The Origin and Existence of the Universe - A New Theory

Peter G. Bass

Abstract

This paper extends Relativistic Domain Theory into cosmology to develop an alternative theory for the origin and existence of the Universe. The main result is the derivation of a theoretical relationship for, and corresponding numerical value of, the Hubble constant, which is then compared with empirical results.

1 Introduction.

Current hypotheses concerning the origin and existence of the Universe are still largely dominated by the so called "Big Bang" theory. However, a growing accumulation of empirical data is now beginning to produce results that are contrary to this doctrine. All of this data together with appropriate interpretative comment is well documented in both the paper and electronic literature. Hence, alternative hypotheses have recently been put forward as alternatives to the Big Bang. The Hoyle/Narlikar/Burbidge Quasi Steady State Universe is one such. This idea does away with the continuous creation of matter of the old Steady State Theory and replaces it with a series of mini Big Bang type "creation events" within our local part of a largely infinite Cosmos. This marriage of the Big Bang and Steady State ideas avoids some of the problems of each but, others remain, and as a result further alternative ideas should not be excluded from consideration. Accordingly, it is the purpose of this paper to present a new theory for the origin and existence of the Universe, based solely upon a Relativistic Domain in which a mathematically definable new gravitational effect is the main contributory factor.

It is very important, for a complete understanding of the development to be presented here, that reference [3] be read thoroughly first.

In the interests of brevity, unless necessary for complete clarity, a parameter will only be defined in this paper if it has not previously been so in either [1], [2] or [3], with which familiarity is assumed.

2 Development of a Relativistic Domain Theory for the Existence of the Universe.

Prior to the presentation of the mathematical development of this subject, it is necessary to address some preliminary preparatory points. These will be followed by a description of the proposed evolutionary process. Both of these will help to establish the foundation on which the mathematical development will be based.

2.1 *Preliminary Discussion.*

(i) Galactic Spectral Redshift.

Since Edwin Hubble's discovery of galactic redshift and its interpretation as a signature of galactic recession according to Hubble's Law, a number of inconsistencies have been discovered which do not appear to fit with this law or any other current theory of Universal evolution. As a result a number of other alternative hypotheses for spectral redshift have been put forward such as "tired light" and "quantum field" energy attenuation et al. While these may well be, to some extent, valid causes, the main cause accepted in the development presented here is the original one of galactic recession, largely according to Hubble's Law but also augmented by a significant gravitational component. This is discussed and mathematically detailed in Appendix A. The spectral redshift irregularities mentioned above do not pose a problem in this respect because they are accommodated by the large scale structure of the Universe that results from the development presented here. This aspect is discussed further in Section 3.

(ii) The Physical Nature of the Universe.

In the literature, [4], [14], the Universe has, despite the localised high concentration of matter within it, and with some minor exceptions, generally been considered to be both homogeneous and isotropic throughout. However, only the latter of these descriptions is believed to be strictly possible, and then only if the Universe could be viewed from its very centre. It is further considered that the structure of the Universe should reflect that of the vast accumulation of galaxies, stars and planets etc that are contained within it. Its existence therefore should be describable using the same physics and mechanics with which they are described.

To support this opinion, consider the following natural configurations extant within the Universe. At the most basic a planetary system will consist of from none to possibly many thousands of small orbiting moons. But in all cases the system is characterised by one large central mass, the planet. On the next scale up, although only our own is known in any detail, a solar system similarly consists of a number of orbiting planets, asteroids and comets. However, it is again dominated by one large central mass, the star, or in our case, the Sun. Again, on a further scale up, the galaxies are clearly seen to consist of a vast number of stars distributed about a very large central core. Sometimes the central mass itself is rotating resulting in its star complement being gravitationally dragged into spiral arms. Sometimes it is not, or only very slowly rotating, resulting in a spherical or ellipsoidal shape.

As all of the above configurations occur quite naturally in the Universe and are gravitationally driven, it is considered likely that the Universe itself would conform to a similar one. Therefore it is expected that at the very centre of the Universe there exists a large mass, possibly made up of giant stars all in very close proximity. Further out from this central mass the density of galactic objects would steadily drop off. Such a configuration would clearly not be a homogeneous one, but would, on a large scale, tend to be isotropic when viewed from the centre. However, the observation of such features would depend greatly upon the maturity of the Universal evolutionary process and therefore this matter is further discussed in Section 3 below.

It is considered unlikely that the central mass would be rotating, or if it is, only very slowly, otherwise the recessional velocities of the distant galaxies would not conform to Hubble's law. As a consequence, the shape of the Universe would be expected to be spherical.

(iii) The Universe as a Gravitational Source.

With the Universe exhibiting a physical configuration as described above, it can now be likened to a normal astronomical object such as a very large spherical galaxy. The central mass is synonymous with the central galactic core, while the outlying galactic population can be likened to the outer star complement of the galaxy. Accordingly, it is therefore proposed that the Universe would possess a gravitational field in its own right, and in an identical manner to a star or any other stellar or galactic object, this gravitational field will have both an internal and external existence. It is the nature of the internal part of this field, and its effect on the outer stellar and galactic objects within the Universe that is the main subject of the later development. The region outside the Universe is however, also briefly addressed.

(iv) The Generation of Repulsive Gravity.

In ascribing a gravitational field to the Universe as a whole, there is one major difference to those of most other stellar and galactic objects. That is the size and mass of the Universe. These are such that the physical radius of the Universe will be of the same order of magnitude as its gravitational radius. It will be seen in the ensuing Sections that this, under the gravitational action within the Universe, gives rise to a situation at the very centre which results in its gravitational field being reversed and thereby becoming a repulsive one. As a result, it will be shown that it is this effect that is responsible for the recession of the distant galaxies observed today.

2.2 A Description of the Evolution of a Relativistic Domain Universe.

The evolution of a Relativistic Domain Universe is solely gravitational in nature, with no interfering outside influences or forces. It consists essentially of two phases. In the first of these the Universe possesses internally a normal attractive type gravitational field, while in the second it exhibits a reversed or repulsive field.

2.2.1 The Overall Life Cycle.

The overall evolutionary life cycle of a Relativistic Domain Universe is proposed as follows. In the vast spatial and temporal expanse that is Pseudo-Euclidean Space-Time, there exists a near infinite amount of particulate matter and radiant energy. The particulate matter exists in the form of the smallest individual elementary particles up to the massive galactic constructions of many billions of stars. All of these are in continual motion due to normal attractive gravitational forces. By this means, should a localised volume of increased density occur, it will become the centre of a gravitational attraction and start to draw more and more matter towards it. This forms the start of the first phase of the evolution of a Universe. Gradually, a central core will form and together with nearby stellar and galactic objects start to generate its own spatial expansion, the spatial variability of which results in its own gravitational field. As the central core draws more and more matter closer, so the physical and gravitational radii start to approach each other. Eventually a point is reached where the physical radius is no more than three times the gravitational radius. This results in the reversal of internal gravitation and the initiation of the second phase of evolution. All matter inwardly mobile towards the centre will be gradually slowed, reversed and then gravitationally propelled away from the centre to ultimately reach relativistic velocities. This would continue until the dispersion was sufficient to result in the cessation of the combined gravitational effect of this matter, and all that would be left was the small central core. This core may continue to exist for many aeons and radiate significant quantities of particulate and radiant energy.

At some cosmologically nearby location where another localised density peak was formed, the whole process could be repeated - ad infinitum. If this is a localised occurrence in an "infinite" expanse of Pseudo-Euclidean Space-Time, it could well be that there are many such island Universes evolving through this life cycle many times over.

2.2.2 The Gravity Reversal Process at the Centre.

The gravity reversal process when the physical radius of the evolving Universe equates to three times its gravitational radius is proposed as follows. Reference [3] is central to this description.
Subsequent to a definable boundary being formed, the Universe will be continually generating a spatial expansion and the appropriate spatial linear expansion velocities of the form given by [3], Eq.(3.19) and [3], Eq.(3.30). This will have consequently resulted in the generation of Acceleration Potentials of the form given by [3], Eq.(3.34) and [3], Eq.(3.35). Thus via these normal internal and external gravitational fields, all luminous and other matter within and in the near vicinity of the Universe will be drawn towards the centre. This will also cause both the mass and the gravitational radius to steadily increase. The physical radius of the Universe will also be increasing due to this process but, at a slower rate than the gravitational radius. The physical radius and the gravitational radius therefore slowly converge. This process results in the temporal rate at all parts of the Universe slowly reducing with the greatest effect occurring at the centre. It continues until the physical radius approaches a value of three times the gravitational radius the result of which is, at the very centre, to cause the temporal rate to approach zero. This represents a critical point in the process. As it tends to continue and the physical radius equates to exactly three times the gravitational radius, the temporal rate at the centre becomes unstable and, as a result, a transformation between the temporal and the spatial expansion flows occurs. This results in a reversal of the spatial part of these flows and thereby a reversal in the direction of gravity. This is the end of the first phase of the evolution, and start of the second.

The process that has been briefly described here will, in the remaining Sections of this paper, be put into mathematical form. This development will lead to a theoretical expression and an appropriate value for Hubble's constant which is then compared with empirical values.

2.3 ***The Mathematical Development.***

This will cover the process after the formation of a definable boundary in the first phase and then proceed through both phases. Throughout, the characteristics of each phase will be derived and the precise mechanism resulting in the change between them demonstrated. The details covering the initial part of the first phase including the dynamic relationship between the physical and the gravitational radii will form the subject of a future paper.

2.3.1 The First Phase and the Change to the Second.

The first phase has been described as one in which the Universe is generating a spatial expansion volume such that the associated spatial linear expansion velocity at some random point σ_i is of the same form as that of [3], Eq.(3.30). To give this mathematical form, it is expressed as

$$\upsilon_{i\sigma} = \left(\frac{3\gamma m_u}{\sigma_u} - \frac{\gamma m_u \sigma_i^2}{\sigma_u^3} \right)^{1/2} \tag{2.1}$$

where

m_u is the mass of all matter in the Universe.

σ_u is the physical radius of the Universe.

To determine the Acceleration Potential in this phase, (2.1) cannot simply be differentiated with respect to the time. This is because the physical radius, σ_u , is now a secondary variable, unlike in most other gravitational sources in which the physical radius is constant. The Acceleration Potential at σ_i is solely a function of the spatial distribution of $\upsilon_{i\sigma}$ at that point, and includes the magnitude of σ_u but not its rate of change. To determine the Acceleration Potential therefore, it is necessary to partially differentiate (2.1) with respect to σ_i and then transform the result to a time variable. Thus the partial differential of (2.1) is

$$\frac{\partial \upsilon_{i\sigma}}{\partial \sigma_i} = -\frac{\gamma m_u \sigma_i}{\upsilon_{i\sigma} \sigma_u^3} \tag{2.2}$$

and the Acceleration Potential is then given by

$$A_{i\sigma} = \upsilon_{i\sigma} \frac{\partial \upsilon_{i\sigma}}{\partial \sigma_i} = -\frac{\gamma m_u \sigma_i}{\sigma_u^3} \tag{2.3}$$

and which therefore has the same form as that internal to all other gravitational sources as represented by [3], Eq. (3.35).
The second order rate at which the spatial volume at σ_i is expanding in this phase, is from (2.1) and (2.3)

$$\frac{\partial^2 W}{\partial \tau^2} = 4\pi\sigma_i^2 \left(A_{i\sigma}\right) + 8\pi\sigma_i \left(\upsilon_{i\sigma}^2\right) \tag{2.4}$$

$$= 24\pi\gamma m_u \frac{\sigma_i}{\sigma_u} - 12\pi\gamma m_u \frac{\sigma_i^3}{\sigma_u^3} \tag{2.5}$$

Which at the edge of the Universe, when $\sigma_i = \sigma_u$, becomes

$$\frac{\partial^2 W}{\partial \tau^2} = 12\pi\gamma m_u \tag{2.6}$$

Eqs.(2.5) and (2.6) are the same as for a normal gravitational source applicable both internally and externally as discussed in [3].

Now consider the temporal rate within the Universe. This, in line with [3], Eq.(3.31), is given by

$$u_i = \left(1 - \frac{3\alpha_u}{\sigma_u} + \frac{\alpha_u \sigma_i^2}{\sigma_u^3}\right)^{1/2} \tag{2.7}$$

where

α_u is the gravitational radius of the Universe.

At the very centre of the Universe, i.e. when in (2.7), $\sigma_i = 0$, u_i becomes

$$u_i = \left(1 - \frac{3\alpha_u}{\sigma_u}\right)^{1/2} \tag{2.8}$$

and is the temporal rate at the centre.
At this point to best illustrate the mechanism by which this first phase of the evolution is transformed to the second, it is useful to introduce a somewhat more detailed version of the spatial/temporal flow diagram first shown in [3], Fig.(2.3). The diagram presented below for the first phase shows the spatial/temporal flows both internal to the Universe and just beyond its outer periphery.

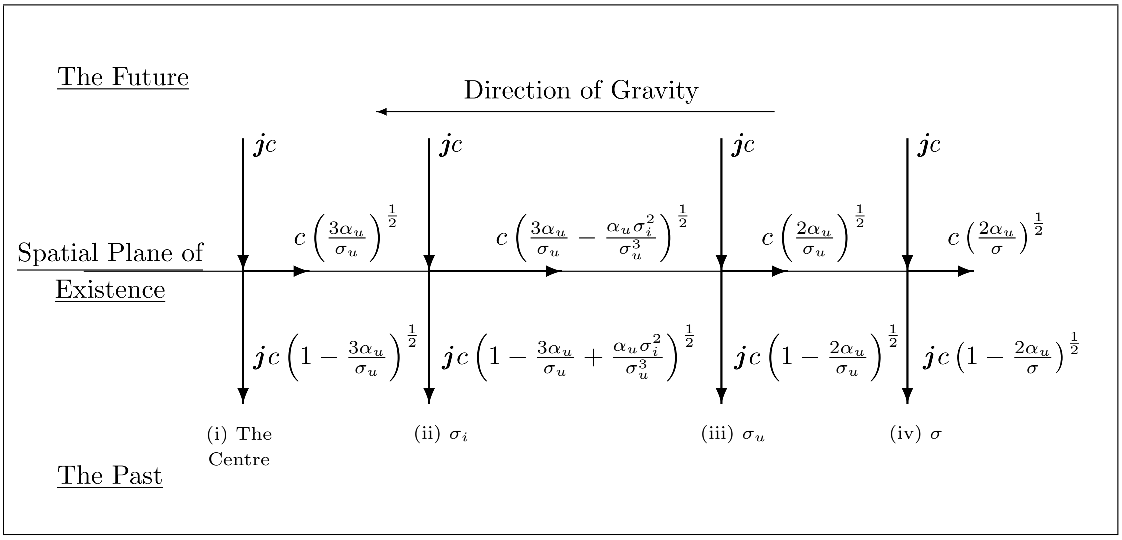

Fig. 1 Spatial/Temporal Flows in the First Phase of the Evolution of the Universe.

In Fig. 1 the terms along the Spatial Plane of Existence are the applicable spatial linear expansion velocities at (i) the centre of the Universe, (ii) the general point σ_i internal to the Universe, (iii) at σ_u , the edge of the physical Universe, and, (iv) the general point σ external to the Universe. The terms transverse to the Spatial Plane of Existence, (the $\boldsymbol{j}$ terms), are the corresponding temporal velocities. All of these terms were developed in [3] for a single gravitational source.

As all matter in the Universe gravitates towards the centre, eventually its physical radius, σ_u , and its gravitational radius, α_u converge to the point whereby the physical radius equates to three times the gravitational radius. When this occurs, it can be seen from (2.8) and Fig.1 that at the centre of the Universe the temporal rate, and therefore the temporal flow, is reduced to zero. At this point therefore the passage of time at the centre has stopped. Also the spatial linear expansion velocity at this point has increased to the maximum possible, the velocity constant c. At this one singular instant the spatial/temporal flows have become as shown in Fig. 2 below.

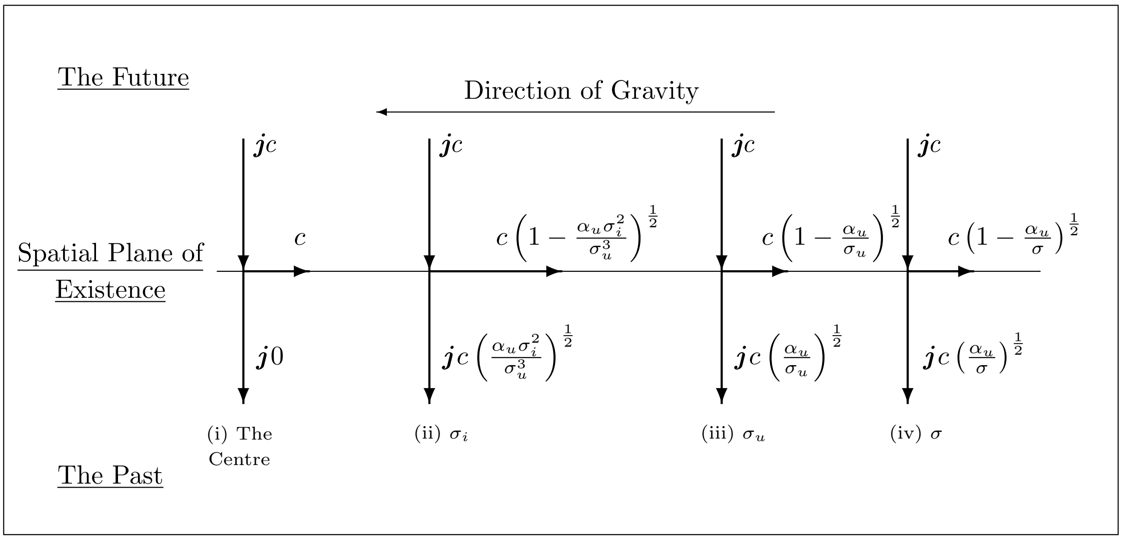

Fig. 2 Spatial/Temporal Flows at $\sigma_u = 3\alpha_u +$

As can be seen from Fig. 2, at all points of the Universe other than the centre, the spatial/temporal flows continue to generate a negative Acceleration Potential, as in (2.3), which in turn continue to cause the gravitational migration of all galactic masses towards the centre. This tends to cause the physical radius of the Universe to reduce to less than three times its gravitational radius. As a consequence, at the centre, the temporal flow undergoes the following transformation at the critical point when $\sigma_u = 3\alpha_u$ exactly. Using (2.8), Transformation from

$$\left.\frac{dx_0}{d\tau}\right|_{\sigma_u=3\alpha_u+} = jc\left(1-\frac{3\alpha_u}{\sigma_u}\right)^{1/2}\Bigg|_{\sigma_u=3\alpha_u+} = j0 \tag{2.9}$$

To

$$\left.\frac{dx_0}{d\tau}\right|_{\sigma_u=3\alpha_u-} = jc\left[-\left(\frac{3\alpha_u}{\sigma_u}-1\right)\right]^{1/2}\Bigg|_{\sigma_u=3\alpha_u-} = -0 \tag{2.10}$$

Thus the temporal flow at the centre has been transformed to a negative spatial flow, and it is proposed that at that instant, for reasons of flow continuity, this change is promulgated throughout the rest of space. In this way the first phase of the evolution of the Universe is thereby transformed to the second.

2.3.2 The Second Phase.

Subsequent to the above transformation, the spatial/temporal flow pattern will have changed from that in Figs. 1 and 2, to that in Fig. 3 below.

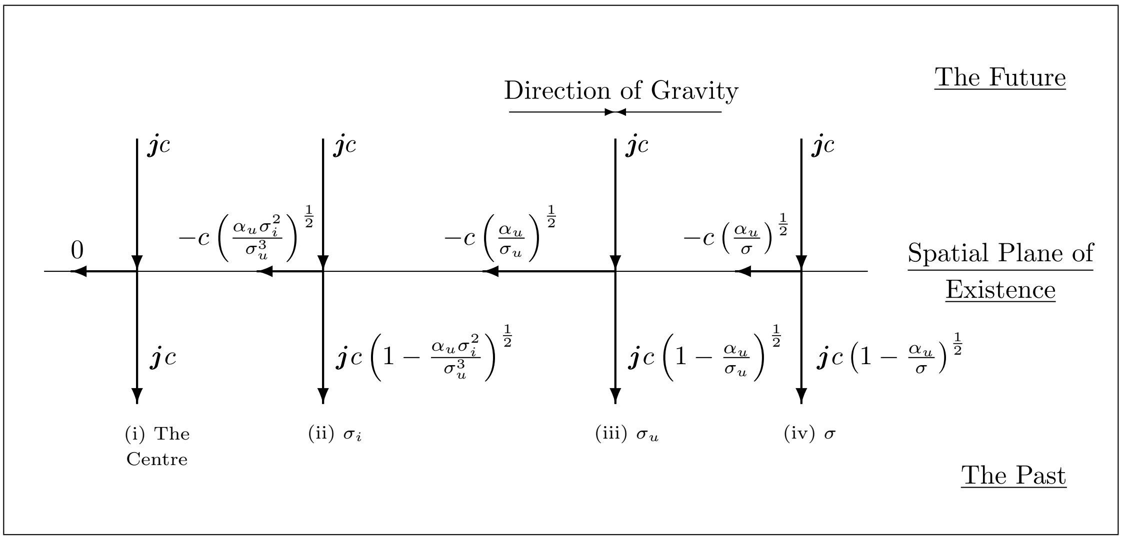

Fig. 3 Spatial/Temporal Flows in Phase II

As can be seen from Fig.3, and also implicit in (2.9) and (2.10), both the spatial flow, and the temporal flow in the past region of the temporal dimension, have, in this form of representation, been rotated clockwise through 90° by the transformation.

The main characteristics of this phase are as follows. First, from Fig. 3, it can be seen that the spatial linear expansion velocity is now negative and the spatial dimension is now caused to contract instead of expand as in the first phase. Thus $\upsilon_{i\sigma}$ in this phase is a contraction velocity and, from Fig. 3 for the general point σ_i , is given by

$$\upsilon_{i\sigma} = -\left(\frac{\gamma m_u \sigma_i^2}{\sigma_u^3}\right)^{1/2} \tag{2.11}$$

From this, the internal Acceleration Potential in this phase is

$$A_{i\sigma} = \upsilon_{i\sigma}\frac{\partial \upsilon_{i\sigma}}{\partial \sigma_i} = \frac{\gamma m_u}{\sigma_u^3}\sigma_i \tag{2.12}$$

Eq. (2.12) shows that gravity internal to the Universe in this phase has reversed and is now repulsive. Under this Potential the inward migration of all galactic masses towards the centre is gradually halted, reversed and then, with a steadily increasing velocity, gravitationally accelerated away from the centre. This phase continues until the dispersion of all galactic objects is so great that the Universe no longer retains a unique gravitational capability.

In this phase the second order rate of spatial contraction at σ_i is as follows

$$\frac{\partial^2 W}{\partial \tau^2} = 4\pi\sigma_i^2\left(\frac{\gamma m_u}{\sigma_u^3}\sigma_i\right) + 8\pi\sigma_i\left(\frac{\gamma m_u}{\sigma_u^3}\sigma_i^2\right) \tag{2.13}$$

$$= 12\pi\gamma m_u\frac{\sigma_i^3}{\sigma_u^3} \tag{2.14}$$

Which at the edge of the Universe, the "surface" of the gravitational source, reduces to

$$\frac{\partial^2 W}{\partial \tau^2} = 12\pi\gamma m_u \tag{2.15}$$

Which is identical to the boundary condition in phase I. The external condition has however changed. Again the spatial flow has become negative in concert with the internal flow. This occurs as a result of continuity across the boundary. The Acceleration Potential outside the Universe is still attractive but the magnitude has halved and from Fig. 3 is given by

$$\frac{dv_\sigma}{d\tau} = -\frac{\gamma m_u}{2\sigma^2} \tag{2.16}$$

Accordingly the second order rate of change of spatial volume contraction, while still positive, is also halved and is given by

$$\frac{d^2W}{d\tau^2} = 6\pi\gamma m_u \tag{2.17}$$

As a result, from (2.12) and (2.16), in addition to their opposed direction of action, there is a discontinuity in the magnitude of the Acceleration Potentials at σ_u , the edge of the universe. This consequently tends to accentuate the density across the boundary.

The effects of the reversed gravity of the second phase on a galactic mass within the Universe can now be derived. This is accomplished in the following Sections.

2.3.3 The Velocity of Recession of a Distant Galaxy.

The recessional velocity that is to be derived here is for a galaxy far from the centre of the Universe and also at a time when the second phase of evolution is well established. This scenario has been chosen so that the resulting relationship can be approximated for comparison with empirical results determined via observations on the Earth at the present day.

The velocity of recession of such a galaxy is determined from the internal temporal rate of the Universe in phase II, which from Fig. 3, for the general point σ_i , is given by

$$u_i = \left(1 - \frac{\alpha_u \sigma_i^2}{\sigma_u^3}\right)^{1/2} \tag{2.18}$$

The velocity of any mass subject to an Acceleration Potential in a Relativistic Domain is given by [2], Eq. (3.2), repeated here for convenience

$$\dot{\sigma} = cu\left(1 - \frac{u^2}{u_0^2}\right)^{1/2} \tag{2.19}$$

Applying this using (2.18) to a distant receding galaxy, there is after minor reduction

$$\dot{\sigma}_i = \frac{u_i}{u_0}\left(\gamma m_u\right)^{1/2}\left(\frac{\sigma_i^2}{\sigma_u^3} - \frac{\sigma_0^2}{\sigma_{u0}^3}\right)^{1/2} \tag{2.20}$$

Where

- σ_i is the current radial position of the distant galaxy from the centre of the Universe.
- σ_0 is the initial radial position of the galaxy from the centre of the Universe, i.e. the radial position where its inward motion from Phase I was halted in Phase II.
- u_0 is the temporal rate at σ_0 .
- σ_{u0} is the radius of the Universe when $\sigma_i = \sigma_0$.

The temporal rate u_0 is given by

$$u_0 = \left(1 - \frac{\alpha_u \sigma_0^2}{\sigma_{u0}^3}\right)^{1/2} \tag{2.21}$$

If the point of inflexion, the point where the inward motion of the galaxy from phase I is halted in phase II, is close to the centre, then by comparison with σ_i and σ_u , σ_0 may be approximated to zero, and therefore u_0 may be approximated to unity. Eq. (2.20) may then be restated as

$$\dot{\sigma}_i \cong u_i\left(\frac{\gamma m_u}{\sigma_u^3}\right)^{1/2} \sigma_i \tag{2.22}$$

Eq. (2.22) shows that the velocity of recession for a distant galaxy is directly proportional to its distance from the centre of the Universe. This agrees with the empirical results of Edwin Hubble in 1929 and others since. The coefficient of (2.22) can therefore be compared with the Hubble constant. This will form the subject of the next Section.

2.3.4 Derivation of a Theoretical Expression for the Hubble Constant.

With the results obtained in Section 2.3.3, the derivation of this relationship has already been effected and from (2.22) can be stated directly as

$$H_0 = u_i \left(\frac{\gamma m_u}{\sigma_u^3}\right)^{1/2} \tag{2.23}$$

Accordingly (2.20) is the full theoretical version of Hubble's law of motion for receding galaxies in phase II.

It should be noted that, because σ_u varies with time, thereby causing a variation in ρ_u the matter density of the Universe, from (2.23) and (2.24) below, it is therefore evident that H_0 is in fact not a constant but will also vary with time. However, in view of the magnitude of the parameters involved, mass, radius and density of the Universe, such variation will only be significant over cosmological periods. Furthermore, the presence of u_i in (2.23) shows that H_0 also varies with distance from the centre of the Universe. This variation is again however, due to the nature of u_i , a small one. These matters will be discussed in more detail in Section 3.

The relationship expressed by (2.23) can of course only be verified by comparing the numerical value it produces with those derived empirically. From (2.23) it can be seen that this would require knowledge of the energy mass of all matter in the Universe, together with its radius. Neither of these parameters are known. In addition, knowledge of u_i is required which effectively means that the location in question, i.e. the point of measurement, (the Earth), in relation to the centre of the Universe is also needed. Again, an unknown parameter. Although u_i is a variable as is evident from (2.18), its value will always be just below unity. Therefore to enable an estimate of H_0 to be made, u_i will be taken as unity which will accordingly give a slightly high value for H_0. Therefore, with $u_i = 1$, rewriting (2.23), as

$$H_0 = \left(\frac{4}{3}\pi\gamma\rho_u\right)^{1/2} \tag{2.24}$$

where

ρ_u is the average density of all matter in the Universe.

enables a value for H_0 to be computed using current estimates for ρ_u. The average density of all matter in the Universe has been estimated from such exercises as counts of stellar objects per unit stellar volume and the density then calculated via estimates of the masses of the objects counted. Two such estimated densities are shown in the following table.

ρ_u (g/cm^3)	Reference	Note
1 x 10^{-29}	[8]	1
6.69 x 10^{-29}	[9]	2

Table 1 Average Density of All Matter in the Universe.

Notes:-

1:- By comparison with the second estimate, some allowance for the mass of dark matter may have been made here, but has not been stated.

2:- This figure, calculated from the proton mass given in [10], is quoted as the equivalent proton mass per cubic metre, (0.4), and incorporates the assumption that the mass of proposed dark matter in the Universe is 10 times that of luminous matter.

Using a figure of 6.67 x 10^{-8} cm^3 $/g.sec^2$ for γ , [7], insertion of the numbers in Table 1 into (2.24) gives a range of values for H_0 as

$$H_0 = 1.67\text{x}10^{-18} \quad to \quad 4.3\text{x}10^{-18} sec^{-1} \tag{2.25}$$

However, Hubble's constant is normally quoted in units of $Km/sec/10^6 L.Y$., and the corresponding numbers from (2.25) in these units are

$$H_0 = 15.8 \quad to \quad 40.7 Km/sec/10^6 L.Y. \tag{2.26}$$

with an average of

$$H_0 = 28.3 Km/sec/10^6 L.Y. \tag{2.27}$$

To compare this figure with empirically derived estimates, reference is made to Table 2 below where, from the "Big Bang" model of the Universe's origin, most figures have been quoted in years for the age of the Universe.

Reference	**Age of Universe** ***(Years x 10^9)***	**Actual/Equivalent Value of H_0** ***(Km/sec/10^6 L.Y.)***
[8]	10	30
[9]	-	20
[11]	13 to 22	13.6 to 23.1
[12]	10 to 20	14.9 to 30
[13]	10 to 20	14.9 to 30
[14]	15	20.1
[14]	-	29.8

Table 2 Empirical Estimates of Hubble's Constant

The average of all the figures for H_0 in Table 2 is

$$H_0 = 22.6 Km/sec/10^6 L.Y \tag{2.28}$$

which concurs exactly with more modern estimates, [15].

Thus the comparison between the theoretical, Eq.(2.27), and the empirical, Eq.(2.28), values for H_0 yields agreement to within some 18%. Considering the difficulty in determining such parameters as galactic distance, velocities via the Doppler shift in spectral wavelength, and galactic masses etc, this degree of agreement is considered very good. Even so, despite the improvement that could be realised by the inclusion of the correct value for u_i , it is seen that the larger of the two theoretical figures is considerably larger than the largest empirical figure. As noted earlier, the estimate for the average density of matter in the Universe, upon which this figure is based, has, via the mass to light ratio comparison method been inflated by a factor of 10. However, if it exists at all, that method of assessment of the density of dark matter, may be flawed due to the effect of the solar wind on free particles within the Solar System, dark or otherwise. Hence the higher figure for density used in the theoretical computation for H_0 may be too high. If this were the case, the agreement between the theoretically and empirically derived figures could be closer.

Finally, it is necessary to further clarify this derivation, and the comparison of H_0 with empirical results, for their cosmological time of applicability. The values of average density in Table 1 involve observations over wide parts of the cosmos from the astronomically nearby to the cosmologically distant. In doing so, the observations are of the Universe as it was in the past. The greater the distances the further in the past are the objects being observed. Because the density of the Universe is changing with time, the particular value of density that is eventually arrived at is therefore a composite made up from observed objects from relatively recent cosmological periods to extremely remote ones. This density will therefore correspond to some particular cosmological time somewhere in between the two extreme times associated with the applicable observations. Call this time $\tau_{C.}$ Consequently, the theoretical value of Hubble's constant will likewise correspond to this particular past cosmological time $\tau_{C.}$

In a similar manner, the empirical determinations of the Hubble constant will suffer from exactly the same problem. The further away an observed galaxy is, the further back in time will its measured parameters correspond to. As a result the empirical values of the Hubble constant shown in Table 2 above will represent parameters over a past cosmological period. The average will therefore, as in the case of the density, correspond to some past cosmological time. The fact that the theoretical and empirical figures of H_0 agree relatively well is because their cosmological times of applicability are very close. This coincidence occurs simply because the objects observed in the determination of both parameters, density of the Universe and the empirical values of H_0 , were from the same statistical population.

3 General Discussion of the Results.

During the above development, a number of significant points have arisen that need to be addressed in more detail. In this Section these points and others are discussed.

(i) Comparison of the Acceleration Potentials of Phase I and II.

Comparison of (2.3) and (2.12) shows that the Acceleration Potentials of Phase I and II, while opposite in sign, are equal in magnitude. This result is expected but nevertheless extremely important because both potentials are generated by exactly the same particulate matter. As a consequence, this equality in magnitude is a necessary condition for the viability of the Relativistic Domain Theory of the evolution of the Universe. As a further consequence, it is probable that the lifetime of each phase will also be of the same order of magnitude.

(ii) The Variability of H_0 in Phase II.

From (2.23), the expression derived for the Hubble constant, it is clear that H_0 is not a constant, but is a variable that slowly changes with time, and also possesses a spatial gradient. This is because (2.23) contains the terms σ_u , and u_i . The former effectively provides variability with time as the physical Universe expands. The latter provides the spatial gradient as it contains the parameter σ_i . However, u_i also contains σ_u and so neither the variability with time nor the spatial gradient are of a simple nature. The variation with time is however such that as the physical Universe expands, the value of H_0 will reduce. The spatial gradient is such that H_0 also reduces with increasing distance from the centre of the Universe. When H_0 is estimated from measurements of the velocities of receding galaxies, a graph of recession velocity versus distance results in an apparently near linear relationship. This is due to the combination of the two types of variation detailed above, augmented by the problem discussed at the end of Section 2.3.4 whereby, due to the finite velocity of light, measurements of parameters at cosmological distances apply to past cosmological times. A series of such measurements over a range of distances thereby produces a composite of recession velocities applicable over the cosmological period spanning the measurements. Graphing of such velocities against distance thereby produces the approximately linear relationship. However, this graph only remains linear out to certain distances. Once measurements are taken of receding galaxies so distant, that at the cosmological time applicable, the galaxy being measured was close to the edge of the Universe, the velocity/distance graph starts to tail off due to the reduction in the spatial gradient of the temporal rate at those extreme distances. This then gives the appearance that the expansion of the physical Universe is accelerating, when in fact exactly the opposite is true. In a future paper, a computer model of this effect will be presented which will demonstrate it more graphically than the above textual description.

(iii) The Status of Individual Gravitational Sources in Phase II.

With the reversal of Universal internal gravity in phase II, the question arises as to the status of the gravitational effect of individual stellar and galactic objects within the Universe. The reversal of gravity occurred because the temporal flow at the centre tended to reduce below zero. This was due to the combined effect of all the matter in the Universe. However, the reversal is initiated at the centre and while promulgated throughout the rest of space is still an effect emanating at the central core. The gravitational status of all individual stellar and galactic objects would not be changed by this process, and would continue to exhibit normal attractive gravitation throughout both phases.

(iv) The Current Status of the Evolution of the Universe.

Because it has been observed that the distant galaxies are all receding from a central point, some at quite considerable velocities, this suggests that the evolution of the Universe must be well into its second phase. This phase will continue until the dispersion is so great that the Universe ceases to act as an unique independent gravitational source. Accurate determination of the amount of time for this to occur is not considered possible at the present time, however, some speculative estimate is provided as follows.

If the "Big Bang" age of the Universe is estimated at 15 billion years, in the theory proposed here this time may be assumed as close to that for the Universe to have expanded from the point of inflexion to its present day size. Also, if phase II is say approximately 50% complete, then it will take a like amount of time for it to run its course. If also, because both phases are driven by the same particulate matter, it is assumed that it takes an equivalent amount of time to reach the point of inflexion from the fully dispersed position, i.e. phase I plus that part of phase II to reach standstill, then the minimum total lifecycle can be roughly estimated at 60 billion years. On this basis, this theory puts the current age of the Universe, $\sim 50\%$ into phase II, at some 45 billion years. Accordingly, a considerable amount of dispersion will have taken place since the point of inflexion, and for this reason, the current view of the Universe from any point within it, i.e. the earth, will tend to show a high degree of homogeneity and isotropy. However, there is some observable divergence from this, discussed in (v) below, in which an overall configuration based upon a central core is still evident. The above figures could be more accurately estimated when, and if, this centre of the Universe is located and the distance from it to the home galaxy established.

(v) The Large Scale Internal Structure of the Universe During Evolution Throughout Both Phases.

The large scale internal structure is identified as that formed at the galactic level and upwards. The galaxies themselves could in many cases exist within the grand cosmos prior to the formation of the local Universe, as well as having formed subsequently.

During its evolution, the individual bodies, (galaxies), will not only be subjected to the radial gravitational potentials generated by the core and each other, they will also be subjected to the gravitational effects of each other in the radial normal direction. The net effect of the individual galactic sources is to encourage clustering into simple clusters and the so called super clusters. If this was the only effect, then such conglomerations would be expected to occur somewhat at random throughout the Universe. However, there are two other radial effects that change this general configuration. The first, as mentioned above, is the radial Acceleration Potential generated by the core. The second is the acceleration resulting from the galactic masses traversing through the overall internal time dilatation gradient. This latter effect will also become stronger as masses approach the central core. The overall result will be a tendency for closer clustering in the radial direction. The eventual reversal of gravity as the physical radius passes the $3\alpha_u$ criterion will further accentuate this tendency as will the increased mutual attraction between the clusters and super clusters as they radially approach one another. The final result, probably sometime well into the second phase of evolution, will be the gradual formation of spherical layers of clusters around the core, e.g. much like the layers of skin on an onion. Due to the stochastic nature of their formation however, these galactic layers would not exhibit any form of mathematical regularity, but would most likely possess a ragged profile with many gaps in the radial normal direction. However, the current age of the Universe, estimated above at some 45 billion years, is such that they should be relatively well established.

This structure would have a significant effect upon galactic spectral redshift, especially in the latter stages of Phase II. Irregularities would occur firstly due to the local gravitational variation across layers. In addition, galaxies/clusters in any particular layer would also experience Doppler shift variations. At the lower edge of the layer they would tend to be gravitationally accelerated towards the centre of the layer, thus increasing their recessional velocity from the Universal centre. Galaxies/clusters at the top edge of the layer would experience the opposite effect. The effect on the spectral redshift would therefore be, across the layer, a reverse gradient 'kink'. This effect may also contribute to the observed apparent 'quantisation' of redshift distribution.

The literature contains many references, articles and papers etc., in which all of the above effects are reported, particularly the clustering. The layering effect is not so well observed but is becoming an established fact. Nevertheless, the structure as discussed here is the least well defined aspect of this development, possessing minimal mathematical support. The processes involved, because of the randomness of the galactic distribution and motions prior to the initiation of the first phase of evolution, would be of a highly stochastic nature. Accordingly it would not be possible to generate a mathematical model of any particular Universe, such as our own, and only the general nature of a representative average could be so described.

(vi) The Centre of the Universe.

In Section 2.1, it was stated that the physical configuration of the Universe would be expected to contain a central core. Accordingly, the question arises as to whether this core would be visible from the Earth. There are essentially two possibilities. First, it could be hidden behind (a) the centre of the home galaxy, (b) some other large stellar or galactic object or (c) intervening non-luminous matter. In any of these cases it would not be recognisable either visually or as a radio source. Furthermore, in the second possibility, where it was in full view from some location on the Earth, it may still be difficult to recognise. It may well be so distant that it appears indistinguishable from other stellar or galactic objects that are relatively closer. Its size would be variable during both phases, growing during evolution in phase I and then shrinking again in phase II. If as stated above the Universe is well into its second phase, the size of the core may no longer be any larger than a large spherical galaxy which at great distance would not therefore appear unique. Nevertheless, output of radiant energy would be extremely large and in phase I would exhibit a significant gravitational spectral red shift. This would be offset by a Doppler violet shift as all matter gravitationally migrated towards the centre. In Phase II however, its gravitational shift would be towards the violet end of the spectrum, offset against a Doppler red shift as all matter gravitationally receded from the centre. It may well be that other than this, the only distinguishing characteristic would be that it would probably appear very much like a Quasar.

(vii). Other Factors.

There are four other factors which, in addition to the receding galaxies, are often quoted, [11], as supporting the "Big Bang" models of the Universe. The first, is the preponderance of free hydrogen,(73%), and helium, (25%), in the Universe. The second is the background microwave radiation discovered by Penzias and Wilson in 1964, [11]. Both of these factors are well established and consequently need an explanation of existence within the new theory proposed here. The third is the period of "Inflation" purported to exist as part of the "Big Bang" theory, while the fourth is the excessive existence of Dark Matter and Dark Energy. All of these factors are discussed below.

(a) For the first, the preponderance of hydrogen and helium, the process that produces this may well be associated with the birth and death of stars. As the clouds of non-luminous ordinary and possibly dark matter condense to start forming the core of a star, its temperature and pressure will steadily increase under gravitational compression. Whatever the constituents of this material, under this ever increasing temperature and pressure it will rapidly start to break down. Once the temperature and pressure reaches the levels in the T-Tauri variable stage, breakdown in the core and possibly several layers above will have progressed to the point where both degenerate helium and eventually hydrogen are being produced in vast quantities. In this manner, as it grows, the star manufactures its own fusion fuel, which when fusion temperature and pressure is reached reverses the process and starts re-building the higher elements via nuclear fusion. The star is then in the main sequence and stable.

When the fusion process at the core has reached the stage of producing iron, it stops and the temperature and pressure there are no longer able to withstand the gravitational compression of the outer layers. The core collapses and the outer layers are, via nova and super nova processes, [16], released back into space. These will contain considerable amounts of hydrogen and helium, and traces of other elements, [6], that were unused in the fusion process before the core collapsed. If this evolutionary process of stars occurs over many aeons throughout the entire Universe, (and beyond), then the preponderance of these free elements will stabilise. Whether the figures quoted above are typical throughout the Universe is not known but the density of such matter should accordingly be higher in inter-stellar space than it will be in inter-galactic.

(b) Concerning the second phenomena, the microwave background radiation. It is currently proposed that this background is the glow of the early Universe as produced by the "Big Bang", and was then visible light now greatly red shifted because of the expansion. It is being observed now because from very distant parts of the Universe it would only just be reaching the Solar System, [13].

Within the concept proposed here, the microwave background would have a much simpler explanation that permits its continual generation today. One possibility is the presence of the inter-stellar, and to a lesser extent, inter-galactic non-luminous ordinary and also possibly dark matter. While in itself not an inherent source of radiation, all this matter is continuously absorbing the entire spectral output of the vast number of luminous objects in the Universe. Despite the large distances involved and the resultant attenuation, this radiation will have the effect of heating the matter that absorbs it. Over long enough periods of time the temperature of this matter will become stable at some value above absolute zero, and will accordingly radiate a black body spectrum of frequencies associated with that temperature. It is considered that such a source of generation is quite in keeping with the discovery of hot and cold spots in this background.

In the theory of the Universe proposed here, it is important to note that the spatial dimension would be "flat" as opposed to the curved characteristic of the General Theory of Relativity, and would accordingly conform to modern opinion resulting from the spatial mapping of the microwave background.

(c) In the "Big Bang" theory, in order to explain some of the observed dynamic characteristics of the Universe, it has been suggested that immediately after the initial "explosion", the expansion of the Universe underwent a period of "Inflation". In this, its rate of expansion was of such astronomical proportions so as to exceed the velocity of light, thus contravening the maximum theoretical rate possible as extant in Einstein's Special Theory of Relativity.

The Relativistic Domain theory. as proposed here, does not contain, or need, such a feature, because, in it, the expansion of the Universe, (in its second phase), does not start from a singularity, but from a physical radius of twice its gravitational radius. The quoted specific value of this feature will be fully demonstrated in a future paper.

(d) In the "Big Bang" theory, in order to explain the observed apparent acceleration of the expansion of the Universe, the preponderance of so called Dark Matter and Dark Energy, (Quintessence), has been suggested to be such as to make up as much as 95% of the mass of all the matter in the Universe. Accordingly it would be expected that, certainly Dark Matter, would be readily detectable by either absorption and re-emission, or by reflection, of incident electro-magnetic radiation from the many luminous sources throughout the Universe.

The possible existence of Dark Matter and Energy has been acknowledged in this paper in the derivation of a numerical value for the Hubble Constant. However, the acceleration of the expansion of the Universe in this Relativistic Domain theory, is gravitationally driven by the reverse gravity effect in its second, (and current), phase. Thus the presence of these materials in this theory is not a prerequisite for this purpose. Consequently, if they do exist, the preponderance of Dark Matter and Quintessence is likely to be very much lower than the 95% of Universal mass quoted earlier, and possibly, at a level so as to make detection and observation unlikely.

4 Concluding Remarks.

The alternative theory for the evolution and existence of the Universe presented here, just like all such theories, must, in view of the lack of observational support, be regarded as speculative. However, in its favour, it is based upon an existing universal phenomena, gravitation, and has been demonstrated to be mathematically sound. As such it does not rely upon exotic events such as spontaneous creation on any scale from some unknown source of energy. Also it does provide a very good theoretical estimate for the one sound observational fact, the Hubble constant of the recession of the distant galaxies, albeit this parameter is very difficult to measure.

It is also evident that the new theory does in fact contain some elements of both of the existing models. The original Steady State theory is to some extent embedded in the existence of everything outside the physical Universe. This continuum is believed to be Pseudo-Euclidean in nature and contains everything from which our Universe, and possibly others, are created and eventually disperse into. The difference is that spontaneous creation of matter is not a feature. Its near infinite spatial and temporal existence being quite self sustaining without the necessity for such bizarre events.
The "Big Bang" theory is essentially embodied in phase II of the evolution of the Relativistic Domain Universe. The similarity is augmented by the inclusion in the "Big Bang" theory of such ideas as the anti-gravity feature of dark energy and quintessence. There the similarity ends however, because of the nature in which these characteristics are generated. The spatial contraction/material expansion process of phase II of the evolution of the Universe in this new theory does not emanate from the sudden spontaneous creation, from absolutely nothing, of any form of energy or space-time continuum, or the existence of an exotic virtual particle quantum energy field. Instead it results from the simple reversal of a universally natural phenomena, gravitation.

As a result of the theory presented here, the possible resulting age of the current Universe, as roughly estimated at some 45 billion years, is considered much more in keeping with the potential age of some of its more unusual constituents such as the very distant Quasars etc.

Appendix A

Galactic Spectral Redshift in the Relativistic Domain D_1 .

Coupled with the recession of the distant galaxies is the Doppler/gravitational shift of their spectral radiation. This is used to determine the velocity of a receding galaxy. Because the recession velocities being considered may be a significant fraction of the Terminal Velocity in this Domain, ($\sim$ the velocity of light), the derivation of redshift presented here will include the effects of relativistic velocity correction. However, by virtue of the definition of the Relativistic Space-Time Domain D_1 , the derivation of spectral redshift in this Domain will differ slightly from that classically presented in the literature. The derivation of redshift in D_1 is presented below, combining the methods in both [5] and [1], Appendix D.

Let the velocity of a distant spectral emitter, (galaxy), as a function of the time at its location, with reference to some distant point of observation within the Universe be υ_G . If this source galaxy, within its spectral output generates a particular wave with frequency $f_1^{/}$ it will be given by

$$f_1^{/} = \frac{dn_1^{/}}{d\tau_1^{/}} \tag{A.1}$$

where

$n_1^{/}$ is the number of cycles generated by the source in a time $\tau_1^{/}$.

$\tau_1^{/}$ is the local time of the source galaxy.

When this wave is emitted and emerges into the gravitational field of the source galaxy, (D_1) , due to the resulting temporal rate change, its frequency will become

$$f_1 = \frac{dn_1^{/}}{d\tau_1} = \frac{dn_1^{/}}{d\tau_1^{/}}\frac{d\tau_1^{/}}{d\tau_1} = f_1^{/}\left(1 - \frac{\upsilon_G^2}{c^2u_1^2}\right)^{1/2} \tag{A.2}$$

Where

u_1 is the temporal rate at the location of the source galaxy.

τ_1 is the local time of free space within D_1 at the source galaxy.

These waves, in a unit of time at the source galaxy in D_1 occupy a distance of

$$l_{\lambda_1} = cu_1 + \upsilon_G \tag{A.3}$$

So that the apparent wavelength at the point of emission at the source galaxy is

$$\lambda_1 = \frac{cu_1 + \upsilon_G}{f_1'\left(1 - \frac{\upsilon_G^2}{c^2u_1^2}\right)^{1/2}} \tag{A.4}$$

This wavelength incorporates the Doppler shift. The wave then travels to the distant point of observation, where, if the temporal rate is u_2 , then the apparent wavelength will become

$$\lambda_1^{//} = \frac{cu_2 + \upsilon_G\left({}^{u_2}/_{u_1}\right)}{f_1^{//}} \tag{A.5}$$

Now f_1'' is the frequency of the incident wave from the source galaxy at the location of the observer and is given by

$$f_1'' = \frac{dn_1'}{d\tau_2} = \frac{dn_1'}{d\tau_1}\frac{d\tau_1}{d\tau_2} = f_1\frac{u_1}{u_2} = f_1'\frac{u_1}{u_2}\left(1 - \frac{\upsilon_G^2}{c^2u_1^2}\right)^{1/2} \tag{A.6}$$

So that in (A.5) this gives

$$\lambda_1'' = \frac{u_2}{u_1}\frac{cu_2 + \upsilon_G\left(\frac{u_2}{u_1}\right)}{f_1'\left(1 - \frac{\upsilon_G^2}{c^2u_1^2}\right)^{1/2}} \tag{A.7}$$

This apparent wavelength now contains a variation due to two causes. The Doppler shift due to υ_G , and a gravitational shift represented by the ratio of the temporal rates at the two locations, u_2/u_1 .
If another wave, of frequency f_2 , is generated from an identical source, at the location of the observer, its wavelength will be

$$\lambda_2 = \frac{cu_2}{f_2} \tag{A.8}$$

Thus from (A.7) and (A.8)

$$\frac{\lambda_1^{//}}{\lambda_2} = \frac{f_2}{f_1'}\frac{u_2}{u_1}\left(\frac{1+\frac{\upsilon_G}{cu_1}}{\left(1-\frac{\upsilon_G^2}{c^2u_1^2}\right)^{1/2}}\right) \tag{A.9}$$

Now, the emission of radiation is an internal function of the atom concerned and independent of the Relativistic Domain in which it occurs. The consequence of this in (A.9) is that

$$f_2 = f_1' \tag{A.10}$$

So that with (A.10), (A.9) becomes

$$\lambda_1^{//} = \lambda_2\frac{u_2}{u_1}\frac{\left(1+\frac{\upsilon_G}{cu_1}\right)^{1/2}}{\left(1-\frac{\upsilon_G}{cu_1}\right)^{1/2}} \tag{A.11}$$

To determine the velocity of recession of the distant emitter galaxy, (A.11) is now solved for υ_G to yield

$$\upsilon_G = cu_1\left(\frac{\frac{\lambda''^2_1 u_1^2}{\lambda_2^2u_2^2}-1}{\frac{\lambda''^2_1 u_1^2}{\lambda_2^2u_2^2}+1}\right) \tag{A.12}$$

It is important to note that this value is the velocity of recession as extant at the location of the distant galaxy itself, i.e. measured in terms of the temporal rate at that location.
If the effects of the gravitational shift can be neglected. i.e. $u_1 \approx u_2$, (A.12) becomes

$$\upsilon_G \cong cu_1\left(\frac{\frac{\lambda_1''^2}{\lambda_2^2}-1}{\frac{\lambda_1''^2}{\lambda_2^2}+1}\right) \tag{A.13}$$

However, this approximation is only valid if the emitting galaxy and the galaxy containing the distant point of observation are of comparable size and are, on a cosmological scale, relatively close together.
Finally, if υ_G is very small, it is easily seen that (A.12) and (A.13) both reduce to non-relativistic equivalents thus

$$\upsilon_G \cong cu_1\left(\frac{\lambda_1''u_1}{\lambda_2u_2}-1\right) \tag{A.14}$$

for (A.12), and

$$\upsilon_G \cong cu_1\left(\frac{\lambda_1''}{\lambda_2}-1\right) \tag{A.15}$$

for (A.13), and is clearly a rearrangement of the so called "gross" Doppler effect.

It is important to note that υ_G as determined in (A.11) to (A.13) above, is slower than the classical result due to the presence of the multiplier temporal rate term u_1 .

Eq.(A.12) gives the recession velocity of the distant galaxy from the point of observation. To determine specific values, in addition to knowledge of λ_1'' and λ_2 , it is obviously necessary to know the values of u_1 and u_2. These can be obtained from [1], Eqs. (4.6) and (4.7), wherein a reasonable estimate of the masses of the source galaxy and the galaxy containing the point of observation is required. The value of σ in [1], Eq.(4.7) will be the estimated effective radius of the source galaxy, and, for the point of observation, the distance of that point from the centre of the galaxy in which it resides. Clearly the accuracy with which υ_G is determined, will depend entirely upon the accuracy with which these gravitational parameters can be estimated.

In addition to the above, allowance should be made for the temporal rate of the position of each location relative to the centre of the Universe. This allowance would normally be incorporated into the temporal rates at the source galaxy and point of observation. However, this data is currently unknown and so any computed υ_G will contain a degree of error. It is however, considered that this error will be fairly small because of the extreme size, and age of the Universe as estimated in the main text, ($\sim$ 45 x 10^9 years). The error should only approach significant levels for the most distant galaxies that lie on the radius vector from the centre of the Universe through the point of observation.

One further point concerning the velocity of light. In general, in the Relativistic Domain representing the entire Universe, it is given by the term cu, thereby containing the temporal rate. The temporal rate is given by (2.7) in phase I and (2.18) in phase II. In both of these equations the parameter σ_u appears in the denominator. Because this term, the radius of the physical Universe, varies with time, so then will the velocity of light vary according to the contraction of σ_u in phase I and its expansion in phase II. This is in addition to the variation that occurs due to gravitation. The temporal variation is again, due to the magnitude of the parameters involved, a very slow one.

REFERENCES

[1] P.G.Bass, *Gravitation - A New Theory*, Apeiron Vol.10 (4), October 2003.

[2] P.G.Bass, *Further Kinetics of Gravitational Motion*, Apeiron Vol.11 (1), January 2004.

[3] P.G.Bass, *Generation of the Gravitational Acceleration Potential and the Time Dilatation Effect.* Apeiron Vol.11 (1), January 2004.

[5] M.Nelkon, *Light and Sound*, William Heinemann Ltd, (1957).

[6] Martin Cavendish, (Publisher), *"Quest" Magazine*", (1991).

[7] V.Fock, *The Theory of Space, Time and Gravitation,* Pergamon Press, (1959).

[8} Patrick Moore/Ian Nicolson, *Black Holes in Space*, Ocean Books Ltd., (1974).

[9] Jim Breithaupt, *Einstein - A Beginners Guide*, Hodder and Stoughton, (2000).

[10] E.E.Condon/Hugh Odishaw, (Eds), *Handbook of Physics*, McGraw-Hill, (1967).

[11] Cosmology Today, A New Scientist Guide

[12] Nigel Calder, *Einstein's Universe*, British Broadcasting Corporation, (1979).

[13] Steven Hawking, *A Brief History of Time*, Bantam Books, (1988).

[14] Isaac Asimov, *The Universe*, Penguin Books, (1983).

[15] Scientific American Inc., (Publisher), *Scientific American, (Special Edition), Vol. 12, #2, 2002*

[16] New Scientist Magazine, *Inside Science Article #76*

For further papers see:- ***www.relativitydomains.com***