THE EXPANSION OF THE UNIVERSE: A STUDY OF THE INITIAL CONDITIONS

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Received 19 February, 1979

The big bang model of the universe, frequently alleged to prove that the universe is billions of years old, is examined using first classical Newtonian mechanics and then general relativity. The model is, in fact, found to be incapable of determining the age of the universe, and does not prove the age usually associated with the model. A recent Creation is just as consistent with the laws of physics of the model as the big bang followed by the vast times needed for evolution. A modified Hubble's law is thus derived. This modified Hubble's law shows, among other things, that the quasars, for instance, are not as distant as previously believed. This reduction in the distance to quasars should aid the understanding of the energy which they radiate.

Introduction

The expanding universe is a world view popularized especially by George Gamow[1] and generally accepted by astronomers as being the history of a 15 billion-year-old universe. This article is an analysis of the expanding universe.

Simplified, this world-view states that each galaxy in the universe is moving away from all the other galaxies at a speed directly proportional to the distance between galaxies. As seen from our galaxy, the Milky Way Galaxy, all other galaxies appear to be moving radially away from us, as illustrated in Figure 1.

The experimental evidence supporting the expanding universe is an indirect chain of observations. It is not my purpose to examine that evidence[2] in this article. However, the final step in this chain of observations is a correlation of two sets of data. First, the radial velocity of a galaxy can be inferred from a measurement of its Doppler shift. Second, the distance to the galaxy can be measured by an independent method. Plotting these two measurements for many galaxies gives the graph illustrated in Figure 2. The experimental points in such a figure clearly describe a straight line through the origin, the equation of which is

$$v = Hr, \tag{1}$$

where v is the radial velocity of another galaxy, r is the distance to that galaxy, and H is a constant of proportionality known as Hubble's constant. Equation (1) is the solid line in Figure 2. From the graph, the numerical value of the Hubble constant, the slope, is found to be approximately

$$H = 10^{-5} \text{ miles/sec light year.} \tag{2}$$

The Hubble equation (1) can only be checked out to a distance of one or two billion light years, because for distances believed to greater than that, the actual distance to the galaxies are not known. Thus, equation (1) should actually read

$$v = Hr, \; r < 2 \text{ billion light years.} \tag{3}$$

However, since the equation works so well for $r < 2$ billion light years, it is assumed to hold true for distances greater than 2 billion light years. For these great distances, Equation (1) is used to determine the distance of a galaxy from its measured Doppler shift velocity and the known value of the Hubble constant.

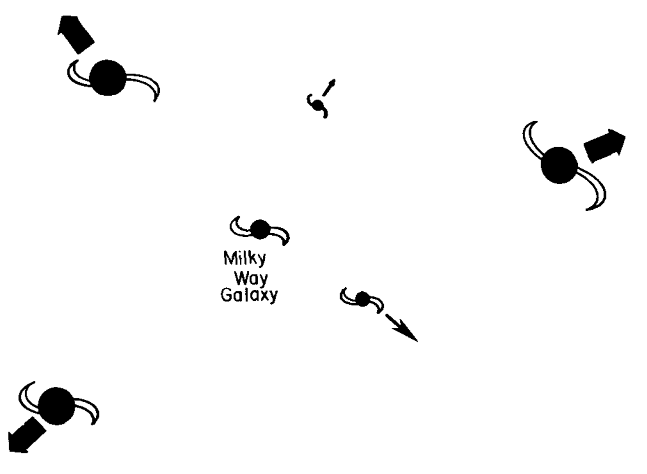

Figure 1. The expanding universe as seen from the Milky Way Galaxy.

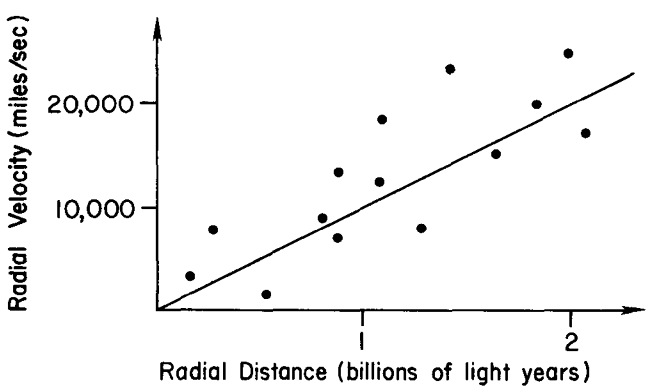

Figure 2. The graph of velocity vs. distance for galaxies. The distances and velocities are the observed ones.

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The motion described by Equation (1) is similar to the motion of the fragments of an explosion in which all the fragments started from the same place. The more distant fragments are further from the point of the explosion, only because they move faster; the velocity is proportional to the distance. Assuming the velocities to be more or less constant, $v = rt$, where t is the time since the explosion. Using this constant velocity equation in Equation (1) gives[3] for the time[4] since the explosion,

$$t = \frac{1}{H} \approx 18 \text{ billion years} \tag{4}$$

Thus, it appears that approximately 18 billion years ago all of the matter in the universe was concentrated together in a relatively small volume, exploded and has been expanding ever since. This summary describes Gamow's Big Bang theory of the origin of the universe.

Thus, it seems that the experimentally verified Equation (1) and the Hubble constant prove the universe to be 18 billion years old. Such a simple, but seemingly factual demonstration puts a Creationist in an awkward situation if it is true.

This article shows that the Hubble constant does *not* determine the age of the universe, even if equations (1), (2), (3) and (4) are correct. Rather, this article shows the Hubble constant is a very slowly varying function of time that determines the present *density* of the universe, not its age.

Equation of Motion

This section examines the motion of the universe after the big bang. All of the results are obtained under the assumption of classical Newtonian mechanics. Relativistic considerations are discussed in Appendix A.

Suppose that prior to time $t=0$, the universe consisted of one uniform[5] sphere of radius R_0. At time $t=0$, the big bang occurred, and all parts of the sphere began moving radially outward with speed $v_0(r)$ as shown in Figure 3. The uniform mass density of the sphere at $t=0$ is ϱ_0. The resulting motion of the universe after the big bang is determined by the initial conditions and by the law of gravity. All other forces will be neglected. The simplest non-trivial initial condition described all matter as having energy $E=0$ immediately after the big bang. This initial condition also yields a result in agreement with the apparent state of motion of the universe as described by astronomers today. Currently, astronomers believe the universe is expanding radially outward. They also believe that it is on the borderline between (a) continuing its expansion to infinity forever, and (b) stopping its expansion and beginning to contract sometime in the distant future. The condition $E=0$ in this section of the article yields a universe which just barely expands to infinity in an infinite time. This model is called the flat model of the universe. Any more energy, and the universe would continue to expand at a significant rate forever. The second model is called the open model of the universe. Any less energy, and the universe would stop its expansion at some finite time in the future, and contract after that time. This third model is called the closed model of the universe. Only the flat model is considered here because it seems to lead to the observed motion of the universe.

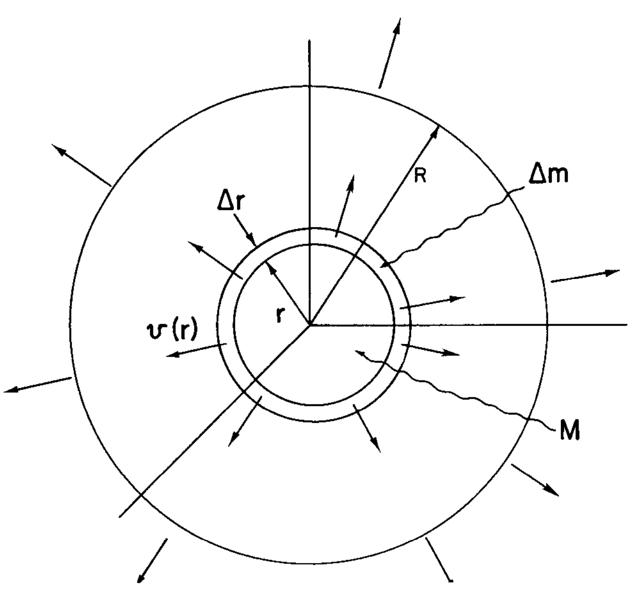

Figure 3. The geometry of the big bang model.

The thin spherical shell of thickness Δr, a distance r_0 $(0 < r_0 < R_0)$ from the origin at time $t=0$ as shown in Figure 3, would have energy $\Delta E = 0$, so that

$$\frac{\Delta m}{2} v_0^2(r_0) - \frac{G \Delta m M_0(r_0)}{r_0} = \Delta E = 0 \tag{5}$$

In Equation (5), Δm is the mass of the thin spherical shell, $M_0(r)$ is the mass *within* the sperical shell, and $v_0(r)$ is the initial radial velocity of the spherical shell. The first term in Equation (5) is the kinetic energy. The second term is the usual gravitational potential energy due to only the mass within Δm. It can be shown that for this spherical distribution the gravitational effects of the mass outside of Δm cancel.[6] The mass within Δm is the uniform density at time $t=0$ times the volume within Δm at time $t=0$, or

$$M_0(r_0) = \varrho_0 \frac{4}{3} \pi r_0^3. \tag{6}$$

When Equation (6) is substituted into Equation (5) the radially outward velocity at time $t=0$ is found to be proportional to r_0 according to

$$v_0(r_0) = \left(\frac{8\pi\varrho_0 G}{3}\right)^{1/2} r_0 \tag{7}$$

Equation (7) is a kind of Hubble law at $t=0$, since v_0 is proportional to r_0.

After $t=0$, each shell will expand radially outward, no shell passing any other shell. This expansion will be governed by a conservation of energy equation with $\Delta E = 0$ similar to equation (5).

$$\frac{\Delta m}{2} v^2(r) - \frac{G \Delta m M(r)}{r} = 0. \tag{8}$$

In Equation (8) Δm and $M(r)$ are constant; their values the same as they were at time $t=0$ since mass is conserved in Newtonian mechanics. Thus, Equation (6) can be used for $M(r)$ to yield,

$$v = \left(\frac{8\pi\varrho_0 G r_0^3}{3}\right)^{1/2} r^{-1/2} \quad (9)$$

As a check, note that Equation (9) reduces to Equation (7) at time $t=0$ when $r=r_0$. When the calculus definition $v=dr/dt$ is used in Equation (9), the differential equation that results can be integrated from r_0 at time 0 to r at time t to give:

$$r = [(6\pi\varrho_0 G)^{1/2} t + 1]^{2/3} r_0. \quad (10)$$

The density of the expanding universe can now be found from the requirement of mass conservation. All of the mass $4\pi\varrho_0 r_0^2 \Delta r_0$ in a thin spherical shell at r_0 of the thickness δr_0 at time 0, must be in the volume $4\pi r^2 \Delta r$ in the thin expanded spherical shell at r of thickness δr at time t. So $4\pi\varrho r^2 \Delta r = 4\pi p_0 r_0^2 \Delta r_0$; thus $\varrho = \varrho_0 \ (r_0/r)^2 (dr_0/dr)$.

When Equation (10) is substituted into this equation, the resulting mass density ϱ at any time t after the "big bang" is

$$\varrho = \frac{\varrho_0}{[(6\pi G\varrho_0)^{1/2} t + 1]^2} \quad (11)$$

When Equation (10) is solved for r_0, and that result used for r_0 in Equation (9), the velocity of the mass at a distance r from the origin at time t is found to be

$$v(r,t) = \frac{2}{3} \frac{r}{(t+T)}, \quad (12)$$

where T is a time constant, an abbreviation for

$$T = (6\pi\varrho_0 G)^{-1/2}. \quad (13)$$

Equation (12) appears to be a Hubble's law (v proportional to r). One adjustment must still be made. Speeds of the galaxies at time t are given by equation (12), but light seen at time t at a distance r would have been emitted at time $t - r/c$. So $v_{observed}(r, t) = v(r, t - r/c)$. When the t in Equation (12) is replaced by the earlier time $t - r/c$,

$$v_{observed}(r,t) = \frac{2}{3} \frac{r}{(t - \frac{r}{c} + T)} \quad (14)$$

where t now stands for the observer's time. This final result is *not* exactly a Hubble's law as usually stated, because r appears in both the numerator and the denominator. However, Hubble's law is known to be correct only for r small in comparison to the size of the universe. This limit on Hubble's law is expressed in Equation (3). Thus, it is not necessary to arrive at an equation for which $v=Hr$, only an equation in which $v \rightarrow Hr$ as $r \rightarrow 0$. This small r of Equation (14) is

$$v_{observed}(r,t) = \frac{2r}{3(t+T)}, \text{ when } r << ct, \quad (15)$$

and it is a Hubble law in the region where Hubble's law is known to be valid. It is the slope of this equation near the origin as shown in Figure 4, which is equal to the Hubble constant, $H = 2/[3(t+T)] \approx 10^{-5}$ miles/sec. light year $\approx 10^{-9}/18$ per year. So

$$t + T = \frac{2}{3H} = 12 \text{ billion years} \quad (16)$$

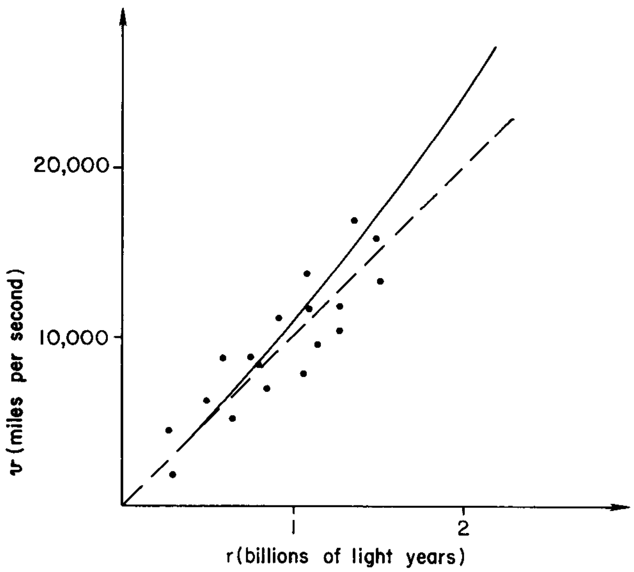

Figure 4. The theoretical relation, v vs. r. The solid line is the exact Equation (14). The dotted straight line is the approximation for r small, as expressed by Equation (15). The dots represent the same known data points as were shown in Figure 2.

When T is replaced from Equation (13), the above equation becomes

$$t + (6\pi\varrho_0 G)^{-1/2} = \frac{2}{3H} = 12 \text{ billion years.} \quad (17)$$

The importance of this simple result is that the Hubble's constant alone does *not* give the age of the universe t. Rather, the Hubble constant will determine the age of the universe t only if the initial mass density ϱ_0 is assumed to be known. Thus, only if one assumes he knows the initial state of the universe, can he calculate its age.

An evolutionist convinced that the initial density of the universe at the time of the "big bang" was essentially nuclear density would use equation (17) to calculate the age of the universe as follows:

Nuclear density[7] is taken as that of a neutron, i.e. mass divided by volume, about $2 \cdot 3 \times 10^{17}$ kg./m^3 When this value is substituted into Equation (17) the resulting age of the universe is[8] about 12 billion years, as often stated, the term involving the square root being negligible.

On the other hand, a Creationist who thinks that the age of the universe is $t = 10{,}000$ years (just to use a round figure) could use the *same* equation (17) to calculate the initial density of the universe at its creation as follows: $\varrho_0 = [6\pi G]^{-1} \ [(2/3H) - t]^{-2} = 4 \cdot 7 \times 10^{-30}$ gm/cm^3 when the appropriate numbers are put in. This would also be approximately the current density of the universe, because the universe changes relatively little over only 10,000 years. It is assuring to note that the Creationist can check his result by comparing his theoretical value of mass density for the universe with the measured mass density for the universe as quoted by astronomers. Although there is a large uncertainty in the value of universe mass density, a value of 5×10^{-30} gm/cm^3 is suggested by cosmologists Adler, Bazin, and Schiffer.[10] This best measured value is almost identical to the Creationist's prediction of 4.7×10^{-30} gm/cm^3.

The fact that the age of the universe cannot be determined until one *assumes* the initial state of the universe can be expressed another way mathematically. Eliminating t, the age of the universe, between equations (11) and (17) gives

$$\varrho = \frac{3H^2}{8\pi G} \qquad (18)$$

as the mass density for the universe at any time t. This relation does not mean that ϱ is constant. H is time-dependent as can be seen in Equation (17). What the Hubble constant *does* give is the present mass density in the universe, *not* the age of the universe. From Equation (17) the age t of the universe is

$$t = \frac{2}{3H} - (6\pi\varrho_0 G)^{-1/2} \qquad (19)$$

One must assume an initial mass density ϱ_0, in addition to knowledge of the Hubble constant, in order to determine the age of the universe. Therefore, the Hubble constant alone does *not* determine the age of the universe.

With a value of 18 billion years for $(3/2)(t + T) = 1/H$, a value both Creationists and evolutionists should agree on, equation (14) becomes

$$v_{observed} = \frac{r}{(5.68 \times 10^{17} - 5 \times 10^{-9} r)} \qquad (18)$$

using r in meters and v in meters/sec. When v is expressed in miles/sec and r in billions of light years Equation (18) becomes

$$v = 10{,}000 \frac{r}{(1 - \frac{r}{12})} \qquad (19)$$

A graph of this function appears in Figure 5. The graph shows that over the first billion light years the velocity is essentially a linear function of the distance, so that Hubble's law does hold. However, beginning at about 1 billion light years from the origin, the velocities as given by Equation (19) are 9% larger than predicted on the basis of a simple Hubble law. As the distances increase, the deviations from a linear Hubble law become larger. In terms of the Doppler velocity shift, any velocity of 15,000 miles per second or greater is too high to use the linear Hubble law to determine its distance. For objects having velocities in excess of 15,000 miles per second, the graph in Figure 5, or Equation (19), should be used to determine the distance of that object at the time it emitted the radiation we observe today.

As an example of the use of Figure 5, consider the quasar QQ172 with a Doppler shift velocity of 91 percent of the speed of light. According to the linear Hubble's law, the straight dashed curve in Figure 5, the distance of QQ172 corresponding to its velocity is about 16 billion light years. However, when the accurate Hubble's law given by Equation (19), or the solid curve in Figure 5, is used, the distance to QQ172 corresponding to its velocity is found to be about 7 billion light years, roughly half as far as previously estimated. Since it is only 7/16 as far as previously estimated, and since the apparent luminosity varies as the square of the distance, QQ172's absolute luminosity would need to be only $(7/16)^2 \approx 20\%$ of the absolute luminosity previously ascribed to it. This reduction in the absolute luminosities of quasars would greatly aid in explaining the nature of quasars, since a major problem is the excessive absolute magnitudes of quasars.

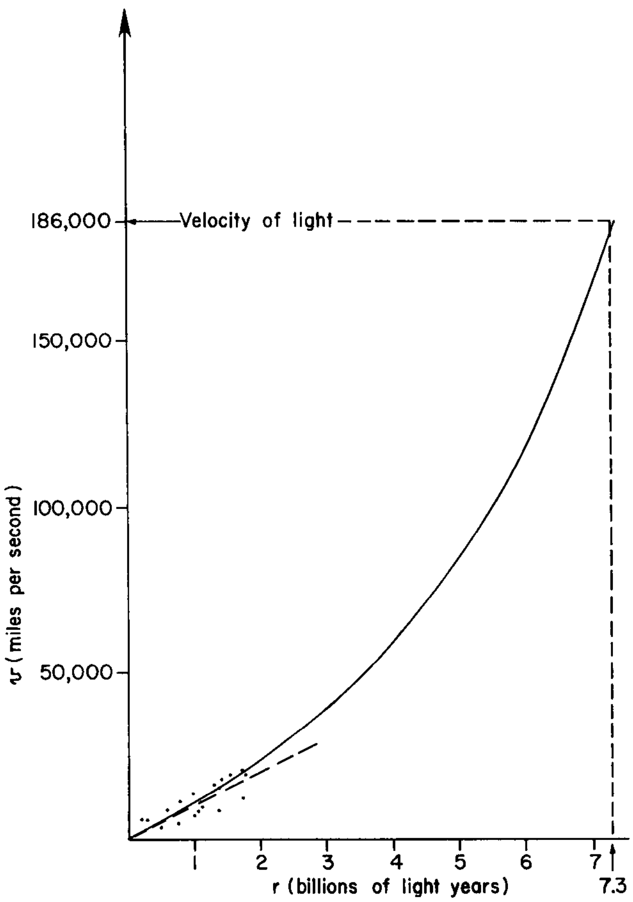

Figure 5. Equation (14). The points represent the galaxies, the smooth curve is Equation (19), the dashed straight line is the Hubble's law linearization of Equation (19), and the asymptotes indicate the limits set by the finite speed of light.

Figure 5 was obtained using classical Newtonian mechanics. This figure is not expected to be accurate for velocities v approaching the speed of light c or for distances r large enough to include a significant portion of the mass of the universe. These two restrictions can be removed only by using the general theory of relativity to solve the problem. This general relativity solution is presented in Appendix A. Unexpectedly, the general relativity solution is identical to the classical Newtonian solution. Therefore, any doubt as to the validity of the results obtained classically should be removed, and Figure 5 should be considered accurate over its entire range.

Conclusions

Great care is required to give proper consideration to initial conditions in a cosmological model. The simplified model presented in this article shows that the Hubble constant by itself does not determine even a ball-park figure for the age of the universe, although it may determine other features of the universe such as present mass density. An initial creation only 10,000 years ago is just as consistent with the Hubble constant and density of the universe as is the "big bang" model which dates creation billions of years ago. Therefore, one must be able to demonstrate what the actual initial conditions at creation where; or one must acknowledge that the time and initial state of creation can vary within the wide limits stated.

The Hubble law is shown to be linear over a relatively small distance of approximately a billon or two light years, corresponding to a Doppler velocity of up to 15,000 miles per second. Doppler velocities greater than this can still be used to determine the distance the light source was at the time it emitted its light. However, the non-linear relation given by Equation (14) or Figure 5 must be used. The general effect of this non-linear distance determination is to reduce the distances to the mysterious objects that present us with unusually large Doppler shifts.

Acknowledgement

I greatfully acknowledge the kind assistance of Dr. Harold Slusher, Physics Department, University of Texas, El Paso, Texas, for reviewing this manuscript and for the suggestions he offered.

Appendix A

General Relativity Effects

This appendix will examine the effects general relativity would have on the previous results. The previous results seem to be restricted to velocities much less than the speed of light c. They also seem to be restricted to distance r small enough so as not to contain enough mass to significantly affect the curvature of the space-time structure of the universe within r. The restriction on the speeds could be removed by using the concepts of special relativity. However, the formalism of general relativity is required to accurately account for both the high speeds and the large masses encountered in the problem of the expanding universe. The reader who is not equipped to follow the mathematics of general relativity will at least want to read the concluding paragraph of this appeandix to see the corrections required by general relativity, since it obviously *must* be dealt with.

The reader who is equipped to follow the mathematics of general relativity needs to be introduced to the terms used here. The derivation will begin with the Einstein equations and the Robertson-Walker metric. This metric will have a zero cosmological constant Λ, since it is the static universe theories that require a non-zero cosmological constant. The form of the Robertson-Walker metric used is the metric for the flat expanding universe. For this choice of metric the universe expands with classical zero potential energy plus kinetic energy as in the body of this article. The equations used are taken from chapters 12 and 13 of *Introduction to General Relativity* by Adler, Bazin, and Schiffer. Chapter 12 is "Descriptive Cosmic Astronomy," and chapter 13 is "Cosmological Models." Using their notation, the zero cosmological constant is expressed by $\Lambda = 0$, and the flat expanding universe is expressed by $k = 0$. The model considered assumes all galaxies have only radial motion. Hence, the pressure is $P = 0$, because the pressure would be due to the average random motion of galaxies. Adler, Bazin, and Schiffer ultimately resort to $P = 0$ too, although some of their initial equations allow a non-zero pressure.

Finally the symbol for the universal gravitational constant is k in the equations of Adler, Bazin, and Schiffer, but will be written as G in this appendix.

The metric is defined for the model under consideration by the differential line element in four-space (Equation (12.56) of Adler, Bazin, and Schiffer),

$$(ds)^2 = c^2(dt)^2 - \frac{R^2(t)}{r_0^2}(dr)^2 = \sum_{\alpha,\beta} g_{\alpha\beta}dx^\alpha dx^\beta$$

since only radial motion is considered. $R(t)$ is an unknown function of t and r_0 is an undetermined constant. Adler, Bazin, and Schiffer give the Einstein field equations

$$G^\nu{}_\mu + \Lambda g^\nu{}_\mu = -\frac{8\pi G}{c^2}T^\nu{}_\mu$$

in their equations (13.18a) and (13.18b). The T^0_0 component of the Einstein equations is

$$\frac{8\pi G}{c^2}\varrho = 3\left(\frac{\dot{R}}{cR}\right)^2 \tag{A.1}$$

and the T^1_1 component of the Einstein equations is

$$0 = \left(\frac{\dot{R}}{cR}\right)^2 + \frac{2\ddot{R}}{c^2R} \tag{A.2}$$

All other components are $0 = 0$. A combination of Equations (A.1) and (A.2) yields $(d/dt)(\varrho r^3) = 0$. Thus the total mass of the universe is constant,

$$M = \frac{4}{3}\pi R^3\varrho = \text{const.} \tag{A.3}$$

Equation (A.2) can be rearranged to give

$$\frac{d}{dt}(R^{1/2}\dot{R}) = 0$$

so that

$$\dot{R} = \frac{D_0}{R^{1/2}} \tag{A.4}$$

where D_0 is a constant of integration. When Equation (A.4) is substituted into Equation (A.1), the constant D_0 can be evaluated,

$$D_0 = \left(\frac{8\pi G\varrho R^3}{3}\right)^{1/2} = (2GM)^{1/2} \tag{A.5}$$

The general solution of Equation (A.4) is

$$R = \left(R_0^{3/2} + \frac{3}{2}D_0t\right)^{2/3} \tag{A.6}$$

where $R(0) = R_0$. Since, $R^3\varrho$ is constant from Equation (A.3), D_0 could be written

$$D_0 = \left(\frac{8\pi G\varrho_0 R_0^3}{3}\right)^{1/2} \quad (A.7)$$

When the expression for D_0 is used in Equation (A.6) and the resulting equation solved for R_0, we get

$$R(t) = R_0(1 + \frac{t}{T})^{2/3} \quad (A.8)$$

or

$$R_0 = \frac{R(t)}{(1 + \frac{t}{T})^{2/3}} \quad (A.9)$$

where T is the time constant previously defined by Equation (13.)

The motion of one of the galaxies is defined by the geodesic

$$\frac{d^2x^1}{ds^2} + \{\beta{}^1\gamma\}\frac{dx^\beta}{ds}\frac{dx^\gamma}{d\,s} = 0 \quad (A.9a)$$

Since the only non-zero $({}_\beta{}^1{}_\gamma)$ is

$$\{{}_0{}^1{}_1\} = \{{}_1{}^1{}_0\} = \frac{\dot{R}}{cR} = \frac{2}{3(t+T)} \quad (A.10)$$

the geodesic equation becomes

$$\frac{d^2x^1}{ds^2} + \frac{4}{3c(t+T)}\frac{dx^1}{ds}\frac{dx^0}{ds} = 0 \quad (A.10a)$$

or

$$\frac{d}{dt}(\frac{dr}{ds}) + \frac{4}{3(t+T)}(\frac{dr}{ds}) = 0 \quad (A.10b)$$

This geodesic equation can be manipulated into the simpler form

$$\frac{d}{dt}[(t+T)^{4/3}(\frac{dr}{ds})] = 0 \quad (A.10c)$$

Integrating gives

$$\frac{dr}{ds} = \frac{A}{(t+T)^{4/3}} \quad (A.10d)$$

where A is a constant of integration.

A possible solution occurs when $A = 0$, yielding

$$r = \text{constant}. \quad (A.11)$$

It will become obvious that this is the choice for A which corresponds to the non-relativistic solution in the body of this article. Note that r is the coordinate point, while the physical distance dr_P between nearby radially separated points is given by $g_{11}^{1/2}dr = (R/r_0)dr$, or

$$dr_P = \frac{R_0}{r_0}(1 + \frac{t}{T})^{2/3}dr. \quad (A.12)$$

so that the universe is physically expanding. Equation (A.12) is easily integrated to give the physical distance to a galaxy at our time (i.e., the observer's time), t.

$$r_P = \frac{R_0}{r_0}(1 + \frac{t}{T})^{2/3}r. \quad (A.13)$$

When Equation (A.13) is differentiated, the physical velocity v_p at time t is

$$v_P = \frac{2R_0 r}{3r_0 T}(1 + \frac{t}{T})^{-1/3} \quad (A.14)$$

The constant coordinate distance r can be eliminated between Equation (A.13) and (A.14) to yield

$$v_P = \frac{2r_P}{3(t+T)} \quad (A.15)$$

Equation (A.15) is the prototype of Hubble's law, and it should be compared with Equation (12) in the body of this paper.

The final effect to be accounted for is the time required for light to travel the physical distance r_p back to the observer. Light travels along the null world line $(ds)^2 = 0$ or $c^2(dt)^2 - (R/r_0)^2(dr)^2 \doteq 0$. By combining Equations (A.8) and (A.12), this null geodesic becomes $|dr_p| = c|dt|$ Thus, light travels with the constant velocity c between the two physical points r_p and the origin. Therefore, the replacement $t \to t - (r_p/c)$ in Equation (A.15) accounts for the time of travel of light. The final equation, accurate in the strictest sense of *general relativity* relating the distance of a galaxy to its observed velocity at observed time t is

$$v_P = \frac{2}{3}\frac{r_P}{(t + T - \frac{r_P}{c})} \quad (A.16)$$

This relationship from general relativity is identical to the corresponding relationship given by Equation (14) in the body of this article. Also, the solid curve in Figure 5 should now be considered accurate over its entire range.

As before, the Hubble constant H is the ratio of v_p to r_p when r_p is small compared to the size of the universe.

$$H = \lim_{r_P \to 0}\frac{v_P}{r_P} = \frac{2}{3(t+T)} \quad (A.17)$$

Since Equation (A17) is identical with Equation (16) in the body of this article, it is still true even in the sense of general relativity that the age of the universe is *not* determined by the Hubble constant. Rather, one must assume he already knows the initial state of the universe by specifying the density ϱ_0 at Creation (equivalent to specifying T), before he can calculate the time t at which that initial state existed.

Hubble's constant still does determine the density of the universe according to Equation (18) in the body of this article. This relation is shown by using the solution (A.8) and the definition (A.17) in the first Einstein tensor equation (A.1) to obtain

$$\varrho = \frac{3H^2}{8\pi G} \quad (A.18)$$

which is identical to Equation (18).

The conclusion of this appendix on general relativity is that the results and comments in the body of this article are true even in the light of general relativity. No correction is required to allow for relativity.

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CREATION RESEARCH SOCIETY

History The Creation Research Society was first organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a real need for an association devoted to research and publication in the field of scientific creationism, with a current membership of about 500 voting members (with graduate degrees in science) and over 1600 non-voting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as probably the outstanding publication in the field.

Activities The Society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible.

Membership Voting membership is limited to scientists having at least an earned graduate degree in a natural or applied science. Dues are $10.00 (Foreign, $11.00 U.S.) per year and may be sent to Wilbert H. Rusch, Sr., Membership Secretary, 2717 Cranbrook Road, Ann Arbor, Michigan 48104. Sustaining membership for those who do not meet the criteria for voting membership, and yet who subscribe to the statement of belief, is available at $10.00 (Foreign, $11.00 U.S.) per year and includes subscription to the Annual Issue and Quarterlies. All others interested in receiving copies of all these publications may do so at the rate of the subscription price for all issues for one year: $13.00 (Foreign, $14.00 U.S.).

Statement of Belief Members of the Creation Research Society, which include research scientists representing various fields of successful scientific accomplishment, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution), both of the universe and the earth with its complexity of living forms.

We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. In 1970 the Society published a textbook, *Biology: A Search for Order in Complexity*, through Zondervan Publishing House, Grand Rapids, Michigan 49506. Subsequently a Revised Edition (1974), a Teachers' Guide and both Teachers' and Students' Laboratory Manuals have been published by Zondervan Publishing House. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including man, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The great Flood described in Genesis, commonly referred to as the Noachian Flood, was an historic event worldwide in its extent and effect.
4. We are an organization of Christian men of science who accept Jesus Christ as our Lord and Saviour. The account of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Saviour for all mankind. Therefore, salvation can come only through accepting Jesus Christ as our Saviour.

Expansion of the Universe

(Continued from page 181)

References

[1]Gamow, George, 1974. One two three infinity. Viking Press, New York. Chapter X.

[2]Shipman, Harry L. 1978. The restless universe. Houghton Mifflin Co., Boston, is a good standard astronomy test in which to read the long chain of indirect measurements supporting the distances associated with the notion of an expanding universe.

[3]The exact numerical value for t found by using $H = 10^{-5}$ miles/sec light year in Equation (3) is 18.6 billion years. However, as Figure 2 shows, the value of the Hubble constant is not accurately known. Therefore, its reciprocal is, of course, not accurately known. Here, the round figure of 18 billion years will be used for the reciprocal of the Hubble constant instead of the figure 18.6 billion, which would be consistent with Equation (2).

[4]Actually, it is well known that for a flat universe $t = (2/3)(1/H)$, about 12 billion years, instead of $t = 1/H$, about 18 billion, as in Equation (4). This correction factor of 2/3 is not new, and it is evident from Equation (16) later in this article.

[5]The assumption of a homogeneous universe prior to the big bang will result in a homogeneous universe now; but the universe is not homogeneous. The galaxies are known to occur in groups. See, e.g., Smith, Elske, V.P. Jacobs, and Kenneth C. Jacobs, 1973. Introductory astronomy and astrophysics. W.B. Saunders, Philadelphia. Section 19.3. The assumption of homogeneity is made purely for simplicity. It is well to note here that the transition from the big bang to the present inhomogeneous universe has evolutionists stumped. See Slusher, Harold S., 1978. The origin of the universe. Creation-Life Publishers, San Diego, California.

[6]Halliday, David, and Robert Resnick, 1974. Fundamentals of physics. John Wiley and Sons, Inc., New York. Section 14.4.

[7]Hurley, James P., and Claude Garrod, 1978, Principles of physics. Houghton Mifflin, Boston, give the mass of the neutron as 1.67495×10^{-27} kg, on the inside front cover. Evans, Robbley D., 1955. The atomic nucleus. McGraw-Hill, New York. Equation (1.3) gives the radius of the neutron, a thing actually rather hard to define, as 1.2×10^{-15} m.

[8]The last term $(6\pi\varrho_0 G)^{-1/2}$ is expressed in metric units.

[9]All times have been converted into seconds.

[10]Adler, Ronald J., Maurice Bazin, and Menahem Schiffer, 1975. Introduction to general relativity. Second edition. McGraw-Hill, New York. p. 394.