Toward A New Theory 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 an attempt at a new theory for multiple universes. 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 infinite period. 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 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' energy is not conserved, and entropy tends to remain constant.

Keywords: the Universe, time, Big Bang, age, existence, theory

На пути к новой теории «Тотальной Вселенной»

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Последние результаты в физике элементарных частиц и космологии приводят, естественно, к существованию множества Вселенных. Хотя прямое подтверждение других Вселенных доказать трудно, это – не невозможно. Эта статья является попыткой новой теории для множественных Вселенных. Время началось задолго до Большого Взрыва, который дал начало нашей Вселенной. На самом деле, наша Вселенная – это лишь одна из большого количества Вселенных, которые существуют на огромной территории пространства. Таким образом, Большой Взрыв, который был первопричиной нашей Вселенной, не является началом времени, тем не менее это было основой нашего мироздание. Идея времени, которая равняется 0, берёт своё начало еще задолго до создания нашей Вселенной. Время было вокруг в течении бесконечного периода. Оно не только длится в нашем мироздании, но и продолжается в той области пространства, где началась наша Вселенная. Так как время намного старше нашей Вселенной, и этому существует множество доказательств. Ведь лимит времени неограничен, потому что оно берет начало миллиарды лет назад. Это относится и к другим мирам, которые намного старше нашей Все-

ленной. Ведь кроме нашей существует бесчисленное множество других Вселенных, которые старше чем наша, поскольку огромная площадь пространства содержит много других миров. Таким образом, число Вселенных бесконечно. Эти последние области пространства были началом нашей Вселенная, и там же, по-прежнему, создаются новые Вселенные. Поскольку многие Большие Взрывы произошли в прошлом, то множество их произойдёт и в будущем. Ведь Большие Взрывы не то, что происходит только один раз или два раза, а несколько раз. При этом они создают множество различных Вселенных в пространстве, совокупность которых мы можем назвать «тотальной Вселенной». В области энергии «тотальная Вселенная» не сохраняется, и при этом энтропия имеет тенденцию оставаться постоянной.

Ключевые слова: Вселенная, время, Большой Взрыв, возраст, существование, теория

1 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 infinite period. Then the variable time t, takes on only positive values, then it becomes positively infinite. We write,

$$t \to \infty \qquad (1)$$

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

$$\lim_{t \to \infty} t_b = \infty \qquad (3)$$

where t_b is the begin 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 $x \geq K$, then $f(x) \geq M$. 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 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'. The 'Total universe' is the area where big bangs occur; our universe is just one of many universes that have started there.

2 The Definition of Time in the 'Total Universe'

The question then becomes how to define time in the 'Total universe', and how to define time in other universes[*Dodelson*, 2003; *Mukhanov*, 2005; *Tegmark*, 2004].

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

This 'Total Universe' started at $t_l \rightarrow \infty$, which is long before our universe got it 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 total 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 have began 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 total time that the 'Total universe' has existed,

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

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

3 Structure of the 'Total Universe'

The total 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 occur in this region in the 'Total Universe' where temperatures approach ∞. The reasons that big bangs occur 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, so then

$$\Delta S_{systgem} = 0. \tag{9}$$

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, around the regions where universes are being created. The entropy is 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 gained 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 created universes. In the 'Total Universe' energy must be created 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 constant. Each individual universe starts with a big bang, and then starts to expand. These individual universes began by expanding from an infinitesimal volume with extremely high density and temperature. The universes were initially significant smaller then 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. Tracing back these expanding universes, we see that the separations between galaxies become smaller while the density 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. As the universes expanded, they cooled, and the mean photon energy diminished. Eventually at a temperature of about 300^{0} K, the photon energies became too low 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. 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. 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,

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

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:

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

where μ, ν { 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:

$$ds^2 = g_{\mu\nu}\, dx^{\mu} dx^{\nu} \qquad (14)$$

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:

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

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 individual 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 are flat , then computing distances on the moving grid should be easy. One very important 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:

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

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 travelled by light since the beginning of that universe:

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

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. In terms of η, the FRW metric becomes,

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

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 in terms of n. In particular, during radiation domination (RD) and matter domination (MD),

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

$$\text{MD: } \rho \,\alpha\, n^{-3},\ \eta \,\alpha\, \sqrt{n} \quad (20)$$

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

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

where n_{eq} denotes the epoch of matter-radiation equality. Another important 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:

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

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 α $n^{-3/2}$, then

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

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

For small z, $d_{lookback} \approx \frac{z}{H_0}$, 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:

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

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

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

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

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

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 is around 14 billion years old. This calculation shows that the big bang occurred as long as 15 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 15 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

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

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

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

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_o, as

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

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 $k_o = 0$. 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 term. We have,

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

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

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

with $\rho(t)R(t)^3 = \rho(t_o) R(t_o)^3$, where t_o is the present time in the 'Total Universe'. If $R \rightarrow \infty$, then $k_o = 0$, and the present time in the 'Total Universe' $t_o \rightarrow \infty$. So time in the present 'Total Universe' is infinite. So we have,

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

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

$$t_p = t_l + 15 \text{ billion years} \tag{42}$$

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

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

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

4 Conclusions

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 individual universe can expand and contract, but the 'Total Universe' is generally constant. 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 constant [*McGraw*, 2014;*Narlikar*, 2002; *Hawley, Holcomb*, 1998;*Roos*, 2003;*Tegmark*, 2004].

References

Dodelson, 2003 –*Dodelson S.* Modern Cosmology. – Academic Press, 2003.

Hawley, Holcomb, 1998 –*Hawley, John F. & Katerine A. Holcomb*. Foundations of Modern Cosmology. – Oxford University Press, Oxford, 1998.

Leslie, 1989 –*Leslie J*. Universes. – London, Routledge, 1989.

McGraw, 2014 – *McGraw Jr., David*. "Time and the Structure of the 'Total Universe'"// International Journal of Science, Commerce, and Humanities, Vol. No 2, No. 3, April, 2014.

Mukhanov, 2005 –*Mukhanov V*. Physical Foundations of Cosmology. – Cambridge, 2005.

Narlikar, 2002 –*Narlikar J*. An introduction to Cosmology, 3rd edition. – Cambridge: Cambridge University Press, 2002.

Roos, 2003 –*Roos Matts*. Introduction to Cosmology. – John Wiley & Sons, Ltd, Chichester, 2003.

Tegmark, 2004 –*Tegmark M*. Parallel universes // Science and Ultimate Reality, ed. John D. Barrow, 2004.

Zinkernagel –*Zinkernagel H*. "Did time have a Beginning?" // International Studies in the Philosophy of Science 22(3): 237–258.