POLYTROPIC MODEL OF THE UNIVERSE

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Non-Technical Summary

Many scientists accept the idea that everything in the universe started with the big bang. This model sets the upper limit to the age of the universe at approximately 15 billion years. Even though no known physical force could start such an event, evolutionists accept this as a fact just as we as Christians accept God's act of creation. I will readily accept that God could do anything He chooses. He could have chosen to start his creation as a big bang but this does not easily allow for the creation to be a recent event. For example, God did not create Adam as a babe and then allow him to grow. God created him as a man, fully grown, fully aware of God and His creation. I see no reason why God could not have created the universe fully formed and physically stable. Therefore, our task is to discover what form and structure God used to stabilize the universe.

To that end we can look for patterns within God's creation. All life shows patterns of a common designer. The solar system of our planet shows a pattern of orbits. The stars within our Milky Way show a pattern of orbits about the center of our galaxy. Our galaxies all have one thing in common. They all show the pattern stars orbiting around some center. This is true despite which structure we see: spiral, irregular, globular, or spherical. Recent observations even show that groups of galaxies have a pattern or structure that may indicate that something bigger is attracting them.

The polytropic model of the universe is a simple physical and mathematical structure extending ideas of the patterns seen in God's creation to the universe. The universe may be a structure like a galaxy where we replace the stars by galaxies. The orbital motion causes the red shifts that we observe here on earth. The universe is smaller than the big bang model at approximately 600 million light years in diameter. We are somewhere near the center and everywhere galaxies move across the sky in their orbits. The details of the physics, mathematics and astronomy match the observations very well and give considerable insight to the mystery of the quasars. The polytropic model for the first time allows a direct measurement of the mass of the universe. It is found to be approximately 6×10^{54} grams. This universe is stable and is not expanding. It will not collapse. God could have created it recently just as He described for us in Genesis.

Abstract

The universe is either expanding or it is not. If it is expanding then the Big Bang may have been the cause. If it is not expanding then the Big Bang did not occur. In recent literature, there has been a significant number of objections and problems presented concerning the Big Bang. In this work, a non-expanding polytropic model of the universe is presented that can account for many of the observations previously attributed to the Big Bang and some observations that cannot be explained if the Big Bang did occur.

Introduction

The structure of the universe is currently considered to be an expanding ball of matter and space. This expansion was caused by an initial explosion known as the Big Bang (Sciama, 1977). The basic unit of matter in this expanding structure is the galaxy. The major observational evidence supporting the Big Bang Model of the Universe is (Kaufmann, 1973; Bouw, 1982): 1) the 3K cosmic background radiation, 2) the Hubble Law based on the expansion of galaxies away from our galaxy, 3) the apparently extreme age of quasars, and 4) the ratio of hydrogen to helium: H/He. Each of these observations presents problems when analyzed in detail. For example, formation of galaxies (Alpher and Herman, 1978) and the large scale structure of galactic clusters both create significant problems for the Big Bang model because the cosmic microwave background (CMB) is so completely uniform (Gulkis, et al., 1990).

The Hubble relationship indicates that an expanding universe has an inexplicably large portion being "dark" matter (Bouw, 1982). Quasars also present an unknown energy source because their luminosity is three or four orders of magnitude greater than theoretically possible. If quasars are 15 billion light years away as represented by a cosmological red-shift, then their energy source is not known. If their red-shift is not cosmological then much of the evidence for the expanding universe is eliminated (Alpher and Herman, 1978).

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The structure of the universe is intimately related to the model of its origin. The Big Bang Model can be used to predict the cosmological source of the 3K background and the Hubble Law (Gulkis, et al., 1990). Therefore, the structural model of a non-expanding universe will be presented that addresses these relationships and shows that expansion is not necessary to account for these observations.

Physical Models

There are a number of simple and useful physical models that allow a better understanding of more complex ideas. The Bohr model of the atom is still extremely useful; its simplicity allows for a deeper understanding of spectroscopy, exciton transitions, atomic orbitals, (Hench and West, 1990) and others. Another example is that of Pauling's valence model of chemical bonding. It is simple and still useful for explaining molecular ratios in chemical compounds. Complex things become easier to understand if they can be visualized using a simple model.

Another example is the simple model of the solar system that was put forth by Copernicus, improved upon by Kepler, and formalized by Newton. The idea is simple; the planets orbit about the sun and the earth is one of those planets.

Another example of an orbiting structure is that of the galaxies. We have observed that most galaxies are rotating. Nearby Galactic stars orbit about some center (Mihalas, et al., 1981; Gorenstein, et al., 1978; Whitney, 1971). There is however a difference between stars in orbit in a galaxy and planets in orbit about our sun.

The planets in our solar system follow what is known as Keplerian motion (Abell, 1969). That is, the inner planets have much higher orbital velocities than the outer planets. This is not true for stars in orbit about a galactic center. Most galaxies have inner stars with much lower orbital velocities than the outer stars. This is caused because the mass of a galaxy is distributed whereas more than 99 percent of the mass of our solar system is concentrated in our sun (Whitcomb, 1971).

It is proposed that the structure of the universe itself is much like that of a galaxy. If the mass of the universe is distributed then galaxies near the center of the universe should have lower orbital velocities than those further out from the center. It is also proposed that mass distribution follows a polytropic structure. This would be a first approximation to the distribution of galaxies orbiting about some center of the universe.

In the polytropic model presented below, it is assumed that classical physics will give a reasonable first approximation for the gravitational potential. Relativistic equations will then be applied where orbital velocities approach the speed of light.

Model of a Polytropic Star

The polytropic model was first developed as a solution to the structure of a normal star. A normal star is one in which the size or luminosity does not change over short time periods and obeys the following five equations:

$$\frac{dP}{dr} = -\frac{GM(r)}{r^2}\rho \quad \text{“hydrostatic equilibrium,”} \quad (1)$$

$$\frac{dM(r)}{dr} = 4\pi\rho r^2 \quad \text{“continuity of mass,”} \quad (2)$$

$$\frac{dL(r)}{dr} = 4\pi\rho\epsilon r^2 \quad \text{“thermal equilibrium,”} \quad (3)$$

$$\frac{dT}{dr} = \frac{-3}{4ac}\,\frac{\kappa P}{T^3}\,\frac{L(r)}{4\pi r^2}$$

“for radiative equilibrium,” (4)

or

$$\frac{1}{T}\frac{dT}{dr} = \frac{\gamma-1}{\gamma}\,\frac{1}{P}\,\frac{dP}{dr}$$

“for convective equilibrium,” (5)

where P(r), M(r) and L(r) are the pressure, mass and luminosity at radial distance r in the structure; ρ is the density, T is the temperature, G is the gravitational constant, k is the opacity, γ is the exponent of the adiabatic gas law, and ε is the energy generation rate.

The polytropic solution to this system of related equations has been discussed in great detail by Eva Novotny (1973) and others.

A polytropic star is one in which the pressure obeys an equation of the following form:

$$P = \kappa\rho^{(1+\frac{1}{n})} \quad (6)$$

Since the pressure is an explicit function of density only, polytropic stars are determined by the equation of hydrostatic equilibrium (equation 1) and the equation of continuity of mass (equation 2). By combining these two equations and using dimensionless variables, one differential equation can be formed which defines the structure of a polytropic star of index n which is part of the exponent in pressure equation 6.

$$\frac{1}{\xi^2}\frac{d}{d\xi}\left(\xi^2\frac{d\theta}{d\xi}\right) = -\theta^n \quad (7)$$

This is known as the Lane-Emden equation (Novotny, 1973). The variables are defined as follows with the subscript c indicating the core values:

$$\theta^n = \frac{\rho}{\rho_c} \quad (8)$$

$$\theta = \frac{T}{T_c} \quad (9)$$

$$\xi = \frac{r}{r_n} \quad (10)$$

where r_n is known as the Emden unit of length and

$$R = \xi_0 r_n \quad (11)$$

The polytropic model provides a good approximation to the structure of certain types of real stars and our sun (Novotny, 1973). This idealized model is often useful in qualitative and even in semi quantitative discussions and aids considerably in gaining an overall insight into the structure of stars.

A Polytropic Universe

This defines the mathematical formalism for a model of a polytropic universe in which galaxies orbit within a distribution of matter. Thus, the mass at a polytropic radius, x, can be determined by integrating the continuity of mass equation (2):

$$M_\xi = M\frac{[-\xi^2\, d\theta/d\xi]}{[-\xi^2\, d\theta/d\xi]_{\xi_0}} \quad (12)$$

and the temperature at this radius is

$$T = T_c\theta \quad (13)$$

with M being the total mass of the universe and T_c is the central temperature. This by no means implies that galaxies collide like an ideal gas. This distribution of galaxies would, however, create the gravitational potential under which the gas and dust in the universe might be governed. The scale factor, $\alpha \equiv r_n$, defined from equation 11 is

$$\alpha \equiv \frac{R}{\xi_0} \quad (14)$$

where R is the radius of the universe and ξ_0 is determined by the choice of n. Then

$$\xi = \frac{r}{\alpha} \tag{15}$$

Therefore the total mass, M, the total radius, R, and the polytropic index, n, are parameters of the solution.

A choice of the polytropic index for the universe is arbitrary but it could be re-selected to match astronomical observations more closely after this following example. Let us consider a polytropic universe where

$$n = 1.5 \tag{16}$$

The density of the universe (or any polytropic structure) then can be plotted from the core to its outer edge (see Figure 1) with n = 1.5.

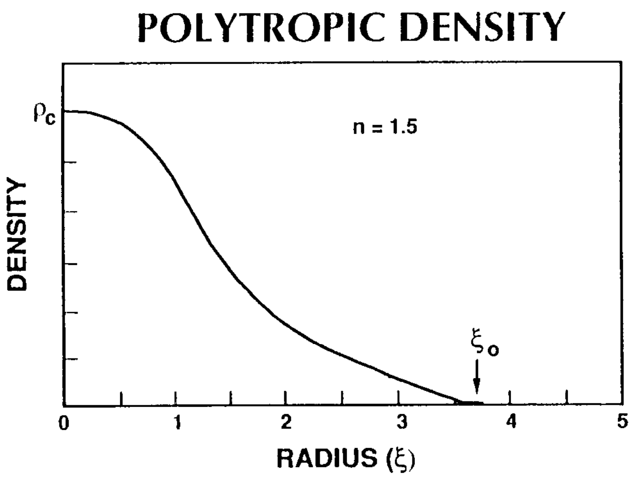

Figure 1. The calculated density of a polytropic structure with an index of 1.5.

Motion of the Milky Way

Having formulated a model structure of the universe, we need now analyze how our own galaxy will fit into this picture. One of the first questions to be answered is how our galaxy moves with respect to this model.

We can first assume that our galaxy is in a Newtonian orbit about the center of the polytropic universe. The equation governing its motion is

$$a_0^3 = P_0^2(M_\xi + m_0) \tag{17}$$

where M_ξ is the mass of the universe inside the orbit of the Milky Way, a_0 is the semi-major axis of the Milky Way's orbit in the universe, P_0 is the orbital period in years, and m_0 is the mass of the Milky Way.

This can be simplified by using the fact that

$$M_\xi >> m_0 \tag{18}$$

then the orbital equation becomes

$$a_0^3 = P_0^2 M_\xi \tag{19}$$

If we also assume a circular orbit, then the circumference is $2\pi\ a_0$ and the orbital velocity is given by:

$$\nu_0 = \frac{2\pi a_0}{P} \tag{20}$$

Solving for the period and substituting into the orbital equation yields.

$$a_0^3 = \left(\frac{2\pi a_0}{\nu}\right)^2 M_\xi \tag{21}$$

$$a_0 = \left(\frac{2\pi}{\nu_0}\right)^2 M_\xi \tag{22}$$

Thus.

$$\nu_0 = 2\pi \left(\frac{M_\xi}{a_0}\right)^{1/2} \tag{23}$$

The radius of the orbit a_0 can be re-written in reduced units using equation (15):

$$a_0 = \alpha\xi \tag{24}$$

Thus the orbital velocity becomes

$$\nu_0 = 2\pi \left(\frac{M_\xi}{\alpha\xi}\right)^{1/2} \tag{25}$$

Divide this equation by the square root of the total mass, $\sqrt{M}$ which yields

$$\frac{\nu_0}{\sqrt{M}} = \frac{2\pi}{\sqrt{\alpha\xi}} \left(\frac{M_\xi}{M}\right)^{1/2} \tag{26}$$

Multiply through by $\frac{\sqrt{\alpha}}{2\pi}$:

$$\frac{\nu_0}{2\pi}\left(\frac{\alpha}{M}\right)^{1/2} = \left(\frac{M_\xi}{\xi M}\right)^{1/2} \tag{27}$$

Define a reduced velocity, ω, as:

$$\omega \equiv \frac{\nu_0}{2\pi}\left(\frac{\alpha}{M}\right)^{1/2} \tag{28}$$

then

$$\omega = \left(\frac{1}{\xi}\frac{M_\xi}{M}\right)^{1/2} \tag{29}$$

The reduced orbital velocity, ω, of the polytropic universe can be determined as a function of the radius, ξ. Table 1 shows the calculational parameters for this model with the last two columns as calculated from this model. Figure 2 plots the orbital velocity of the universe around the center as a function of radius, ξ. In keeping with the hypotheses of a polytropic model, the Milky Way and many other galaxies show very similarly shaped orbital velocity curves (Mihalas and Binney, 1981), (see Figure 3). In fact, most of the known spiral galaxies exhibit maxima at large radii in their orbital velocity curves just as predicted by the polytropic model.

For this model of the universe, we must pick a position of the Milky Way with respect to the polytropic radius, ξ. We simply postulate that the Milky Way orbits the center of the universe at a radius, $\xi_\star$, where

$$0.200 < \xi_\star < 0.300. \tag{30}$$

The location of the Milky Way at $\xi_\star$ is shown in Figure 2. In fact, $\xi_\star$ could be anywhere in this range without greatly affecting the characteristics of the universe as observed from the earth as we shall see below. But first we must discuss the origin of the red-shift.

Table 1

Polytropic Model with n = 1.5

θ	ξ	$\xi^{1/2}$	$d\theta/d\xi$	$-\xi^2\, d\theta/d\xi$	M_ξ/M	ω
1.0000	0.000	0.000	0.0000	0.0000	0.0000	0.00000
.9983	0.100	0.316	-0.0333	0.0003	0.0001	0.03493
.9934	0.200	0.447	-0.0663	0.0026	0.0010	0.06990
.9851	0.300	0.547	-0.0987	0.0089	0.0033	0.10445
.9737	0.400	0.632	-0.1302	0.0208	0.0077	0.13852
.9591	0.500	0.707	-0.1605	0.0401	0.0147	0.17146
.9151	0.750	0.866	-0.2238	0.1258	0.0463	0.24846
.8451	1.000	1.000	-0.2872	0.2872	0.1058	0.32527
.7166	1.400	1.183	-0.3494	0.6848	0.2523	0.42452
.5707	1.800	1.342	-0.3736	1.2104	0.4459	0.49771
.3504	2.400	1.549	-0.3503	2.0177	0.7434	0.55655
.1588	3.000	1.732	-0.2842	2.5578	0.9424	0.56048
0.0000	ξ_0	1.911	-0.2033	2.7141	1.000	0.52329

$\left[-\xi^2 \frac{d\theta}{d\xi}\right]_{\xi_0} = 2.71406$ and $\xi_0 = 3.65375$ with $\omega = \left(\frac{M_\xi}{\xi M}\right)^{1/2}$

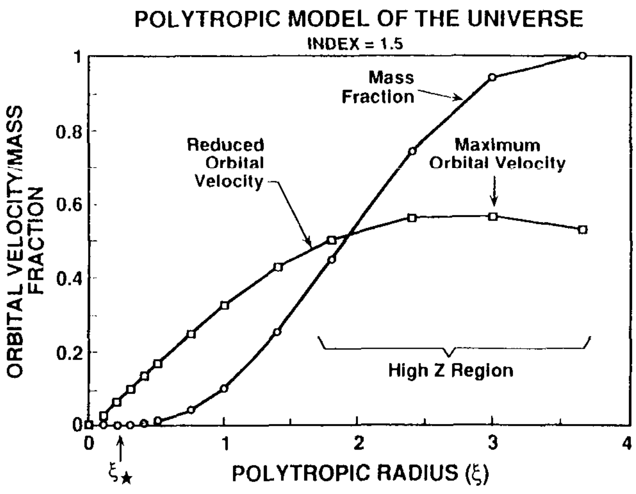

Figure 2. The orbital velocities of galaxies in a polytropic universe with an index of 1.5.

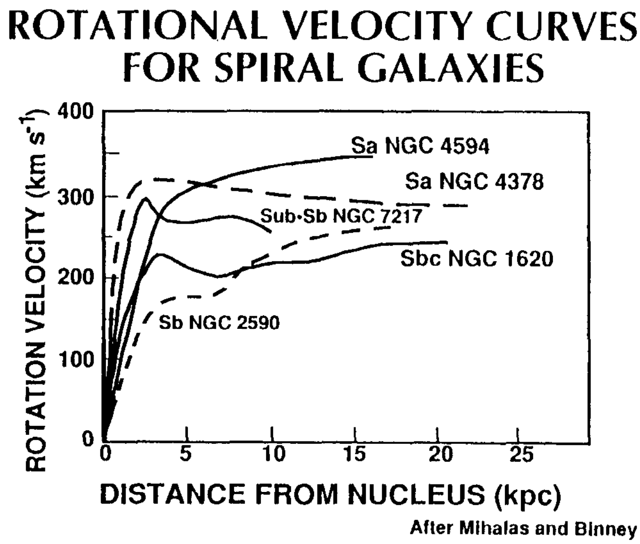

Figure 3. Orbital velocities of stars in some nearby galaxies measured by doppler shifts.

Transverse Doppler Effect

The Hubble relation clearly presents a picture of an expanding universe. Any other model, i.e., non-expanding, must account for this observation. A large number of galaxies have red-shifts, few have blue-shift. The polytropic universe can yield similar results if the relativistic form of the red-shift is applied to the motion of the galaxies that orbit the polytropic universe.

The red-shift seen for galaxies is typically analyzed as a recession effect. The transverse component of the velocity, λ, is not generally measurable because of the extreme distances involved. The more general form of the Doppler Effect is derived in J. D. Jackson's "Classical Electrodynamics" (1962, p. 364):

Table 2. Transverse Doppler Effect.

v/c	Δλ/λ Transverse Red-Shift (γ = 90°)
0.1000	0.005
0.2000	0.020
0.3000	0.048
0.4000	0.091
0.5000	0.155
0.6000	0.250
0.7000	0.400
0.8000	0.667
0.9000	1.294
0.9797	3.988
0.9900	6.089

Table 3. Relative Velocities in the Universe.

Object	Velocity	Description
Earth	30 km/sec	Solar Orbit
Sun	230 km/sec	Milky Way Orbit
Andromeda	80 km/sec	W.r.t., Milky Way
Milky Way	600 km/sec	W.r.t., Local Galaxies

$$\lambda_r(\gamma) = \lambda_t \frac{[1-(\nu/c)\cos\gamma]}{[1-(\nu^2/c^2)]^{1/2}} \qquad (31)$$

which is related to the transverse angle γ.

The change in wavelength, Δλ/λ, is usually defined as z, and it has the following form:

$$\frac{\lambda' - \lambda}{\lambda} = \frac{\Delta\lambda}{\lambda} \equiv z_{\text{tran}} = \left[\frac{1 + (\nu/c)\cos\gamma}{(1 - (\nu/c)^2)^{1/2}}\right] - 1 \qquad (32)$$

Table 2 shows the relationship of the change in velocity, expressed as a fraction of the speed of light, c, with z = Δλ/λ.

We can see that the full range of observed galactic red-shifts fall within the values available for the transverse Doppler Effect. For example, generally the higher observed galactic red-shift reported by Gregory and Thompson (1982) is

$$z(galactic) \leq 0.4. \qquad (33)$$

In contrast, the maximum observed red-shift for quasars is reported by Osmer (1982)

$$z(quasars) \approx 4. \qquad (34)$$

Note also that there are very few objects in between the galaxies and the quasars, i.e., there is a gap in the data. Note also that the maximum observed z is 3.8 for Quasar 4C41.17 (Miley, et al., 1993). There is one extreme valve of z = 3.395 reported for an optical galaxy (Eales, et al., 1993). This high velocity optical galaxy would be analogous to high velocity stars in our galaxy or a comet in our solar system having a highly elliptical orbit.

Relationship Between Red-Shift and Distance

Direct measurement of distances in the universe is limited at present to triangulation (called parallax) based on the shift in stellar positions as the earth moves through its orbit about the sun. This direct measurement results in the definition of the distance unit known as the parsec (pc). A distance of one parsec is defined as the distance required to shift the apparent position of a stellar object one second of arc when the base of the triangle is one astronomical unit (A.U.) the radius of earth's orbit about the sun. Thus, 1 parsec is 3.26 light years. The best that can be done with this method of distance measurement is approximately 100 parsecs or 326 light years. This distance is still well within our own galaxy. All other distance measurements are indirect.

The remarkable story of the discovery of our galaxy and the scale of our universe is presented in numerous places (Whitney, 1971; Abell, 1969). The indirect methods that were developed to measure distances to extra-galactic objects have been carefully evaluated. They are self consistent and have been cross-checked thoroughly. The extremely large scale of the universe has been extrapolated from these measurements for normal galaxies. The only distance measurement for Quasars, however, is based on the Hubble Law.

In the 1930's Hubble correlated the recessional velocity of a galaxy to its distance; (Kaufmann, 1973; Abel, 1969; Hawking, 1988; Geller and Huchra, 1988, pp. 3-29). This relationship became known as the Hubble Law:

$$v = Hr \qquad (35)$$

where

$$r = \text{distance to a galaxy} \qquad (36)$$

$$H \approx 100 \text{ Km per sec per Mpc} \qquad (37)$$

where

$$H = \text{“Hubble Constant”} \qquad (38)$$

and

$$v = \text{recessional velocity} \qquad (39)$$

$$r = \text{distance to a galaxy.} \qquad (40)$$

The velocities of optical galaxies were initially determined from the non-relativistic form of equation 32:

$$z_{\text{rec}} = \frac{\nu}{c} = \frac{\Delta\lambda}{\lambda}. \qquad (41)$$

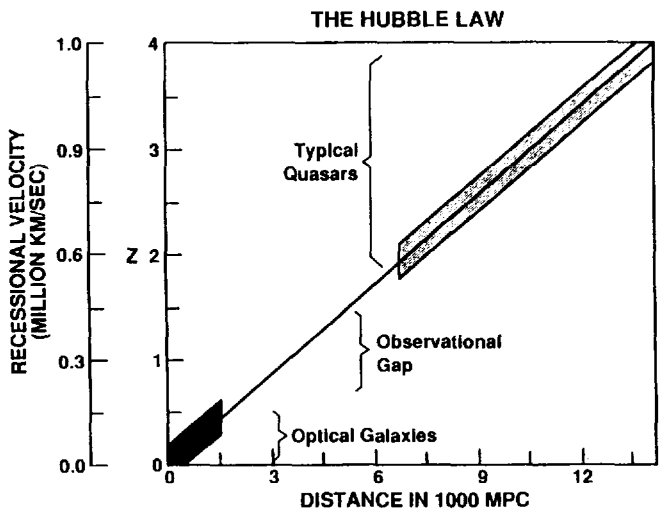

Figure 4. The Hubble Law showing the relationship of galaxies to Quasars.

Figure 4 shows the Hubble relationship for galaxies visible by optical means. The discovery was first made by comparing the absolute luminosity of the galaxies with the red-shift. The line in Figure 4 is as calculated from the Hubble Law. The shaded area represents the observational data where the distances are, in general, estimated from the luminosities.

The red-shift, z, is co-plotted along with the recessional velocities. Figure 4 shows the extent of the data for optical galaxies. Quasars, in general, have much larger z values. Only the optical galaxies have independent estimates for their distances. It is nearly impossible to measure the distance to the Quasars, apart from the Hubble Law. Their Hubble distances are extreme and this is the basis for the extravagant age currently assigned to the universe.

Distance to the Quasars

These objects were discovered in the early 1960's by astronomer Maarten Schmidt (Osmer, 1982) and designated Quasi Stellar Radio Sources. They quickly became known as the Quasars. Their optical spectra had been shifted into the IR and radio regions. The shift implied recessional velocities very near the speed of light (see Table 2). Using the Hubble law, their distances could be 10-15 billion light years and Quasars would be about 1000 times more luminous than a galaxy of 100 billion stars (Osmer, 1982; Courvoisier, et al., 1991). However, there is no way to verify or cross-check this distance except by their luminosity. Their luminosity has to be so great for their Hubble distance that no known physical phenomena can account for it.

The most distant quasar, by the Hubble relationship, is

$$d \approx 15 \text{ X } 10^9 \textit{ light years.} \tag{42}$$

Based upon this Hubble distance, the calculation of the absolute luminosity required to produce its measured luminosity is L_0,

$$L_0 = 10^{47} \text{ ergs / sec.} \tag{43}$$

If it is a normal galaxy of approximately 10^{11} solar masses then the luminosity each star in a quasar must produce, is $L_\star$:

$$L_\star = 10^{36} \text{ ergs/sec.} \tag{44}$$

For comparison, our sun with one solar mass produces a luminosity of

$$L_{sun} = 10^{33} \text{ erg / sec.} \tag{45}$$

Now, this difference is truly remarkable since it requires that each star of a quasar must produce 3 orders of magnitude more energy than our sun and must have at least the same mass as our sun. This is clearly impossible.

The change in the luminosities is ΔL,

$$\Delta L = 10^3 \tag{46}$$

Therefore, the distance must be reduced by a factor of:

$$(\Delta L)^{-1/2} = 10^{-3/2} = (31.6)^{-1} \tag{47}$$

because of the $(1/d)^2$ drop of intensity.

Based on their luminosity, that the distance, r(Quasar), to the highest z Quasar is approximately 474 million light years. In the polytropic universe this Quasar is predicted to be at the maximum of the radial velocity curve calculated for n = 1.5 (see Figure 2). This distance is

$$\xi = 3 \tag{48}$$

for the polytropic universe.

The total radius of the polytropic universe can now be extracted for this simple model. The outside edge of the polytropic universe is at ξ_0, thus,

$$R = (\xi_0/\xi) \text{ x r(Quasar)} = (3.65375/3) \text{ x } 474 \text{ x } 10^6 \text{ light years} \tag{49}$$

$$R = 577 \text{ x } 10^6 \text{ light years} \tag{50}$$

for the radius of the polytropic universe with an index of 1.5.

A prediction can now be made for the proper motion of Quasars with this model. If the motion of the highest z Quasars is totally transverse, the proper motion, μ, in one year the Quasar would transverse approximately 1 light year with v/c being 0.9797:

$$\mu = \frac{1}{474 \text{ x } 10^6} \textit{ radian/year} \tag{51}$$

$$\mu = \frac{1 \textit{ radian/year}}{474 \text{ x } 10^6} \text{ x } \frac{57.3°}{\textit{radian}} \text{ x } \frac{3600 \text{ sec}}{\textit{degree}} \tag{52}$$

$$\mu = 0.00044 \text{ sec } \textit{of arc/year.} \tag{53}$$

This should be detectable in a few thousand years (Geller, et al., 1988; Bouw, 1982).

There are observations that jets from Quasars 3C273 have a proper motion indicating a velocity several times greater than the speed of light (Courvoisier, et al., 1991). This is a clear indication that the distance to this particular object is over-estimated. If the origin of its red-shift is orbital and not recessional, then the observed jets would have velocities less than the speed of light because they are 32 times closer (see equation 47).

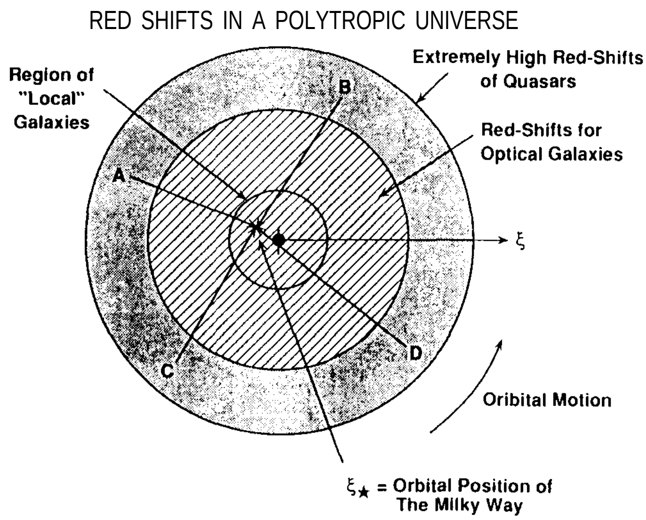

Figure 5. The observer at $\xi_\star$, in a polytropic universe will see a sky full of red-shifted galaxies.

Red-Shifts in the Polytropic Universe

The position of the Milky Way has been postulated to be in the central regions of the universe, at a radius of ξ = 0.3 (see figure 2 and equation 30). If an observer looks around the universe from this position, he will see mostly red-shifted galaxies. This is shown schematically in Figure 5. This postulate is not unreasonable.

For example, our earth is in the interior regions of our solar system. The difference in this analogy is that all of the planets in the outer regions of the solar system have much lower orbital velocities than our earth. In contrast, the orbital velocities of the galaxies in the outer regions of the polytropic universe can have extremely high orbital velocities compared to our galaxy, the Milky Way.

The key to this idea is that the red-shift comes from the transverse velocity, not the recessional velocity. Therefore, there is no general relationships between distance and red-shift except the radial velocity curve (Figure 2). Normal galaxies would then have a nearly linear relationship with red-shift and distance matching the Hubble Law. On the other hand, the Quasars would be in the high z region of Figure 2 and Figure 5 would have a non-linear relationship between red-shift and distance.

The Universe Filled with Red-Shifts

Our universe is filled with red-shifted objects. By referring to the polytropic model in Figure 5, an observer can see a red-shift in virtually any direction: A, B, C, or D. Almost all regions of the universe would indicate a red-shift from the transverse doppler effect. Secondly, the red-shifts would increase as the distance increases, only not linearly. In the region of "local" galaxies, we would predict to observe red-shifts, blue-shifts, proper motions that would be quite random. This is in fact the case (Mihalas et al., 1981).

The Curtis-Schmidt survey also indicates an anisotropic distribution of quasars. Figure 6 shows a summary of this survey as a function of direction (right ascension). Examining Figure 5, it can be speculated that quasars in region A would be easier to observe than those in region D. The distances to each of these regions are very different even though the red-shifts would be very similar. The geometry of the polytropic model would predict an anisotropic distribution in Quasars.

Missing Transitional Galaxies

In the study of quasars and red-shifted galaxies the observations are very interesting. Figure 7 shows the distribution of red-shifts of quasars for the Curtis Schmidt Survey (Osmer, 1982). There is a significant gap or drop in the observations around z = 2. There also seem to be no transitional objects between normal galaxies with z = .4 and quasars with z = 1.8 as also shown in Figure 4. This gap is very difficult to understand for a cosmologically expanding universe and is usually explained by selection effects (Geller, et al., 1988). However, with a polytropic universe the number density reduces rapidly as the radius increases (see Figure 1). Therefore, the distance to the Quasars is much less and their Hubble Law distances are not valid. This eliminates the observational gap. Finally, the highest velocities are very near the edge of the polytropic universe (see Figure 2). This matches the Curtis Schmidt survey very well (see Figure 7). There should be many fewer high-z Quasars because the density falls off significantly at the outer edge of the polytropic universe.

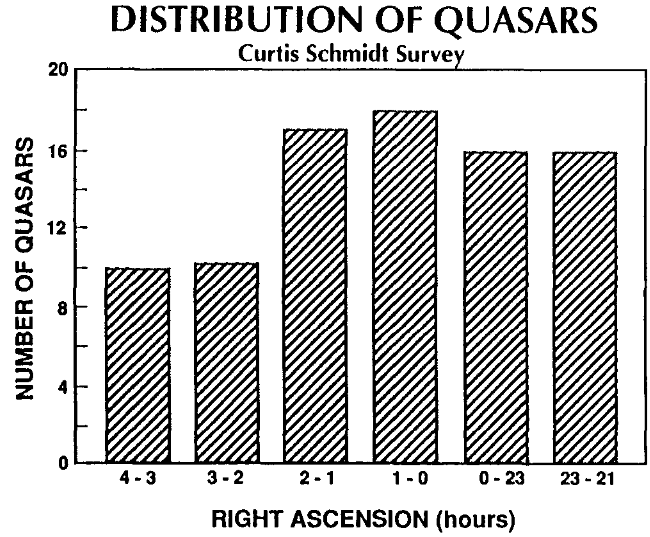

Figure 6. The distribution of Quasars is not uniform.

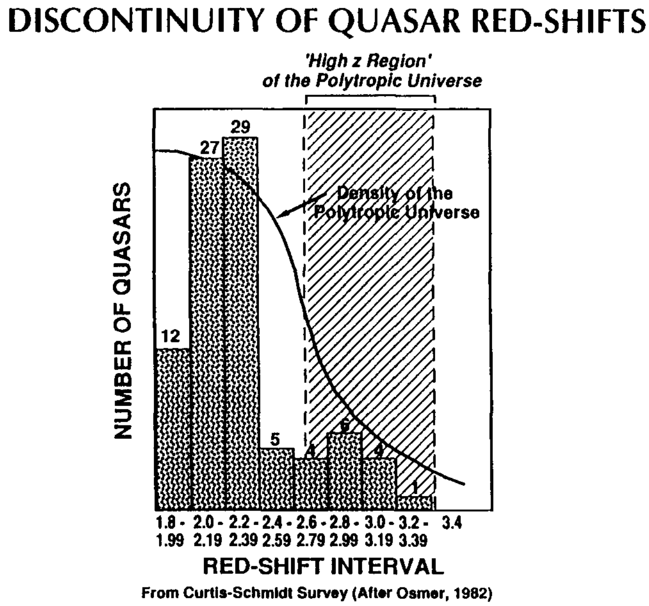

Figure 7. The number density and red-shifts of a polytropic universe match the observation.

The Missing Mass of the Universe

The problem of missing mass in the universe basically centers around the discussion of a closed or open universe. Schwarzschild (Bouw, 1982) developed the concept of a mass radius relationship which defines the size of a closed universe. This radius is known as the Schwarzschild Radius, R:

$$R = \frac{2GM}{c^2} \quad (54)$$

where G = Gravitational constant, c = speed of light, and M = Mass of the universe. In Dirac's larger number cosmology, he estimates the critical mass for forming a closed universe:

$$M = 2 \times 10^{78} \text{ Nucleons} \times 1.67 \times 10^{-24} \text{ gm/Nucleon} \quad (55)$$

$$M = 3.34 \times 10^{54} \text{ gm} \qquad \text{“Mass of the Universe”} \quad (56)$$

this yields a Schwarzchild Radius of approximately

$$R = 500 \text{ million light years} \quad (57)$$

for the universe. The missing mass is postulated because the distance to the quasars is approximately 20 billion light years based on the Hubble relationship. This inconsistency with the Big Bang model still persists. This missing mass problem is eliminated with a polytropic universe because its radius is approximately that of the Schwarzchild Radius (from equation 50).

$$R = 577 \text{ million light years} = 5 \times 10^{26} \text{ cm} \quad (58)$$

The problem of the missing mass also arises because the temperature of the universe is only 3K and unlike a star, it cannot prevent the collapse of a Big Bang universe. The universe appears to be expanding linearly but not explosively. Therefore, a large quantity of the mass is not observed. The polytropic model does not depend upon its mass to stabilize the structure. It therefore may yield a value of zero for the cosmological constant. The vanishing cosmological constant λ is preferred by most astronomers (Schwarzschild, 1989). The probability for creating this type of flatness from an explosion is unbelievably small.

The Mass of the Universe

With the polytropic model of the universe, and using the red-shifts and luminosities of the high z quasars, for the first time, it might be possible to weigh the universe. The reduced orbital velocity for all objects in the polytropic universe is given by equation 28:

$$\omega = \frac{\nu_0}{2\pi}\left(\frac{\alpha}{M}\right)^{1/2} \quad (59)$$

from table 1 and for $\xi = 3$ we find that

$$\omega = 0.56048 \quad (60)$$

Using a red-shift of approximately 4 and interpreting that as a transverse doppler effect, the Quasar velocity is determined to be (from table 2).

$$v/c = 0.9797 \quad (61)$$

Therefore the ratio α/M can be found to be

$$\alpha/M = 3.23 \times 10^{-9} \text{ in Astronomical Units} \quad (62)$$

The factor α can be determined from the radius, R, of the universe extracted from the luminosities of the Quasars (see equation 50).

$$\xi = R/\alpha \quad (63)$$

thus

$$\alpha = 9.99 \times 10^{+12} \text{ A.U.} \quad (64)$$

The mass of the polytropic universe, M, is then determined to be

$$M = 3.1 \times 10^{+21} \text{ Solar Masses} \quad (65)$$

or

$$M = 6.17 \times 10^{+54} \text{ gm} \quad (66)$$

This is approximately a factor of two larger than the mass of the Schwarzchild universe (equation 56). It is also a totally independent measure for the mass of the universe and it indicates a solution to the missing matter problem of the Big Bang. There is no missing matter.

The 3 K Background Radiation

A critical prediction of the Big Bang theory is the 3 K microwave background black body radiation throughout the universe. It would require approximately 15 billion years for the universe to cool to to this temperature (Sciama, 1977; Webster, 1977). The Big Bang model assumes that the matter and radiation were in equilibrium, i.e., the temperature of the radiation and the thermal temperature of the matter were equal:

$$T(\text{rad}) = T(\text{matter}) \quad (67)$$

After the radiation decoupled, the temperature of the radiation decreased as the radius of the universe increased:

$$T(\text{rad}) = A \times 1/R \quad (68)$$

In a polytropic universe, there must be an alternative but physically reasonable source for the background radiation. Akridge, Barnes and Slusher (1981) proposed that absorption and re-radiation can account for the 3 K radiation. Absorption of stellar light is well known phenomena in astronomy. Significant effort is required to correct for the reddening of light caused by scattering and absorption. Bolometric corrections (Novotny, 1973) are used to adjust the color of stellar observations and are functions of wavelength and celestial coordinates.

The 3 K cosmic background is postulated to be a result of absorption and re-radiation of star-light by inter-stellar gas and dust. In the polytropic universe the temperature, T_{ξ_0}, at a radius ξ_0. is given by

$$T_{\xi_0} = T_c\,\theta \quad (69)$$

Referring to Table 1, we can substitute the values of T_{ξ_0} and θ, at $\xi = 0.3$ and solve for the temperature at the center of the universe T_c.

$$T_c = 2.7 \text{ K}/0.9851 \quad (70)$$

$$T_c = 2.74 \text{ K} \quad (71)$$

Likewise we can calculate the temperature at $\xi = 0.750$ to be

$$T_\xi = (2.73 \text{ K})\,(.9151) \quad (72)$$

$$T_\xi = 2.49 \text{ K} \quad (73)$$

Thus, the polytropic model of the universe predicts a decreasing temperature of the background radiation as the radius increases.

Even if the CMB can theoretically be caused by star light, this is not the most significant problem to the Big Bang model and the cosmic microwave background radiation. This problem is the uniformity of the CMB radiation. As the universe is scanned, the variation in the CMB temperature is less than 20 parts per million (Gulkis, et al., 1990). This smoothness represents the state of matter at the time when matter and radiation decoupled. This smoothness then must represent that of the current universe. This is not the case. There are very large structures of galaxies and very large regions of no matter at all, called voids (Saunders, et al., 1991). There are no explanations for the disparity of these observations. Smoothness in the CMB requires that the universe be smooth if the Big Bang did in fact occur.

The observed smoothness in the CMB radiation can be interpreted as a measure of the smoothness of the distribution of interstellar gas and dust. The temperature of the CMB indicates that the local variations in the density of interstellar gas and dust is small. This is not surprising for a polytropic model of the universe.

Structure in the Universe

The literature (Gleick, 1986; Silk, Szalay, and Zel'dovich, 1983; Dressler, 1987) clearly indicates that the universe is not isotropic. The Big Bang model requires equilibrium between all matter and energy as initial conditions. Perhaps a complex model will eventually be developed to account for the anisotropic nature of our universe but several major theorists (Sciama, 1977; Hawking, 1988) are at least looking in directions away from the Big Bang Model. The anisotropic nature of the universe as presented by Hawking (1988) indicates the need to consider other structural models.

A polytropic model would allow large structures of galaxies to remain for extended periods. Large superclusters have been observed (Gregory, et al., 1982). Analogs of these structural features can be seen in thousands of spiral and irregular galaxies throughout the universe. Clustering of galaxies and voids would be expected in an orbiting polytropic universe.

Motion of Galaxies

Careful study of optical galaxies has led to some very interesting findings. The distribution of velocities of these galaxies is not uniform. There are very large velocity differences for galaxies that appear to be close to one another. Galaxy NGC 7603 has a companion with two-times the red-shift (Arp, 1987). Likewise, NGC 4319 and Markarian 205 have an optical bridge while their red-shifts are 1800 and 21000 km/sec respectively (Arp, 1987). The Big Bang expansion model as presently developed has little hope of predicting this anisotropic nature of optical galaxies (Dressler, 1987). Instead the primary conclusion from these data is that a large unseen mass or great attractor exists in our universe. The large differences in velocities between companion galaxies can indicate orbital like motion.

If one observes a highly elliptical orbit of a comet as it passes near a planet (for example Mars), their velocities could easily be different by an order of magnitude. Similar observations have been made of stars within the Milky Way. They have highly elliptical orbits about the galactic center and are called high velocity stars. High velocity galaxies indicate similar orbital motions centered about some "Great Attractor." An extreme velocity optical galaxy (Eales, et al., 1993) with z = 3.395 has been observed. These motions would be expected for the polytropic model. The most distant objects that are currently being observed are still the high z quasars. However, they are just closer than a linear expansion would predict. Only the observation of the extreme velocities of local galaxies would indicate the existence of a center to the universe.

The extreme velocity of the Milky Way as measured from variations in CMB (Gulkis, et al., 1990; Morgan, 1987) is shown in Table 3. The Big Bang would predict nearly identical velocities for Andromeda and the Milky Way. The polytropic model would allow for large differences that could occur if the universe was structured similar to a galaxy. The center of the polytropic universe could be the "great attractor" that is indicated by these velocity differences. The Big Bang simply cannot predict the large velocity differences that we observe for our neighboring galaxies.

Gravitational Blue-Shift

Photons from the edge of a polytropic universe would have "fallen" into a gravitational well when we observe quasars. This potential well would cause blue-shifting and counteract the red-shifting caused by the transverse doppler effect. This shift z_{grav} is given by (Landau and Lifshitz, 1975, p. 250)

$$z_{grav} = \frac{\Delta\lambda_{grav}}{\lambda} = -\frac{1}{c^2}\Delta\Phi = -\frac{\Phi(r) - \Phi(o)}{c^2} \qquad (74)$$

where the Newtonian gravitational potential, Φ (r), inside a spherical universe at a radius, r, would be

$$\Phi(r) = \frac{2}{3}\pi G\rho r^2 - 2\pi G\rho R^2 \qquad (75)$$

The potential at the outer edge of the sphere of radius R and mass M would be -GM/R. The average density for this spherical universe is given by ρ and is assumed to be uniform.

By balancing gravitational, F_g and centrifugal forces, F_c, for a quasar of mass m, we can solve for r^2.

$$F_g = -\frac{4}{3}\pi mG\rho r \qquad (76)$$

and

$$F_c = -m\frac{\nu^2}{r} \qquad (77)$$

Thus

$$\nu^2 = \frac{4}{3}\pi G\rho r^2 \qquad (78)$$

Then

$$z_{grav} = -\frac{\frac{2}{3}\pi G\rho r^2}{c^2} \qquad (79)$$

$$z_{grav} = -\frac{1}{2}\frac{\nu^2}{c^2} \qquad \text{"Blue Shift"} \qquad (80)$$

for a uniform spherical density, ρ. However, for a polytropic universe the density is not uniform and is given by equation 8, Table 1 and shown in Figure 1. The density is a function of radius and cannot be ignored in the equation for z_{grav} evaluated as the protons travel inward from the outer edge R to the position of the Milky Way at 0.2R. Therefore, we should evaluate:

$$z_{grav} = -\frac{1}{c^2}\Delta\Phi(r)\Big]_R^{0.2R} \qquad (81)$$

Substituting the spherical potential Φ (r):

$$z_{grav} = -\frac{\pi G}{c^2}\left[\frac{2}{3}r^2\rho - 2R^2\rho\right]_R^{0.2R} \qquad (82)$$

$$z_{grav} = -\frac{\pi G}{c^2}[zero - \Phi(r = 0.2R)] \quad (83)$$

Because, at the edge of the polytropic universe, R, all terms in z_{grav} are zero

$$\rho(r = R) = 0. \quad (84)$$

Using Table 1 and equation 8, we find

$$\rho(r = 0.2R) = \theta^n \rho_c = (0.9934)\rho_c \quad (85)$$

Therefore, we obtain:

$$z_{grav} = \frac{-\pi G}{c^2}\rho_c(0.9934)\left[\frac{8}{300}R^2 - 2R^2\right] \quad (86)$$

$$z_{grav} = \frac{-\pi G}{c^2}\rho_c(1.947)R^2 \quad \text{"blue shift."} \quad (87)$$

This leaves the central density of the polytropic universe as a free parameter. We have not used or defined the central density of this model until now. We do, however, observe red-shifted quasars. We can set an approximate upper limit to the central density from these calculations.

If we assume that z_{grav} is no more than 10% of z_{trans} in equation 32, using a series approximation, z_{trans} can be simplified to

$$z_{trans} \approx + \frac{1}{2}\frac{\nu^2}{c^2} \quad (88)$$

Setting $|z_{trans}| \geq 10\,|z_{grav}|$ we get

$$\frac{1}{2}\nu^2 \geq 10\pi G\rho_c[1.947R^2] \quad (89)$$

Solving for r_c and substituting the polytropic model values into equation 87 we obtain:

$$\rho_c \leq \frac{1}{20}\frac{\nu^2}{\pi G[1.947R^2]} \quad (90)$$

and substituting values:

$$\rho_c \leq \frac{(0.9797)^2(3 \text{ X } 10^{10})^2}{20\pi(6.67 \text{ X } 10^{-8})[1.947(5 \text{ X } 10^{26})^2]} \quad (91)$$

$$\rho_c \leq 4.23 \text{ X } 10^{-28}\ gm/cc \quad (92)$$

or approximately one half electron per cubic centimeter. This does not seem too far afield for a first estimate of a hypothetical core of a polytropic universe.

X-Ray Sources

X-ray telescopes, detectors, and observations are becoming an important field of astronomy and astrophysics (Lubkin, 1972; van der Klis, 1988; Saunders, et al., 1991). Their investigations are concentrated on possible mechanisms for x-ray generation. Many of the sources are being modeled by complex binary star arrangements with intense magnetic fields. Extra galactic x-ray sources are more puzzling.

The polytropic model of the universe yields some insight into this problem. This model predicts that some blue-shifted galaxies should be observed clustered about the polytropic center. They may be the observed x-ray sources. Thus, the polytropic model predicts mostly red-shifts with a small percentage of blue-shifts. X-ray detection technology does not have the energy (frequency) resolution of optical detectors. If the Balmer Series of Hydrogen is blue-shifted into the x-ray region of 50 to 100 ev, the structure of the entire Balmer Series (3 ev wide) would be lost in the detector resolution. We would simply see an extra-galactic "x-ray source" not a blue-shifted galaxy.

Hard ultraviolet radiation is just as difficult to detect. However, if the polytropic model holds, it predicts an anisotropic distribution of UV and x-ray sources.

Conclusions

A polytropic model of the universe has been proposed with our galaxy lying about 5% from the core of the universe. These are the only two postulates for the model. Our position near the center of the universe is very much like the fact that we are near the center of our solar system. We are one Astronomical Unit (A.U.) from the sun. Our outermost planet, Pluto, has an orbital semi-major axis of 39.44 A.U. The earth, therefore, is only 2.5% from the center of the solar system. This is not a proof but it does at least allow for the postulate that the Milky Way could be close to the center of the Universe.

Red-shifted objects follow the orbital velocity relationship with distance because of the transverse doppler effect. Thus, the luminosity problem of the quasars is eliminated. This model would also predict that there is an upper limit to the z values of the Quasars as the velocity goes through a maximum value. The maximum proper motion is predicted to be 0.00044 second of arc per year.

The fall off in the Quasar density matches the fall off in density of the polytropic universe nicely. Because the polytropic universe is rotating about some center of mass, the mass and radius of the universe can be determined from the observations of the Quasars. There is no missing matter and the Schwarzschild Radius is consistent with the polytropic model.

The 3 K cosmic background is the result of stellar light absorption and re-radiation. The smoothness of the CMB is the result of interstellar gas and dust and direction to the "great attractor" may have a greater background temperature.

Structure and clustering of galaxies is expected just as similar structures are seen in galaxies throughout the universe. Filamentary or string like structures with large areas of void would be expected. The "great attractor" is not only predicted it is required for the structure to remain stable.

The model predicts that there should be a small fraction of blue-shifted extra-galactic objects. They should be shifted into the UV and soft x-ray region of the electromagnetic spectrum. The resolution of the hydrogen line spectra remains beyond the current technology.

Epilogue

I believe philosophical discussions of origins should be separated from scientific models. I also believe that God created the universe a short time ago as He recorded for us in Genesis. I also believe that His creation displays common designs throughout.

By presenting an alternative and viable model for the structure of the universe, it may be possible for other researchers to discover details of God's creation that are hidden because the wrong model is being used to interpret the observations. This is my goal and prayer.

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VIDEO REVIEW

The Discovery of *Noah's Ark.* A video written and directed by G. Edward Griffin. 1993. American Media, P.O. Box 4646, Westlake Village, CA 91359. One hour.

Reviewed by Don B. DeYoung*

This video is based on the book *The Ark* of *Noah* by David Fasold (1990). Both center around an elliptically-shaped rock formation that was exposed by a 1938 earthquake; it is located 17 miles south of Mount Ararat. The story begins by comparing the Genesis Flood account with those found in the Koran and also the Gilgamesh Epic. The Flood is indeed a universally known event in ancient writings.

There is a healthy debunking of the ark-sighting reports from Fernand Navarra and also the Soviet aviator Roskovitsky. Unfortunately, the people positively promoted in this video range all the way from questionable to professional: David Fasold, Ron Wyatt, Marvin Lukerman, a Kurd named Rasheet, Don Patten, and John Baumgardner, among others. John Morris (1992) has critiqued the ark studies of these men.

The video claims that the 600 foot long rock formation is the fossilized ark itself. All that remains visible is a hull-shaped depression. The video advertisement claims evidence for decks and interior chambers, but this is not shown. In fact, the site was partially destroyed with explosives by ark hunters in 1960!

Several parts of the video raise serious questions:

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1. The Flood mechanism is described as a near collision between the earth and a Mars-size object. This generated tides 30,000 times greater than present, sweeping over the continents.
2. Dozens of nearby "anchor stones," some weighing 20,000 pounds, are claimed to be from the ark. Why did Noah need a hundred tons of anchors? The function of these stones may instead be grave markers, common in the area.
3. Researchers are shown using dowsing rods to map out the floor beams of the ark. This doubtful technique is given the impressive title "molecular frequency generator discrimination!" More credible instruments also shown include metal detectors and ground penetrating radar.
4. It is suggested that there were many more than eight souls on the ark. This false idea comes from accepting the Koran account and rejecting 1 Peter 3:20. Also, animals on board are said to be for food and clothing, not for preservation. The video thus seems to imply a local flood, at best.

The video is quite well done and is entertaining. However, publicity seekers have already given a bad image to the search for Noah's ark. This video, promoting dowsing and also a revision of the biblical flood story, will not clarify the issue.

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