Universal Laws and the Structure of the "Total Universe"

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Recent developments in Particle Physics and Cosmology lead one naturally to the existence of many universes. Although direct confirmation of other universes is difficult, it is not impossible. This paper is a look at a new theory of multiple universes. The idea of t = 0, goes back long before the creation of our universe. The "Total Universe' contains many universes like our universe. The number of universes is infinite, so some universes are far older than our universe. These ultimate areas of space were our universe started, is still creating new universes. Many big bangs have occurred in the past, and many big bangs will occur in the future. Big bangs are not something that happens just once or twice. Many different universes exist; in this larger area of space we can call the 'Total Universe'. In the 'Total Universe' the second law of thermodynamics is violated. The second Law of thermodynamics is a general law; it is not a universal law. The level of disorder in the 'Total Universe' is both increasing, and decreasing. In the 'Total Universe', entropy can increase, decrease, or remain constant. Individual universes are being created in the 'Total Universe'; in these areas of the 'Total Universe' energy is not conserved. The 'Total Universe' is an energy creating machine. The conservation of energy is a general law because there are areas where external forces are being created so that the conservation of energy would not be valid.

Keywords: multiple universes, "Total Universe', entropy, energy, second Law of thermodynamics.

Introduction

Time started long before the big bang that started our universe. In fact, our universe is just one of many that exist in a larger area of space. So the big bang that began our universe is not the beginning of time, but it was just the start of our universe. The idea of t = 0, goes back long before the creation of our universe. Time has been around for an unlimited period. Then the time variable t, takes on only positive values, then it becomes positively infinite. We write,

$$t \to \infty \tag{1}$$

$$\lim_{t \to c} f(x) = \infty \tag{2}$$

$$\lim_{t \to \infty} t_b = \infty \tag{3}$$

where t_b is the beginning of time. We can say this because $\lim_{x \to \infty} f(x) = \infty$ iff for each M>0 there exists K>0 such that, if x≥K, then f(x) ≥ *M*. When a variable becomes infinite, its values increase without bound. Time is not just continuing in our universe, but time is continuing in the area of space where our universe began. Our universe is not as old as time, in the larger area of space that was our universe's origin, time is older than we can understand. The limit of time is infinite; time started zillions and zillions of years ago. Many others universes are much older than our universe. This larger area of space contains many other universes. The number of universes is infinite, so some universes are far younger than our universe. These ultimate areas of space were our universe started, is still creating new universes. Many big bangs have occurred in the past, and many big bangs will happen in the future. Big bangs are not something that happens just once or twice. Many different universes exist; in this larger area of space we can call the 'Total Universe'. The 'Total Universe' is the area where big bangs occur; our universe is just one of many universes that have started there [Hawley, 1998; McGraw 2015].

Observational Evidence for Multiverses

Although direct confirmation of other universes is involved, it is not impossible. There have been some recent studies of the cosmic microwave background. These studies have been interested in looking for collisions between universes. The researchers have found bumps by other universes. If they can verify their data and conclusions, it would be the first evidence that other universes exist [Feeney, 2011]. Roger Penrose and Vane Gurzadyan have also used data from the cosmic microwave background; they have been searching for what could have occurred before the Big Bang. They have found evidence for a cyclic cosmology in which Big Bangs occur over and over [Gurzadyan, 2010]. Observational cosmologists have now detected gravitational waves in the aftermath of the big bang. Some cosmologists have suggested that this discovery might mean that many universes exist. Many cosmologists suggest that the process that inflates a universe also leads to many universes. The many universes concept comes from the idea of external inflation, in which the inflationary period that our universe went through right after the big bang was just one of many inflationary times that different parts of space were and are still undergoing. Eternal inflation occurs an infinite number of times, creating an infinite number of universes. Many observations that have been made of our universe can best be explained by multiple universes. An example is the lack of dark energy that we have not been able to observe in our universe. New observational cosmology results are being discovered as the cosmic microwave background data continues to be studied. This new data has helped us to probe and understand the beginnings of the universe. Over the next few decades, it might be possible for us to discover other universes [De Lorenci, 2002; Dodelson, 2003; Feeney, 2011; Gurzadyan, 2010].

The Definition of Time in the 'Total Universe'

The question then becomes how to define time in the 'Total Universe', and how to determine the time in other universes [Carr, 2007; Gemmer, 2009; Kiefer, 2007; McGraw, 2015].

$t_u = 0$	This is when our universe started	(4)
$t_l = 0$	This is the total time for the 'Total universe'	(5)
$t_w = 0$	This was when other universes started	(6)
$t_l > t_u$	and $t_l > t_w$	(7)

This 'Total Universe' began at $t_l \rightarrow \infty$, which is long before our universe got its beginnings. An example of how this all works is balloons in a large room. The area of the large room would be the 'Total universe'. We could also say the 'Total universe' is the area of this room. The balloons are the smaller universes that form within the entire area. Just one of the balloons would be our universe. Of course, there can be many balloons or many universes. The balloons or universes can expand as much as their masses let them. The balloons or universes could even contract, and lose area. Time then started or began when this larger 'Total universe' came into being. Time has continued forward since the beginning of this 'Total universe'. For example, when the Sun started to burn hydrogen about 4.5 billion years ago, our Sun was created, but that is not the beginning of time. Time did not start at our universe's beginning. The 'Total Universe' existed long before. Just like M4, a globular cluster of stars is 12.7 billion years old, which is older than our Sun. Time will even continue when our universe ends. If our universe would end, time will continue in this 'Total universe'. In fact, many universes had begun and died long before our universe even got it start. The Big Bang that started our universe is one of many universes that are contained in the 'Total Universe'. Many universes have been created since the beginning of time. So if we are interested in the entire time that the 'Total universe' has existed,

$$\text{(Present time)} = t_p$$

$$t_p = (t_l + t_u) \tag{8}$$

Structure of the 'Total Universe'

The entire area of the 'Total Universe' approaches ∞. This area includes all of the many universes that exist now, in the past, or in the future. In this total area, there are places where the big bangs occur. These regions are the only areas for big bang development. The big bangs take place in this area in the 'Total Universe' where temperatures approach ∞. The reasons that big bangs happen in this region of very high temperatures are the combination of several particles. These particles include new species of Neutrinos, Graviton, and the Higgs Boson; these particles are needed for the big bangs to occur. These particles exist in just certain areas of the 'Total Universe'. However, within these regions material that is needed for these high temperatures is continuously being created. Through this process, the big bangs can continue to occur so that new universes similar to our universe can get their start. It is apparent that the second law of thermodynamics is just a general law, and does not hold throughout the 'Total Universe'. In some regions of the 'Total Universe' entropy remains constant or decreases, so then

$$\Delta S_{system} = 0, \text{ or } \Delta S_{system} \prec 0. \tag{9}$$

The system is, of course, the 'Total Universe'. So then the entropy, of our universe and many others, is always increasing. However, in the 'Total Universe' the process is at equilibrium or decreases, around the regions where universes are being created. The entropy is not conserved in the 'Total Universe', in areas where new universes are being created. In these regions, heat is not gained or lost by the system. Also whenever work is done, one system of bodies loses energy and gains energy. The amount of energy lost by one system of bodies always equals the amount of energy acquired by another. In other words, energy can be neither created nor destroyed. This law of the conservation of energy holds in our universe. It also holds in many of the established universes. In the 'Total Universe,' energy must be designed to continue with the creation of new universes. Energy is not conserved in the 'Total Universe'. In summary, in our universe (one of many), the energy in the universe remains constant or is conserved, and entropy in the universe tends to increase. In the "Total Universe', the energy is not conserved, energy is increasing, and the entropy in the 'Total Universe' tends to be increasing, decreasing, or is constant. Each individual universe starts with a big bang and then begins to expand. These different universes began by expanding from an infinitesimal volume with extremely high density and temperature. The universes were initially significant smaller than even a pore on your skin. With each big bang, the fabric of space itself began expanding individual universes like the surface of an inflating balloon. If we trace back these expanding universes, we see that the separations between galaxies become smaller while the density between the galaxies becomes higher; this continues until all matter is compacted into a completely shrunk volume of the universe with incredible density, the moment of the big bang. At very early times the temperature was high enough to ionize the material that filled the universes. The universes, therefore, consisted of plasma of nuclei, electrons, and protons, and the number density of free electrons was so high that the mean free path for Thomson scattering of photons was extremely short [Mukhanov, 2005; Narlikar, 2002]. As the universes expanded, they cooled, and the average photon energy diminished. Eventually, at a temperature of about 300^0 K, the photon energies became too small to keep the universes ionized. At this time, the primordial plasma coalesced into neutron atoms, and the mean free path of the photons increased to roughly the size of the observable universes. Initial inhomogeneities present in the primordial plasma grew under the action of gravitational instability during the matter dominated era into all the bound structures we observe in our universe today. Now, approximately 15 billion years later, it appears that our universe has entered an epoch of accelerated expansion. During most of its history, our universe is very well described by the Big Bang theory. All universes would generally get started in the same way as our universe. Of course, each universe may develop slower or faster than our universe, or it might contain different percentages of the elements, like hydrogen and helium. Also, another universe that evolves from a big bang may even have different sets of physical constants. The value of Plank constant, the electron-proton mass, and the strength of the weak force, etc., does not necessarily have to be the values found in our universe. Their values could be different depending on the type of symmetry breaking that occurs as that new universe is cooling. Just remember that changing these physical constants could alter the structure of that individual universe. For example, if one would increase Plank's constant to 6.626×10^{-20} joules per second, that universe would look very different from our universe. For one thing I doubt atoms could exist in that universe. The energy required to ionize hydrogen depends on h^{-2}. Ionizing is giving the electron of an atom enough energy to leave the hold of the nucleus. So if Plank's constant increases by 10^{14}, then ionization energy of hydrogen would decrease by 10^{28}. If one compared that to the current energy needed to break an electron off an atom, it would reduce dramatically. So if one were to excite an atom even a little bit, it would ionize. Also, if there were a few stable atoms in that universe, they would be huge. The atom would go from being too small to see, to the distance to the nearest galaxy. So that universe would be completely different if one just changed Plank's constant. In general, all universes will be homogeneous and isotropic when averaged over a large scale, expanding, hotter in the past, predominantly matter, and highly inhomogeneous today and locally. On the largest scales, the universe is assumed to be uniform. This idea is called the cosmological principle. There is no preferred observing position in the universes. The universes look the same in every direction. There is an overwhelming amount of observational evidence that our universe is expanding. This means that early in the history of the universe, the distant objects were closer to us than they are today. It is best to describe the scaling of the coordinate grid in an expanding universe by the scale factor [3][9]. In an expanding universe, the scale factor connects the coordinate distance with the physical distance. We have,

$$\text{Coordinate distance} \rightarrow \text{metric} \rightarrow \text{physical distance} \tag{10}$$

The metric is an important tool to make quantitative predictions in an expanding universe. In Cartesian coordinates, we have

$$ds^2 = dx^2 + dy^2 \tag{11}$$

A metric turns observer dependent coordinates into invariants. In 2-D,

$$ds^2 = \sum_{i,j=1,2} g_{ij}\ dx^i dx^j\ , \tag{12}$$

where the metric g_{ij} is a 2×2 symmetric matrix. The advantage of a metric is that it incorporates gravity. In 4 dimensions, the invariant includes time intervals as well:

$$ds^2 = \sum_{\mu,\nu=0}^{3} g_{\mu\nu}\, dx^{\mu}\, dx^{\nu}, \tag{13}$$

where $\mu, \nu\{0, 1, 2, 3\}$ with $dx^0 = dt$ reserved for the timelike coordinate, and dx^i for the spacelike coordinates. A freely-falling particle follows a geodesic in spacetime. The metric links the concepts of geodesic and spacetime:

$$ds^2 = g_{\mu\nu} dx^{\mu} dx^{\nu} \tag{14}$$

where ds^2 is the proper interval, $g_{\mu\nu}$ is the metric tensor, and x^{μ} is a four-vector. If the distance today is x_0, the physical distance between two points at some earlier time t was $n(t)x_0$. At least in a flat universe, the metric must be ≈ Minkowski, except that the distance must be multiplied by a scale factor n(t). So then, the metric of a flat expanding universe is the Friedmann-Robertson-Walker metric:

$$g_{\mu\nu} = \text{diagonal}\,(1, -n^2(t), -n^2(t), -n^2(t)) \tag{15}$$

The evolution of the scale factor depends on the density of each of the universes. When perturbations are introduced, the metric will become far more complicated, and the perturbed part of the metric will become determined by the inhomogeneities in the matter and the radiation. Each universe can expand at different rates at different times. Remember that the 'total universe' has a distance and size that also goes to infinity. So that the 'Total Universe' is not expanding, just the individual universes are expanding. In each universe, we can try to understand time in that particular universe. The fundamental measure from which all others may be calculated is the distance on moving grid. If each of these universes is flat , then computing distances on the moving grid should be easy. One crucial moving distance is the distance traveled by light since the beginning of each of the individual universes. Recalling that we are working in units c=1, in time dt, light travels a distance dx= dt/ n thus, the total moving distance light travels is:

$$\eta = \int_0^t \frac{dt'}{n(t')}. \tag{16}$$

Nothing could have propagated faster than η on the moving grid since the start of that universe; thus η is called the casual horizon. A related concept is the particle horizon d_H, the proper radius traveled by light since the beginning of that universe:

$$d_H = n(t) \int_0^t \frac{dt'}{n(t')} = n(\eta)\,\eta. \tag{17}$$

Area separated by distances > d_H are not casually connected. We can think of η as a time variable and call it the conformal time. Regarding η, the FRW metric becomes,

$$ds^2 = n^2(\eta)[\, d\eta^2 - \frac{dr^2}{1-\kappa r^2} \tag{18}$$

Just like { t,T, z,n}, η can be used to talk about the evolution of each of the universes. In cases that are not complicated, then η can be expressed analytically regarding n. In particular, during radiation domination (RD) and matter domination (MD),

$$\text{RD: } \rho\ \alpha\ n^{-4},\ \eta\ \alpha\ n \tag{19}$$

$$\text{MD: } \rho \; \alpha \; n^{-3}, \eta \; \alpha \sqrt{n} \tag{20}$$

The conformal time as a function of scale-factor in a flat universe containing only matter and radiation is

$$\frac{\eta}{\eta_0} = \sqrt{n + n_{eq}} - \sqrt{n_{eq}} \,, \tag{21}$$

where n_{eq} denotes the epoch of matter-radiation equality. Another necessary moving distance in each of the universes would be the distance between us and a distant emitter, the lookback distance. The moving distance to an object at scale factor n is:

$$d_{\text{lookback}}(n) = \int_{t(n)}^{t_0} \frac{dt'}{n(t')} = \int_{n}^{1} \frac{dn'}{n^2(t')H(n')} \,, \tag{22}$$

where we have used $\frac{dn}{dt} = nH$. In general, we can see objects out to $z \approx 6$. During matter domination (we can ignore radiation), $H \; \alpha \; n^{-3/2}$, then

$$\text{FLAT MD: } d_{\text{lookback}}(n) = \frac{2}{H_0}[\, 1 - \sqrt{n} \,] \tag{23}$$

$$d_{\text{lookback}}(z) = \frac{2}{H_0}[\, 1 - \frac{1}{\sqrt{1+z}} \,]. \tag{24}$$

For small z, $d_{\text{lookback}} \approx \frac{z}{H_0}$, which we know is Hubble Law. We can now define the lookback time, which elapsed between now and when light from redshift z was emitted:

$$t_{\text{lookback}}(n) = \int_{t(n)}^{t_0} dt' = \int_{n}^{1} \frac{dn'}{n(t')H(n')} \,. \tag{25}$$

For a flat, matter-dominated universe, the lookback time to redshift z is:

$$\text{FLAT MD: } \quad t_{\text{lookback}}(z) = \frac{2}{3H_0}[\, 1 - (1+z)^{-3/2}]. \tag{26}$$

The total age of a matter-dominated universe is obtained by letting $z \to \infty$:

$$t_0(\text{FLAT MD}) = \frac{2}{3H_0} \,. \tag{27}$$

For universes that are not totally matter-dominated, the factor $\frac{2}{3}$ will not be right, so we can let $t_0 \approx H_0^{-1}$.

We can estimate how long ago this was by dividing the distance to a galaxy by its recessional velocity. This way we estimate how long ago the distance between that galaxy and ours was essentially zero.

$$\text{Time since the Big Bang} = \frac{s_p}{v_r}, \tag{28}$$

$$\text{Or} \quad v_r = H_0 \times S_p \tag{29}$$

which we can write as,

$$H_0 = \frac{v_r}{s_p} \tag{30}$$

where S_p is the separation distance, and v_r is the recessional velocity. If we use Hubble constant of 71 km/s/Mpc, we find that the universe was around 14 billion years ago. This calculation shows that the big bang occurred as long as 14 billion years ago, which is about three times the age of the Earth. These ages are consistent with the age estimated from the observed expansion of our universe. The age of the universe has been confirmed recently with radioactivity. Thorium and uranium, some of the same elements used to date the formation of the earth, have now been measured in some of the oldest stars in our galaxy, revealing that they are about 14 billion years old. Thus three independent methods of measuring the age agree: the expansion of the universe, the evolution of stars, and radioactive dating. If our universe is 14 billion years old, then the 'Total Universe' is much older. Let us then look at time and area in the 'Total Universe'. The 'Total Universe' is, in general, a static universe. In the 'Total Universe' negative pressure allows for a static universe. So then,

$$\ddot{R} = -\frac{4\pi G}{3}\left(\rho + \frac{3p}{c^2}\right) R, \tag{31}$$

$\ddot{R}$ can be zero if we have,

$$\rho + \frac{3p}{c^2} = 0. \tag{32}$$

Here ρ and p are the sums of contributions from all components. Considering matter and Λ only, for matter $p_M << \rho_M c^2$ so

$$\rho + \frac{3p}{c^2} \approx \rho_M + \rho_\Lambda + \frac{3p_\Lambda}{c^2} = \rho_M - 2\rho_\Lambda . \tag{33}$$

Thus

$$\ddot{R} = -\frac{4\pi G}{3}(\rho_M - 2\rho_\Lambda) R, \tag{34}$$

which is zero if $\rho_M = 2\rho_\Lambda$. This is our static universe. If we continue with Friedmann equation then,

$$\dot{R}^2 + k_0 c^2 = \frac{8\pi G}{3}\rho R^2. \tag{35}$$

Friedmann's equation has on the left-handed side the energy terms and on the right side the curvature term. It is written, in terms of the curvature constant of the system, k_0, as

$$\dot{R}^2 - \frac{8\pi G}{3}\rho R^2 = -k_0 c^2, \tag{36}$$

where R is the scale factor and ρ is the total density in R(t). G is the universal gravitational constant in the 'Total Universe', and c is the speed of light in a vacuum. For our flat 'Total Universe' $R \rightarrow \infty$, and therefore $k_0 = 0$. Equation (35) can be modified, by adding a constant, on the left-hand side of the equation. This additional term can be considered as a density condition. We have,

$$\dot{R}^2 - \left(\frac{8\pi G}{3}\rho + \frac{1}{3}\Lambda c^2\right) R^2 = - k_0 c^2, \tag{37}$$

$$\dot{R}^2 - \left(\frac{8\pi G}{3}(\rho + \rho_\Lambda\right) R^2 = - k_0 c^2, \tag{38}$$

$$\dot{R}^2 - \frac{8\pi G}{3}\frac{\rho_0}{R} - \frac{1}{3}\Lambda^2 c^2 R^2 = - k_0 c^2, \tag{39}$$

with $\rho(t)R(t)^3 = \rho(t_0) R(t_0)^3$, where t_0 is the present time in the 'Total Universe'. If $R \rightarrow \infty$, then $k_0 = 0$, and the present time in the 'Total Universe' $t_0 \rightarrow \infty$. So time in the present 'Total Universe' is infinite [Carr, 2007; Dodelson, 2003]. So we have,

$$t_p = t_l + t_u \tag{40}$$

$$tu = 15 \text{ billion years} \tag{41}$$

$$tp = tl + 15 \text{ billion years} \tag{42}$$

$$tl = \infty \tag{43}$$

$$tp = \infty + 15 \text{ billion years} \tag{44}$$

$$tp = + \infty \tag{45}$$

The Number of Universes Produced in the 'Total Universe'

The 'Total Universe' contains an infinite number of universes. The number of universes was infinite in the past, and there will be an infinite number of universes in the future. The present number of universes must be $\sum_i = \infty$, as expected after an infinite number of big bangs. If the number of universes is $\sum_i = \infty$, then

$$\sum_\infty = \lim_{N\to\infty} \left(\sum_i N^{-N}\right) \tag{46}$$

$$\sum_\infty = [\lim_{N\to\infty} (N^{-N})] \tag{47}$$

Equation (2) is an indeterminate; it is the product of infinity times zero. This outcome will require us to use set theory in our solution of the equation. Sometimes we need a different way to approach a problem. An example is how to count an infinite set. If two sets A and B are infinite sets then the sets have the same cardinality as a one-to-one, onto function (a bijection) f: A→B. It 's hard to assign a standard number to the size of an infinite set, we try to understand the problem in a different way. We line the elements up in exactly corresponding pairs; we can then say the two sets have the same cardinality. So for example, the set of natural numbers N = {0, 1, 2…} has the same cardinality as the number of universes. So then we have a 1-1, onto correspondence[5].

Theorem 1. Set A is called an infinite set if it is not a finite set.

Some examples of infinite sets are the natural numbers $\aleph$, the integers Z, the Reals $\Re$, and the numbers of universes.

Theorem 2. Set A is called countably infinite if there exists a bijection between the natural numbers $\aleph$ and set A. If set A is countably infinite (A $\approx \aleph$), then A is said to have cardinality denoted by $|A| = \aleph_0$. If Set A is countably infinite or finite, then it is called countable.

Theorem 3. All countably infinite sets are equivalent and have cardinality $\aleph_0$. We can prove this because any two countably infinite sets are equal to the number of universes. If any two countably infinite sets are equivalent to each other, then set equivalence is an equivalence relation. Also, by being countably infinite, each has cardinality $\aleph_0$. Whenever A is countably infinite, then there is a bijection f: $\aleph \rightarrow A$. We then can let f (i) = $a_i \in A$ for i $\geq$ 1. Then A can be written as A = { a_1, a_2, ….}.

Theorem 4. If A is finite and non-empty, and B is countably infinite with A $\cap$ B = $\varnothing$, then A $\cup$ B is countably infinite. If A and B are countably infinite with A $\cap$ B = $\varnothing$, then A $\cup$ B is countably infinite. Any infinite subset S of a countably infinite set A is countably infinite.

Theorem 5. The set integers Z is countably infinite.

Theorem 6. If A is countably infinite, then A is an infinite set. So then let A be an infinite set and let f:A $\rightarrow \aleph$ be one-to-one.

We can prove this by redefining the function as f:A→Range f. Then f is both one-to-one and onto. So then, because A is infinite, A is equivalent to Range f which must be infinite. But then, Range f is countably infinite, hence Range f an infinite subset of N.Therefore A is countably infinite because it is equivalent to the countably infinite set Range f.

Theorem 7. Set A is uncountable if it is infinite but not countably infinite.

All finite sets can be counted. Countably infinite sets are infinite, but are equivalent to the natural numbers 1, 2, 3,…., so they can be counted. The irrational numbers, the real numbers, and the number of universes in the 'Total Universe' are uncountable sets.

Theorem 8. The interval (0, 1) is uncountable.

We can prove this because (0, 1) contains all fractions of form 1/ n for n $\geq$ 2; the interval is at least infinite. Suppose though that (0, 1) is countable infinite. We would then obtain a contradiction. If (0,1) is countably infinite, then there exists a bijection f: $\aleph$ →(0.1). So then, for every natural number n, 0 < f(n) < 1. So we can consider the list f(1), f(2), f(3),... All such value in (0,1) has a unique decimal expansion of form $0.d_1d_2d_3$…….= $\frac{d_1}{10} + \frac{d_2}{100} + \frac{d_3}{1000} + \ldots$, where $d_i \in \{0,1,2,\ldots\ldots,9\}$. Also, there is no ending string of all 9. Next, we consider the terms d_{11} in f(1), d_{22} in f(2), d_{33} in f(3), d_{44} in f(4), d_{55} in f(5), etc. We then create a new element x = $0.e_1,e_2,e_3$, …. In (0,1) by letting e_i = 3 if d_{ii} = 4 and letting e_i = 4 if $d_{ii} \neq 4$. In the example values above, the first four digits in x are 0.4443… If the i th decimal digit in x is different than the i th decimal digit in f(i). Then x cannot equal f(i) for any i. So x is not in the range of f. So then, f is not onto, which is a contradiction to it being a bijection. Thus (0,1) cannot be countably infinite. The symbol $\aleph_0$ represents an infinite set, and if we know that the number of universes is always $\aleph_0$, then the number of universes is infinite. When we multiply $\aleph_0$ by an infinite or a finite N, it remains $\aleph_0$. This holds for any infinite or finite N in equation (2), and it extends long into the past. So then, in the 'Total Universe,' the number of universes are infinite for a long time into the past. At each beginning the number of universes increase by a factor N, but N x ∞ =∞, so that the total number of universes will remain infinite into the future. In conclusion, in the 'Total Universe,' the number of universes being created is infinite in both the past and the future [Kiefer, 2007].

The Quantum Structure of the 'Total Universe'

The 'Total Universe' is made up of many universes, in fact, universes are still created. If each of the different universes is homogeneous and isotropic regions of spacetime with a cosmological constant Λ_k, then there are a set of n scalar fields that represent the matter of the k-universes, $\vartheta^{(k)} = (\vartheta_1^{(k)}, \vartheta_2^{(k)} .... \vartheta_n^{(k)})$. The index k labels the different types of universes that exist in the 'Total Universe'. For each of the universes in the 'Total Universe' spacetime general relativity is valid, and the Friedmann-Robertson-Walker (FRW) metric can describe the geometry of the spacetime. The canonical quantization can then be followed for each universe that exists in the 'Total Universe'. Quantum mechanically a wave function ϕ_k = (a, ϑ) is the solution of the Wheeler-DeWitt equation

$$\{-\nabla_{LB}^2 + \nu^{(k)}(a,\vartheta)\}\phi_k(a,\vartheta) = 0, \qquad (47)$$

where ∇_{LB} is the covariant generalization of the Laplace operator, given by

$$\nabla_{LB}^2 = \frac{1}{\sqrt{-\varsigma}} \frac{\partial}{\partial q^A} (\sqrt{-\varsigma}\varsigma^{AB} \frac{\partial}{\partial q^B}), \qquad (48)$$

and $\nu^{(k)}$(a, ϑ) is the potential of each of the fields. The general quantum state of the universes in the 'Total Universe' is given by a wave function $\Psi_N(a,\phi)$. This wave function is a linear combination of product states, like

$$\Psi_{N_1}^{\alpha_1}(a,\phi_1)\Psi_{N_2}^{\alpha_2}(a,\phi_2).........\Psi_{N_m}^{\alpha_m}(a,\phi_m), \qquad (49)$$

where $\phi = (\phi_1, \phi_2, ..., \phi_m)$ and N = (N_1, N_2, ……….,N_m), with N_k being the number of universes of type k represented by the wave function $\phi_k = \phi(a,\vartheta)$. The function $\Psi_{N_k}^{\Lambda_k} = (a,\phi_k)$ in equation (46) would then be the solutions of the third quantized Schrodinger equation

$$\mathrm{k}\frac{\partial}{\partial a}\Psi_{N_k}^{\Lambda_k}(a,\phi_k) = \mathrm{H}^{(k)}(a,\phi,p_\phi)\Psi_{N_k}^{\Lambda_k}(a,\phi_k), \qquad (50)$$

where $\mathrm{H}(a,\phi,p_\phi)$ is the third quantized Hamiltonian that corresponds to each kind of universe. If we consider one scalar field, the Wheeler-DeWitt equation for the k-universe is written,

$$\ddot{\phi} + \frac{\dot{\mathrm{M}}(a)}{\mathrm{M}(a)}\dot{\phi} - \frac{1}{a^2}\phi'' + \omega^2(a,\vartheta)\phi = 0\,, \tag{51}$$

The potential term in Equation (50) can be written

$$\omega^2(a,\vartheta) = \sigma^2(\Sigma^2 a^4 - a^2)\,, \tag{52}$$

where in the last equality it has been assumed to be a quadratic potential and $\Sigma = \Sigma(\vartheta)$ is the Hubble function. Each of the single universes that are created in the 'Total Universe' can be described using equations (50) and (51). So then we can write the Wheeler-DeWitt equation for each single universe as

$$\phi^{SC}(a,\vartheta) = \frac{1}{\sqrt{\mathrm{M}(a)\omega_0(a)}} e^{\pm k\sigma S(a)}\Delta(a,\vartheta), \tag{53}$$

with a prefactor, that depends on the gravitational degrees of freedom. If $\Sigma = \Sigma_0$, then

$$\mathrm{S(a)} = \int^{a} da'\omega_0(a') = \frac{(a^2\Sigma_0^2 - 1)^{\frac{3}{2}}}{3\Sigma_0^2}\,, \tag{54}$$

the function $\Delta(a,\vartheta)$ contains all the information that is needed about the scalar field. Equation (53) satisfies the Schrodinger equation

$$\pm k\frac{\omega_0(a)}{\sigma a}\dot{\Delta}(a,\vartheta) = \left(\frac{1}{2\sigma a^3}\frac{\partial^2}{\partial\vartheta^2} + 2\pi^2 a^3 V(\vartheta)\right)\Delta(a,\vartheta), \tag{55}$$

where $\dot{\Delta} = \frac{\partial\Delta}{\partial a}$, the expansion (or contraction) of each single universe that is contained in

the 'Total Universe', this is given by the Friedmann equation $\frac{\partial a}{\partial t} = \pm\frac{\omega_0(a)}{\sigma a}$. If t is the Friedmann time, the Schrodinger equation (54) is written,

$$\mathrm{k}\frac{\partial\Delta}{\partial t}(\vartheta,t) = \mathbf{h}(\vartheta,t)\ \Delta(\vartheta,t) \tag{56}$$

where $\mathbf{h}\ (\vartheta,t)$ is the Hamiltonian for the matter field ϑ. The equations (52)-(55) are general and are valid for other kinds of potentials and matter fields of the k-type of universes that are in the 'Total Universe'. The function $\Delta(t,\vartheta)$ in equation (55) can be written regarding eigenfunctions $\Delta_n(t,\vartheta)$ with a time-dependent mass. If

$$\Delta(t,\vartheta) = \Sigma_n B_n \Delta_n(t,\vartheta) \tag{57}$$

then,

$$\Delta_n(t,\vartheta) = \left(\frac{1}{2^n n!}\sqrt{\frac{\eta(t)\tilde{m}}{\pi}}\right)^{\frac{1}{2}} \mathrm{e}^{-k(n+1/2)\tilde{m}t}\ \mathrm{x}\ \mathrm{e}^{\frac{k\eta(t)}{2}(-3/2\Sigma_0 + k\tilde{m})\vartheta^2}\ \mathrm{H}_n\left(\sqrt{\eta(t)\tilde{m}}\vartheta\right), \tag{58}$$

with $\eta(t) \approx \frac{\sigma}{8\Sigma_0^3} e^{3\Sigma_0 t}$, H_n (x) the Hermite polynomial of degree n, and $\tilde{m} = \sqrt{m^2 - \frac{9\Sigma_0^2}{4}}$. We can then apply the inverse relation t $\approx \Sigma_0^{-1}$ ln(2 Σ_0 a), and finally write the wave function of universe contain in the 'Total Universe', regarding the scale factor and scalar field as

$$\phi^{SC}(a,\vartheta) = \sum_n B_n \phi^{SC}(a,\vartheta) = \sum_n B_n \left|\phi^{SC}(a,\vartheta)\right| e^{\pm k\sigma S_n(a,\vartheta)} \quad (59)$$

The Wheeler-DeWitt equation can be written for each mode,

$$\ddot{\phi}_N + \frac{\dot{M}(a)}{M(a)} \dot{\phi}_N + \Omega_N^2 (\mathrm{a}, \vartheta)\ \phi_N = 0, \quad (60)$$

where

$$\Omega_N^2(a,\vartheta) = \omega_0^2 \pm 2k\omega_0 \frac{\dot{\Delta}_N}{\Delta_N}. \quad (61)$$

The $\pm$ sign will depend on whether we consider an expanding or a contracting branch of individual universes. It can be useful, to write down the leading order of the asymptotic behavior of $\Omega_N(a)$ for large values of the scale factor a:

$$\Omega_N \approx \Omega = (\mathrm{H}_0^2 (1 \pm \frac{9}{2}\vartheta^2) \pm k3H_0 \tilde{m}\vartheta^2)^{1/2}\ \sigma a^2 . \quad (62)$$

The total Hamiltonian of the k-type of universes, $H^{(k)}$ in equation (49), corresponds to the sum of all the contributions of the modes, where the label k of the type of universe has been reintroduced,

$$H^{(k)} = \sum_N H_N^{(k)} . \quad (63)$$

In the third quantization formalism the wave function of each universe is now an operator, so then

$$\hat{\phi}(a,\vartheta) = \sum_N A_N(a,\vartheta)\hat{c}_{0,N} + A_N^{\bullet}(a,\vartheta)\hat{c}_{0,N}^{\mathrm{T}}, \quad (64)$$

where A_N (a, ϑ) and $A_N^{\bullet}(a,\vartheta)$ are probability amplitudes. The mode is expected to remain at the value n-mode because we are not considering interaction terms between different modes of the wave function of the k-universe. Therefore, we have no interaction terms in the Hamiltonian of the k-universe [De Lorenci, 2002; Gemmer; 2009; Roos, 2003]

Varying the Gravitational Constant and Varying the Speed of Light

In the 'Total Universe' many constants can vary in each individual universe. For example, the gravitational constant G can be a different value in each individual universe. If we start with Friedmann universes with varying speed of light c, and varying gravitational constant G, we have

$$\varsigma(t) = \frac{3}{8\pi G(t)}\left(\frac{\dot{a}^2}{a} + \frac{kc^2(t)}{a^2}\right) \qquad (65)$$

$$p(t) = -\frac{c^2(t)}{8\pi G(t)}\left(2\frac{\ddot{a}}{a} + \frac{\dot{a}^2}{a^2} + \frac{kc^2(t)}{a^2}\right) \qquad (66)$$

The field equations are then,

$$\frac{\dot{a}^2}{a^2} = \frac{8\pi G(t)}{3}\varsigma - \frac{kc^2(t)}{a^2} \qquad (67)$$

$$\frac{\ddot{a}}{a} = \frac{-4\pi G(t)}{3}\left(\varsigma + \frac{3p}{c^2(t)}\right) \qquad (68)$$

where p is the pressure and ς is the mass density, then

$$\dot{\varsigma}(t) + 3\frac{\dot{a}}{a}\left(\varsigma(t) + \frac{p(t)}{c^2(t)}\right) = -\varsigma(t)\frac{\dot{G}(t)}{G(t)} + 3\frac{kc(t)\dot{c}(t)}{4\pi Ga^2} \quad . \qquad (69)$$

In this equation a= a(t) is the scale factor, a dot means a derivative with respect to time t, G = G(t) is the time varying gravitational constant, c= c(t) is the time varying speed of light, and the curvature index k = 0, ± 1. We can then use equation (1.3) and equation (1.4) to try and understand how new universes are being created in the 'Total Universe'.

Let us start by setting k = +1 and c = 0. The scale factor in the 'Total Universe' takes on the form

$$a(t) = a_0\left|\tan(\pi\frac{t}{t_s})\right| \quad . \qquad (70)$$

The gravitational constant can be written,

$$G(t) = \frac{4G_s}{\sin^2(2\pi\frac{t}{t_s})} \qquad (71)$$

Which then gives the mass density and pressure as

$$\varsigma(t) = \frac{3}{8\pi G_s}\left[\frac{\pi^2}{t_s^2} + \frac{3c^2\cos^4(\pi\frac{t}{t_s})}{a_0^2}\right], \qquad (72)$$

$$p(t) = -\frac{c^2}{8\pi G_s}\left[\frac{\pi^2}{t_s^2} + 4\frac{\pi^2\sin^2(\pi\frac{t}{t_s})}{t_s^2} + \frac{c^2\cos^4(\pi\frac{t}{t_s})}{a_0^2}\right] \qquad (73)$$

In the 'Total Universe' if t = mt_s, with m= 0,1,2,….., then we have regularized big bangs. Each time the scale factor a(t) attains a singular value, like vanishes or reaches infinity, the gravitational coupling becomes infinite (G→∞). Then one can the calculate the equation of state from equations (1.8) and (1.9),

$$p(\varsigma) = -c^2\left[\frac{\pi}{2G_s t_s^2} + \frac{\varsigma}{3} - \frac{\pi^{\frac{3}{2}} a_0}{c t_s^2}\sqrt{\frac{2\varsigma}{3G_s}} - \frac{\pi}{4G_s^2 t_s^2}\right] \tag{74}$$

with

$$\varsigma \geq \frac{3\pi}{8G_s t_s^2}, \tag{75}$$

which agrees with equation (1.8) for t= m/2 and m = 0,1,2,……[Leslie, 1989; Tegmark, 2004].

Second Law of Thermodynamics is not a Universal Law

If we generalized Maxwell's electromagnetic Lagrangian (linear and nonlinear) we have,

$$\Gamma = -\frac{1}{4\mu_0} F^{\mu\nu} F_{\mu\nu} = -\frac{1}{4\mu_0} F \tag{76}$$

$$\Gamma = -\frac{1}{4\mu_0} F + \omega F^2 + \eta F^{*2} \tag{77}$$

where $F^{\mu\nu}$ is the electromagnetic field strength tensor and μ_0 is the magnetic permeability. If $F^* = F^*_{\mu\nu} F^{\mu\nu}$, and if we just consider the FRW Model of the Universe, we can write the energy-momentum tensor in nonlinear form as

$$T_{\mu\nu} = -4\frac{\partial\Gamma}{\partial F} F_\mu^{\ \alpha} F_{\mu\nu} + \left(\frac{\partial\Gamma}{\partial F^*} F^* - \Gamma\right) g_{\mu\nu} \tag{78}$$

A modified Lagrangian can be written as,

$$\Gamma = -\frac{1}{4} F + \alpha F + \beta F^{-1} \tag{79}$$

This modified Lagrangian density can be used to discuss the acceleration of the 'Total Universe' for weak fields ($E \cong 0$). The energy density and pressure for electromagnetic fields are written like this,

$$\rho_F = -\Gamma - 4E^2 \Gamma_F \tag{80}$$

$$P_F = \Gamma - \frac{4}{3}(2B^2 - E^2)\Gamma_F \tag{81}$$

If F= 2(B² — E²), then we have,

$$\rho_F = ½(B^2 + E^2) - 4\alpha(B^2 - E^2)(B^2 + 3E^2) - \frac{\beta(B^2 - 3E^2)}{2(B^2 - E^2)^2} \tag{82}$$

$$P_F = \frac{1}{6}(B^2 + E^2) - \frac{4\alpha}{3}(B^2 - E^2)(5B^2 - E^2) + \frac{\beta(7B^2 - 5E^2)}{6(B^2 - E^2)^2} \tag{83}$$

The standard Friedmann equation for a flat FRW Model of the universe can then be written,

$$H^2 = \frac{8\pi G}{3} \rho_{Total} \left(1 - \frac{\rho_{Total}}{\rho_1}\right) \tag{84}$$

So then the energy conservation equation is given by

$$\dot{\rho}_{Total} + 3H\,(\rho_{Total} + p_{Total}) = 0 \tag{85}$$

The electric field E in the 'Total Universe', gives rise to an electric current of charged particles, but then it decays quickly. So the magnetic field dominates and E $\cong$ 0. So then equations (70) and (71), energy density and pressure are,

$$\rho_B = \tfrac{1}{2} B^2 - 4\alpha B^4 - \frac{\beta}{2B^2} \tag{86}$$

$$P_B = \frac{1}{6} B^2 - \frac{20\alpha}{3} B^4 + \frac{7\beta}{6B^2} \tag{87}$$

with

$$\rho_{Total} = \rho_m + \tfrac{1}{2} B^2 - 4\alpha B^4 - \frac{\beta}{2B^2} \tag{88}$$

and

$$p_{Total} = \omega_M\ \rho_m + \frac{1}{6} B^2 - \frac{20\alpha}{3} B^4 + \frac{7\beta}{6B^2} \tag{89}$$

So then the conservation equation (73) is written,

$$\dot{\rho}_m + 3H(1 + \omega_m)\,\rho_m = Q \tag{90}$$

and

$$\dot{\rho}_B + 3H(\rho_B + p_B) = -\,Q \tag{91}$$

where Q is the interaction term, which is written as

$$Q = 2\,\delta\, B\left(1 - 16\,\alpha B^2 + \frac{\beta}{B^4}\right)H \tag{92}$$

with B written as

$$B = -\,\delta + \frac{B_0}{a^2} \tag{93}$$

A hypergeometric function is a function whose power series representation has the form

$$\sum_{k \geq 0} \frac{a_1^{\bar{k}} \ldots\ldots\ldots a_p^{\bar{k}} z^k}{b_1^{\bar{k}} \ldots\ldots\ldots b_q^{\bar{k}}\, k!} \tag{94}$$

We denote such a function by $F(a_1 \ldots\ldots a_p; b_1 \ldots\ldots b_q; z)$. If B_0 and ρ_0 are positive integration constants we can use ${}_2F_1$ a hypergeometric function to obtain,

$$\rho_m = \rho_0 a^{-3(1+\omega_m)} + \frac{2\delta}{a^6}[- \frac{a^6(\beta+\delta^4-16\alpha\delta^6)}{3\delta^3(1+\omega_m)} + \frac{16\alpha B_0^3}{3(1-\omega_m)} + \frac{48a^2\alpha\delta B_0^2}{3\omega_m - 1}] + \frac{2B_0}{a^2\delta^3(1+3\omega_m)}(-3\beta + \delta^4 - 48\alpha\delta^6 + 6\beta_2 F_1[½ (1+3\omega_m), 1, \frac{3(1+\omega_m)}{2}, \frac{a^2\delta}{B_0}] - 4\beta_2 F_1[½ (1+3\omega_m), 2, \frac{3(1+\omega_m)}{2}, \frac{a^2\delta}{B_0}] + \beta_2 F_1[½ (1+3\omega_m), 3, \frac{3(1+\omega_m)}{2}, \frac{a^2\delta}{B_0}]$$

If we have a Flat FRW model universe, the radius is

$$R_A = \frac{1}{H} \tag{96}$$

So then,

$$\dot{R}_A = - \frac{\dot{H}}{H^2} \tag{97}$$

If E $\cong$ 0, then

$$\dot{R}_A = ([B^2(1- 16\alpha B^2 + \frac{\beta}{B^4}) + \frac{3}{2}(1+ \omega_m)\rho_m] \text{ x } [1 - \frac{2}{\rho_1}(\rho_m + \frac{B^2}{2} - 4\alpha B^4 - \frac{\beta}{2B^2})]) \text{ x } ([\rho_m + \frac{B^2}{2} - 4\alpha B^4 - \frac{\beta}{2B^2}] \text{ x } [1 - \frac{1}{\rho_1}(\rho_m + \frac{B^2}{2} - 4\alpha B^4 - \frac{\beta}{2B^2})])^{-1} \tag{98}$$

If we consider the net amount of energy in the 'Total Universe' in time dt, we have

$$-dE = 4\pi R_A^3 H(\rho_{Total} + p_{Total}) dt \tag{99}$$

If the First Law of Thermodynamics is valid, then

$$-dE = T_A dS_A \tag{100}$$

where S_A and T_A are the entropy and temperature of the 'Total Universe'. So then,

$$\frac{dS_A}{dt} = \frac{4\pi R_A^3 H}{T_A}[\frac{2B^2}{3}(1 - 16\alpha B^2 + \frac{\beta}{B^4}) + (1 + \omega_m)\rho_m] \tag{101}$$

By using Gibb's equation

$$T_A dS_1 = dE_1 + \rho_{Total} dV \tag{102}$$

then,

$$\frac{dS_1}{dt} = \frac{4\pi R_A^2}{T_A}\left[\frac{2B^2}{3}\left(1 - 16\alpha B^2 + \frac{\beta}{B^4}\right) + (1+\omega_m)\rho_m\right] \times (\dot{R}_A - HR_A) \quad (103)$$

From equation (89) and (91), we can write the rate change of the total entropy in the 'Total Universe',

$$\frac{d(S_A + S_1)}{dt} = \frac{4\pi R_A^2}{T_A}\left[\frac{2B^2}{3}\left(1- 16\alpha B^2 + \frac{\beta}{B^4}\right) + (1 + \omega_m)\rho_m\right] \dot{R}_A \quad (104)$$

If we substitute equation (86) in (92), and if we use the expressions of B and ρ_m from equations (81) and (83), we can calculate the rate change of total entropy. If different values are used for ω_m we can see that the rate change of total entropy is initially positive, but as time goes on it becomes negative [Peebles, 1993; McGraw, 2014]. In the 'Total Universe,' the second law of thermodynamics is violated. The second law of thermodynamics can also be violated in each of the individual universes. The second law of thermodynamics is a general law it is not a universal law. The level of disorder in the universe is both increasing and decreasing. The 'Total Universe' moves from ordered behavior to random behavior, and back. In the 'Total Universe'

$\Delta S_{'TotalUniverse'} \succ 0$ is not always true. In some areas of the 'Total Universe,' entropy is constant or decreasing.

$$\Delta S_{'TotalUniverse'} \prec 0$$

or,

$$\Delta S_{'TotalUniverse'} = 0 .$$

Entropy is a measure of the disorder of a system. The total entropy of an isolated system is said never to decrease. This is the second law of thermodynamics, entropy always increases. However, in the 'Total Universe' this is not always the case entropy can increase, decrease, or remain constant [Roos, 2003; Tegmark, 2004; Zindernagel, 2001].

Conservation of Energy is a General Law in the 'Total Universe'

If we consider a system that has N point particles of mass m, at positions $\mathbf{r}_1 \ldots\ldots \mathbf{r}_n$, and moves with velocities $\mathbf{v}_1 \ldots\ldots \mathbf{v}_n$. This system can then be subjected to external forces described by a time-dependent potential ϕ_{ext} (**r**, t). An example of this is when atoms in the bottom of a container are being heated from below. If we assume that Newton's Law of motion is valid and that the particles interact via pairwise additive forces which are derivable from a potential, then $\mathbf{F}_{k,l}$ is given by

$$\mathbf{F}_{k,l} = - \frac{\partial u_{k,l}}{\partial r_k} \quad (105)$$

where $u_{k,l}$ is the potential energy of interaction between molecules k and l and depends on the molecular positions through $\mathbf{r}_k - \mathbf{r}_l$. The mechanical energy of this system, E, can be defined as

$$E = \sum_{k=1}^{N} \frac{m}{2} \mathbf{v}^2_k + \sum_{k=1}^{N} \sum_{l=1_{k \neq l}}^{N} u_{k,l} + \sum_{k=1}^{N} \phi_{ext} (\mathbf{r}_k, t). \qquad (106)$$

The last term can be drop from the equation, and if E changes as the particles move around under the action of Newton's Laws, we have

$$\frac{dE}{dt} = \sum_{k=1}^{N} \mathbf{v}_k . \mathbf{F}_k - \frac{1}{2} \sum_{k=1}^{N} \sum_{l=1_{k \neq l}}^{N} \mathbf{F}_{k,l} .(\mathbf{v}_k - \mathbf{v}_l) + \sum_{k=1}^{N} [(\frac{\partial \phi_{ext}(r_k, t)}{\partial t})_{r_k} - \mathbf{v}_k . \mathbf{F}_{ext}(\mathbf{r}_k, t)] \quad (107)$$

If we use the expression for $\mathbf{F}_k$ in the rate of change of E, then

$$\frac{dE}{dt} = \frac{1}{2} \sum_{k=1}^{N} \sum_{l=1_{k \neq l}}^{N} \mathbf{F}_{k,l} . (\mathbf{v}_k + \mathbf{v}_l) + \sum_{k=1}^{N} (\frac{\partial \phi_{ext}(r_k, t)}{\partial t})_{r_k}, \qquad (108)$$

which leads to,

$$\frac{dE}{dt} = \frac{1}{2} \sum_{k=1}^{N} \sum_{l=1_{k \neq l}}^{N} (\mathbf{F}_{k,l} + \mathbf{F}_{l,k}) . \mathbf{v}_k + \sum_{k=1}^{N} (\frac{\partial \phi_{ext}(r_k, t)}{\partial t})_{r_k}, \qquad (109)$$

Newton's third Law states that $\mathbf{F}_{k,l} = -\mathbf{F}_{l,k}$, which means that force k exerts a force on l that is equal in magnitude and opposite in direction to the force l exerts on force k. So if we use this information in equation (97), then

$$\frac{dE}{dt} = \sum_{k=1}^{N} (\frac{\partial \phi_{ext}(r_k, t)}{\partial t})_{r_k} . \qquad (110)$$

In the absence of explicitly time-dependent external forces, the energy of our system of particles does not change in time; it is conserved. However, in the 'Total Universe' there are time-dependent external forces, so the energy is not conserved. Instead of equation (98), we have

$$\frac{dE}{dt} = \sum_{k=1}^{N} (\frac{\partial \phi_{ext}(r_k, t)}{\partial t})_{r_k} + \sum_{m=1}^{N} (\frac{\partial \phi_{ext}(r_m, t)}{\partial t})_{r_m} \qquad (111)$$

Individual universes are being created in the 'Total Universe'; in these areas of the 'Total Universe' energy is not conserved. More energy is needed in some regions of the 'Total Universe'. The 'Total Universe' is an energy creating machine. The conservation of energy is a general law because there are areas where external forces are being created, so the conservation of energy would be invalid [Peebles, 1993; Roos, 2003; Dodelson, 2003; Kiefer, 2007].

Conclusions

As humanity discovers the 'Total Universe', the answer that we get tells us that time start long ago, long before our universe even began. We can say that time has existed forever and that time will always exist. Even long after our universe has come to an end, time will continue on its way. The 'Total universe' will never end, universes contain within it will begin and end but time will continue on. Each universe can expand and contract, but the 'Total Universe' is generally constant. In the 'Total Universe,' the second law of thermodynamics is violated. The second law of thermodynamics can also be violated in each of the individual universes. The second law of thermodynamics is a general law it is not a universal law. The level of disorder in the universe is both increasing and decreasing. The 'Total Universe' moves from ordered behavior to random behavior, and back. Entropy is a measure of the disorder of a system. The total entropy of an isolated system is said never to decrease. This is the second law of thermodynamics, entropy always increases. However, in the 'Total Universe' this is not always the case entropy can increase, decrease, or remain constant. Individual universes are being created in the 'Total Universe'; in these areas of the 'Total Universe' energy is not conserved. More energy is needed in some regions of the 'Total Universe'. The 'Total Universe' is an energy creating machine. The conservation of energy is a general law because there are areas where external forces are being created, so the conservation of energy would be invalid. In summary, in our universe (one of many), the energy remains constant, and entropy tends to increase. In the "total Universe', the energy is not conserved, and the entropy tends to be increasing, decreasing, or constant [Feeney, 2011; Dodelson, 2003; Gemmer, 2009; Leslie, 1998; Hawley, 1998; Peebles, 1993].

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