of the universe has a uniform

velocity given by $v = r/k$. Given that a force due to negative energy opposes the motion of the body, a body moving at a constant velocity implies the action of a repulsive force equal in size but opposite to the motion. The body contains positive energy $+m' C^2$ and negative energy $-m' C^2$, where m' is the mass of the body. The momentum of the negative energy (or mass) of the body is $p = -m'.v$, which is directed towards the centre of the universe.

Furthermore, $p = -m'.r/k$ because $v = r/k$. The force acting on the body is then $F = -m'.v/k$. As time flows, k is replaced by t . This shows that this force acts in the opposite direction to the velocity of the body. This means that the force on this body is due to the negative energy in the sphere of instantaneous radius $r = v.t$ expanding at a velocity v .

Given that $F = -m'.v/t$, $F/m' = -v/t$. For a body of mass m' moving with velocity v , the ratio $F/m' = E$ gives the force/unit mass at any moment in time t as $E = -v/t$. Taking the divergence on both sides of this equation gives

$$\nabla \cdot E = -\frac{\nabla \cdot v}{t} \quad (13)$$

As negative energy opposes the motion of the body, it is given by $\nabla \cdot v = -4\pi G t \rho$, where $\rho < 0$ because $m < 0$. Substituting this in Eq. (13), we obtain $\nabla \cdot E = 4\pi G \rho$. By Gauss' divergence theorem, $\oint_s E \cdot ds = -4\pi G m$ where $m = m_\alpha t$. Here, $\rho < 0$ due to negative energy ($m < 0$). This is Gauss' law of gravitation. For a sphere, E is identical and radial. In this case, $F = -\frac{Gmm'}{r^2} \cdot \hat{r}$, which is Newton's law of gravitation. Thus, we conclude that the force of attraction between two bodies is due to their negative energy. We have already taken the signs of m and m' to be negative. Therefore, we exclude them in the equation, $F = -\frac{Gmm'}{r^2} \cdot \hat{r}$.

11) @Law of Repulsive Force@

The momentum of the positive energy (or mass) of a body is $p = m' \cdot v$ for positive energy $m' > 0$. Similarly, the law of repulsive force is $F = \frac{Gmm'}{r^2} \cdot \hat{r}$. This force due to positive energy is directed radially outwards.

12) Repulsive force has a short range. The attractive force has infinite range; otherwise, the body cannot contract to infinite density.

Proof: Gauss' law of gravitation for negative energy is $\oint_S E \cdot ds = -4\pi Gm$, where

$E = -\frac{Gm}{r^2} \cdot \hat{r}$. Here, $r = v \cdot t$ is the instantaneous radius of a sphere that contains

instantaneous mass $m = m_\alpha t$. This force due to negative energy is attractive.

Questions may arise as to why the attractive force field exists in space or why we have only found the gravitational force. This is because the existence of the force

field in space depends on the property of the space. The equation $E = -\frac{Gm}{r^2} \cdot \hat{r}$

reveals that an attractive force field exists within the space of radius $r = v \cdot t$ that contains negative energy $m = m_\alpha t$. That is, the attractive force field depends on

negative energy. Therefore, the attractive force field exists in space. Its range is infinite because the energy of free space is negative. Hence, the attractive force field has an infinite range.

We now discuss the positive energy $\oint_S E \cdot ds = 4\pi Gm$, where $E = \frac{Gm}{r^2} \cdot \hat{r}$. This force

is repulsive. The equation $E = \frac{Gm}{r^2} \cdot \hat{r}$ reveals that a repulsive force field exists

within the space of radius $r = v \cdot t$ that contains positive energy $m = m_\alpha t$. That is, a

repulsive force field exists in a space of positive energy. Positive energy exists in a

body but not in free space. Therefore, a repulsive force field exists only within the

space of the body. As a result, a body of large mass contracts due to attractive force

but only down to a minimum radius beyond which no further contraction takes

place. In other words, when the radius of the body becomes equal to the minimum

radius, then the repulsive force come into play. As the forces due to positive and

negative energy are equal and opposite, a body cannot contract to infinite density

and its density is uniform. We proved this by considering the expansion of the universe. Now we prove this generally by considering a body of mass m .

Assume that a repulsive force field exists in space. Gauss' law of gravitation is

$$\oint_S E \cdot ds = 4\pi Gm \quad (14)$$

where $E = E_a + E_r$, E_a is the attractive force field due to negative energy, and E_r is the repulsive force field due to positive energy. The body contains equal amounts of positive and negative energy. Therefore the total energy of the body is zero ($m = 0$). Substituting $m = 0$ in Eq. (14) yields

$$\oint_S E \cdot ds = 0. \quad (15)$$

Therefore, $E = 0$. This implies $E_r = -E_a$, or $E_r = \frac{Gm}{r^2} \cdot r$, the law of repulsive force.

From Eq. (15), we obtain $\int_V \nabla \cdot E \cdot dV = 0$. This implies that $\nabla \cdot E = 0$. E_a and E_r are radial, and hence $dE/dr = 0$. This implies that either $E = \text{const}$ or $E_a + E_r = \text{const}$. Given that $E_a = E_r$, $E_r = \text{const} = a$.

Equation $E_a = -\frac{Gm}{r^2} \cdot r$ indicates that an attractive force field exists in a space of negative energy. As explained above, attractive force has an infinite range. Furthermore, as noted above, the equation $E_r = \frac{Gm}{r^2} \cdot r$ indicates that a repulsive force field exists only within the space of a body. The result $E_r = \text{const} = a$ is derived from the assumption that a repulsive force field exists in space. This means that repulsive force comes into existence for a particular minimum radius, at which the forces due to positive and negative energy are equal and opposite. Therefore, the body cannot contract further. In other words, the body cannot contract to infinite density and the density of the body is uniform. Hence the range of the repulsive force is $0 \leq r \leq r_{\min}$.

We now find the expression for the minimum radius of the body. Consider a universe that expands uniformly while energy is created at a constant rate.

According to our assumptions, a repulsive force field exists up to the minimum radius of $r = C.t$. The magnitude of the repulsive force field is

$$Er = \frac{Gm}{r^2} \quad (16)$$

At $r = r_{\min} = C.t$, $Er = a$. Substituting these into Eq. (16) yields

$$a = Gm / r_{\min}^2 \quad (17)$$

Next, we substitute $r_{\min} = C.t$, $m = m_{\alpha}t$, and $m_{\alpha} = C^3 / G$ into Eq. (17) to yield

$$a = C/t \quad (18)$$

Eliminating a from Eqs. (17) and (18), we obtain $r_{\min} = Gm / C^2$.

13) Gravitational waves [10] are absent. Alternatively, a force field pervades space instantaneously when energy is created.

Proof: The momentum of the negative energy of a body of mass m' is $p = -m'.v$. Substituting $v = r/k$ yields $p = -m'r/k$. The force generated by negative energy contained within the space of instantaneous radius $r = v.t$ opposes the motion of the body. From $F = -m'.v/k$, we replace k with t (because k flows) to obtain $F = -m'.v/t$. $E = -v/t$; hence, $dE = v.dt / t^2$ where $dr = v.dt$. When the body covers an infinitesimal distance dr in infinitesimal time dt , then the force per unit mass changes in infinitesimal time dt . This means that the force per unit mass changes instantaneously. Therefore, the force changes instantaneously when a body is displaced under the action of an attractive force field of another body. Thus, gravitational waves are absent. Similarly, for the positive energy of a body, the force is repulsive and the action is transmitted instantaneously.

We now prove that when energy is created, the field pervades space instantaneously. An attractive force field due to negative energy is expressed as $E = -v/t$, and hence $dE = v.dt / t^2$. As $v^3 = m_{\alpha}G$ and $dm = m_{\alpha}dt$, $dE = (G.dm) / v^2t^2$. The attractive force field changes instantaneously when energy is created in infinitesimal time dt . However, energy comes into existence instantaneously. For example, particles such as neutrons and photons come into existence when the

time interval becomes equal to their creation time. Thus, an energy field pervades space instantaneously when energy is created.

14) Geometry of the universe is flat

Proof: Consider a body of mass m' located on a sphere expanding with velocity v . The repulsive force on this body is due to the positive energy in the sphere of instantaneous radius $r = v.t$ that expands at velocity v . Therefore, $F = \frac{m'v}{k}$. The body has radial velocity. Therefore, the displacement of the body from the centre of the universe is equal to the radius vector. Given that the force and displacement are acting in the same direction, the work performed by repulsive force in the interval $0 < s \leq r$ is

$$W = \int F.ds . \text{ This implies that } W = \frac{m'v}{k} \int_{s=0}^{s=r} ds$$

$$W = \frac{m'vr}{k} \quad K = W = m'v^2, \text{ where } v = r/k.$$

The body is under the action of two equal and opposite forces. Therefore, the net effect of force on the body due to repulsive and gravitational force is zero, and thus the net work performed by both forces is also zero. Therefore, the velocity of the body is constant. This indicates that the kinetic energy of the body is due to the expansion of space.

We now find the total mechanical energy of the system. The gravitational potential energy of the body sphere system is $U = -\frac{Gmm'}{r}$. The total mechanical energy of

the system is $E = K + U$. For $E = m'v^2 - \frac{Gmm'}{r}$, substituting $r = v.t$, $m = m_\alpha t$, and

$m_\alpha = \frac{v^3}{G}$ yields $E = 0$. This result indicates that the total energy density of the

universe is equal to the critical density. Hence, the universe is flat.

3. RESULTS

With the above-mentioned assumptions, we obtain the following results from the law of energy creation.

1. The universe expands at a constant rate, i.e. concentric spheres with origins at the centre of the universe expand with uniform velocity according to the law $v = r/k$.
2. The density of the universe is homogeneous.
3. Space-time does not break down, i.e. the universe does not start with a zero radius. Rather, it starts with the minimum radius of r_s .
4. Time has a beginning, i.e. time starts to flow at the minimum value of t_s .
5. All observers measure the age of the universe identically, i.e. the universe is associated with its own cosmic clock.
6. A repulsive force.
7. The creation of energy begins at the smallest time t_s ,
8. When time runs forward, space-time and energy co-exist.
9. The universe has a maximum age T.
10. When the age of the universe becomes equal to T, energy disappears; that is, at time $t = T$, the flow of time stops such that energy disappears.
11. When time runs backward, no energy is created.
12. We can derive Gauss' law of gravitation.
13. Repulsive force has a short range. Attractive force has infinite range; otherwise, the body cannot contract to infinite density.
14. The force changes instantaneously when a body is displaced under the action of the attractive (or repulsive) force field of another body, i.e. gravitational waves are absent. Alternatively, a force field pervades space instantaneously when energy is created.
15. The universe is finite and bounded.
16. The geometry of the universe is flat.

4. DISCUSSION

Energy is created at a constant rate of $m_\alpha = C^3 / G = 4.03 \times 10^{35}$ kg/s. The law of energy creation predicts that the universe is finite and bounded, and that the geometry of the universe is flat. This leads to a total energy density of the universe that is equal to the critical density. Hence, the universe expands at a critical rate, which is in agreement with the WMAP observations. Space either expands or contracts. During the forward flow of time, the universe expands uniformly according to the law $v = r/k$. This law, which has the same form as Hubble's law [11], is applicable only to measurements of the velocities of galaxies made with respect to the centre of the universe. However, observations show that Hubble's relation fits well for all velocities. This means that the position of our Milky Way may be near the centre of the universe. Thus, the law $v = r/k$ holds, and the equation has the status of Hubble's law, that is, $k = 1/H$. This implies that the Hubble constant is a measure of the time or age of the universe. From WMAP data, $H = 71$ km/s/Mpc; the value $t = 1/H$ gives the total energy density of the universe as $\rho = 1.89 \times 10^{-26}$ kg / m³. This is twice as large as that predicted by the Big bang theory [5][6]. The reason is that we have no direct method for measuring the energy density of the universe. The Big bang theory leads to three possible geometries of the universe. We measure the energy density by observing the geometry of the universe. Given that the universe is flat, its energy density can be calculated by the critical density equation [5]. Hence, we obtain an energy density that differs by a factor of two. According to predictions of the law of energy creation, the value $t = 1/H$ gives the energy, time, and radius of the universe as $m = 1.75 \times 10^{53}$ kg, $t = 1.37 \times 10^{10}$ years, and $r = 1.37 \times 10^{10}$ light years, respectively. These values agree well with known observations [8].

The creation of energy and uniform expansion of the universe starts with the smallest radius at which the velocity flux is minimal. Concentric spheres have different expansion rates. Therefore, the rate of energy creation is different, although the energy density of all concentric spheres is identical and depends only on time. Thus, the density of the universe is homogeneous. However, it contains local irregularities such as stars and galaxies. These develop because of the nature of forces due to positive and negative energy. Although attractive force exists throughout space, repulsive force exists only within the space of a body. The latter

comes into play at the minimum radius. Therefore, attractive force is responsible for the aggregation of particles into stars and galaxies. In space, where the density of energy is less than the average density, energy creation maintains a uniform density. This leads to the homogeneity of density on a large scale [1][3][7].

The law of energy creation assumes that created energy contains equal amounts of positive and negative energy. The law of force due to negative energy is Newton's law of gravitation, which states that the force of attraction between two bodies is due to their negative energy. The existence of repulsive and attractive force fields depends on the property of the space. Attractive force fields exist in spaces of negative energy and repulsive force fields exist in spaces of positive energy. Free space has negative energy; hence, the existence of attractive (gravitational) force in space. The repulsive force comes into play when a body contracts to a minimum radius. Forces due to positive and negative energy are equal and opposite. Hence, the body cannot contract to infinite density. When energy is created, a force field pervades space instantaneously. In addition, the force changes instantaneously when a body is displaced under the action of the force field of another body,. In other words, action is transmitted instantaneously. Therefore, gravitational waves [10] are absent.

The law of energy creation predicts that time can run both forward and backward [3]. Time runs forward from smallest value t_s to maximum value T. During the forward flow of time, energy creation occurs in the range $t_s < t < T$. At $t = t_s$ and $t = T$, the energy in the universe is zero. At time $t = T$, time starts to run backward. Here, the universe contracts in the absence of energy creation. When the flow of time reaches t_s , time runs forward once again. This cycle continues.

5. CONCLUSION

Energy comes from free space according to the law of energy creation. A body contains an equal amount positive and negative energy: that is, a positive energy $+mC^2$, and a negative energy $-mC^2$ that does not exist in the form of mass. Thus, the total energy of the body is zero. The universe starts creating energy from the

smallest time $t = t_s$ to the maximum age of the universe $t = T$. At time $t = T$, the energy in the universe disappears. Subsequently, time starts to run backwards. That is, time decreases from T to t_s , during which the universe contracts in the absence of energy creation. When the time once again becomes equal to t_s , energy creation resumes and the universe begins to expand to repeat the cycle. The general theory of relativity does not predict whether the universe is finite or infinite. The law of energy creation predicts that the universe is finite and bounded. General relativity does not predict the origin and fate of the universe. The law of energy creation predicts that the universe starts at a minimum radius and time. The universe begins to expand from smallest to maximum radius, after which contraction begins. This cycle repeats itself.

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