From: aanda.paris@obspm.fr <aanda.paris@obspm.fr>
To: alex@polytron-corp.com <alex@polytron-corp.com>
Date: Tuesday, August 16, 2005 9:52 AM
Subject: AA/2005/4043: comments to authors

16/08/2005

Mr Alex Saharian
alex@polytron-corp.com

Our Ref. : AA/2005/4043

Dear A. Saharian,

We have read your paper, and regret to inform you that it has not the scientific content appropriate for publication in Astronomy and Astrophysics, for the following reasons:

-- the microwave background radiation is interpreted in your paper as coming from the summation of all the stars and galaxies radiation in the universe: but it is well known that this summation is far from giving a blackbody radiation at 2.76K

-- the redshift in your paper is explained by some interactions between the remote photons and charged particles in the intergalactic space. But it is well known that this interaction does not produce the required redshift, and this interaction is known with high precision now.

-- in addition, your paper assumes the existence of a uniformly distributed component of matter glowing in space, and there is no such component observed, but instead very inhomogeneous structures

For all these reasons, we regret that we cannot consider your paper any further for publication in A&A,

with best regards,

The Editors

Astronomy & Astrophysics manuscript no. swp0000
(DOI: will be inserted by hand later)

August 4, 2005

8/4/05
print. II

An alternate physical model for our universe

A. Saharian

Polytron Corporation, 4400 Wyland Drive, Elkhart, Indiana 46516, USA
e-mail: Alex@polytron-corp.com

Received <date> / Accepted <date>

Abstract. The model of an expanding universe raises many unanswered questions that can be explained via an alternate physical model, presented herein. A proposed steady state model explains redshifts of signals, Olbers' Paradox, the "horizon problem", and why distant galaxies appear smaller while distant Type Ia supernovae are fainter than expected. Also, the nature and origin of cosmic background radiation are explained, as well as why the presently observable universe appears 13 to 15 billion years old. The proposed model posits that the distance to a glowing object can be calculated from its redshift, which can also determine the reduction in a signal's radiation intensity in space due to attenuation and spherical expansion. The theory was applied to calculate maximum magnitudes of distant type Ia supernovae; results were comported with experimental data better than those predicted by an expanding universe model, without invoking the dark energy concept. The theory also confirms that the peak of the observed radiation intensity for the galactic density of our universe should occur at a wavelength of about 1 mm and establishes the value of average radiation intensity in our steady state universe.

Key words. redshift – steady state – cosmic background radiation (CBR) – supernovae Type Ia

1. Introduction

As we observe nature, we try to define it by the laws of physics, but our theory is only as good as the model we have selected to describe it. In the model for an expanding universe, many questions about the state of our universe were explained. However, a few puzzling questions remain unanswered. For example, in the expanding universe model, it is claimed that any galaxy's speed of recession is proportional to its distance in space and remains "constant throughout the universe at any given time" (Filippenko 1998). This claim of "constant expansion" is amazingly accurate at lower values of redshift, but it is difficult to grasp when we are approaching relativistic velocities. As we explore our expanding universe, it grows exceedingly complex at greater distances, and new difficulties appear in explaining the behavior of matter in the very early universe (Peebles 2002). Introduction of the "cosmological antigravity" concept (Krauss 2002) together with the "quintessence" concept (Ostriker & Steinhardt 2002), "inflation", and other concepts being investigated (Peebles 2002), are attempts to explain some of these observational difficulties. There are "horizon", "flatness" and other problems (Filippenko 1998). The list of other puzzling aspects of the expanding universe is quite long.

In spite of these difficulties, the Big Bang theory is currently well established. It is based on the following three observational facts: the abundance of the lightest elements in space, the expansion of universe (redshifting of signals), and the existence of cosmic background radiation (CBR) (Filippenko 1998). However, we have seen throughout history, that widely accepted theories are not always right. We will show an alternate choice of a physical model for our universe, which also satisfies these three requirements, and explains previously unanswered questions, revealing the universe to be in steady state within the laws of the General Theory of Relativity.

2. Alternate view of our universe

2.1. Abundance of the lightest elements in space

Before proceeding with the explanation of the mechanism for the redshifting of signals in space, let us take a brief look at the presence of "lightest elements" in space. There are huge amounts of electromagnetic (EM) energy produced in space and glowing bodies of matter produce the bulk of the radiation energy. For example, energy from our sun, a very tiny portion of which we feel on Earth as heat, has been radiating into space for some 4.5 billion years (Gyr). Radiation power (luminosity) of other individual stars could be many times greater. One giant star, LBV 1806-20 is some 150 times larger and up to 40 million times brighter than our sun. Any star in our galaxy or in any distant galaxy is a prolific generator of EM energy, with the greatest amount of it (for quantum-mechanical principles) produced near the visible spectrum. This narrow frequency range of radiated EM energy is of special interest to us, because it is the one that is responsible for the microwave radiation we observe on Earth. The peak intensity of most starlight spectra occurs at a wavelength slightly smaller than 0.0001 cm and is a function of the surface temperature of the star.

Send offprint requests to: A. Saharian

In addition to the observable radiation, billions of stars in billions of galaxies are filling space primarily with a huge number of protons and electrons, the two basic ingredients of the hydrogen atom (the most abundant element in the universe), but also a lesser number of particles and ions with heavier mass. The ejected particles are propelled through space in all directions from their source of origin at extremely high velocities, allowing them to escape into intergalactic space. Auroras confirm their existence in our solar system. With the help of the ionization process, taking place in space, all of these ejected charged and electrically neutral particles ultimately add to an existing very low-density plasma field of some finite particle density (a function of our galactic density) in a dynamic equilibrium in space. The amount of mass ejected by a single star, when multiplied by the number of stars in one galaxy and then by the number of galaxies in some unit volume of space over billions of years, would represent an astronomical amount of mass being recycled in space by glowing stars.

With solar eruptions and other emissions of particles from binary stars, pulsars, quasars, many nova and occasional supernova explosions, our universe is continuously being re-supplied with primarily the lightest elements of mass (but also gold and uranium), maintaining an "abundance of the lightest elements" of matter in space over billions of years. It is not an event that just happened to occur spontaneously 15 Gyr ago.

2.2. Proposal for a dynamic universe in steady state

The apparent brightness of a star, the apparent luminosity of a galaxy, the apparent maximum magnitude of a supernova (SN), the redshift value of signals from a glowing object in space, and the shape of the cosmic background radiation (CBR) curve are all real and exact facts. All of these entities that we can observe and measure on Earth are independent of the physical model we have chosen to represent our universe. But the choice of the model we have selected to describe our universe is based on the scientific perception of our mind. What we actually end up representing out there in space will depend very much on the correct choice of our model, which must ultimately be capable of explaining all "established experimental results."

It is natural that all of the assembled matter in space would be in a dynamic state, subject to initial conditions. The theory of relativity dictates that. But why couldn't there be many small, dynamic volumes of space as part of a larger universe of an indeterminate size subject to the same conditions? That is, matter anywhere in space could not stay put in one place over time, but would have to either expand or contract or even oscillate independently – and it does. However, our universe as a whole would be in a dynamic steady state. Matter in these adjoining areas of space could interact and exchange matter with their neighboring volumes of space and even beyond, over a period of billions of years, since their boundaries are not uniquely defined. All of these events would take place in various, individual sections of our steady state universe, but within the restrictions imposed on each one of them by the General Theory of Relativity.

Because of the unopposed, mutual gravitational attraction between bodies in space, there is an inherent tendency for the matter in space to converge and to clump together. In most cases, these individual groupings of objects are widely separated from each other by space that is essentially devoid of all VISIBLE matter. One would expect all the attracted matter in any galaxy or in any other of these clusters of galaxies to continue this merging process into some smaller volume of space with no quick end to this motion in sight. It appears that this converging matter in space, once subjected to a mutual gravitational attraction, is destined to combine into one, or one of several individual black holes that are close to the center of some of these areas of converging mass. It is a reasonable assumption based on the observed behavior of matter in these areas of space.

However, it appears that, in this instance, the bulk of all mass of assembled glowing bodies anywhere in space is being recycled over time, while in the process of merging into one. All bodies of matter in various areas of space appear to have been assembled NATURALLY near each other by gravity and set into some form of orderly, rotational motion around some fuzzy, common centers of gravity (centers of mass), such that they are all in a state of a complete dynamic equilibrium relative to each other. In each case, because of the acquired angular momentum, individual bodies of matter are free to move laterally, but they are restrained in their radial motion towards the center of their rotational system. Gravitational forces keep each system together in a dynamic equilibrium. Even lateral changes in their relative positions would be very gradual with time. Suspension of stars in spiral or elliptical galaxies would be good examples of entrapment of mass in very close proximity to each other in a timeless fashion. An example of suspension of bodies of dark matter close to each other would be the motion of our planets and the incessant revolutions of our moon for some 4.5 Gyr. Even a barred spiral galaxy, an unusual-looking structure in space, is a stable rotational star system.

All stars in various bodies of matter are individually in equilibrium, during which time they continue to convert a significant amount of their mass to smaller particles of mass and radiation energy, propelling them from a point source to faraway places, until the very end of their glowing lives. There are other more violent mass conversion processes in place for stars, some of them could be thermonuclear, and all leading ultimately to the same result – a complete destruction of the star. For example, a type Ia supernova (SN Ia) is a thermonuclear explosion of a white dwarf star 1.4 times the mass of our Sun (Riess 2003). In this explosion, the contents of the dwarf are ejected at velocities of some 10,000 km/sec into the deep space far beyond the area of gravitational influence of its parent galaxy, with no residue left behind. Thus, in one flash of light, a galaxy loses an entire medium-size star from its gravitational control, and continues to do so at a rate of about once every century. As new matter from other, similar events in space is accumulated in this dynamic system, feeding existing stars or forming new ones, all of the arriving mass is ultimately reconverted, thereby maintaining uniform mass density anywhere in space and thus preventing matter from merging into one.

We do not suggest, however, that there are no collisions of stars taking place in our universe, but they probably are occurring in very isolated instances, simply because we are dealing here with relatively small bodies of mass in motion and such inordinately large distances in space. Only in the core centers of galaxies, where older stars and remnants of their burned out cousins, like white dwarfs and other dark objects slowly converge and approach each other with time, a violent activity between stars is taking place. As individual stars approach the virtual center of a galaxy that is populated with many other stars and not a single large body of solid matter, their angular velocity slows down, unlike the motion of planets in our solar system. However, the speed of rotation of the whole system is maintained at about the same rate. A barred spiral galaxy would be a good example describing this behavior. The increased density of stars and the reduction of their angular velocity nearer the center of a galaxy brings individual stars in closer proximity. Thus, in various areas of the galactic center, two or more stars will find themselves close enough to begin interacting with each other (like binary stars), with even more stars joining them later. This process escalates and continues until the number of interacting stars is reduced by one, probably initiated by accretion of matter from a glowing companion star. Over the years, new stars would be joining these groups of stars as part of a complex and very violent process with no end in sight. The planes of rotation of stars near the center of a galaxy typically become less organized, similar to the motion of stars in elliptical galaxies.

A large amount of radiation is produced near the center of our galaxy. The bulk of this radiation is in the visible frequency spectrum, however emission of X-rays and radio frequency energy in these same areas was also observed. The Chandra X-ray observatory detects almost daily flair-ups of X-rays in the center of our galaxy, indicating some occasional, very violent behavior of matter. Because of this behavior of stars, galactic centers would also serve as generators of copious amounts of small particles of mass. Supernovae, typically not very homogeneous and isotropic "Mini Bangs" from a point source, are not caused by direct collisions of stars. Even colliding galaxies with hundreds of billions of stars appear to produce no actual collisions. The above described mass conversion processes serve as "eternal source(s) of material for new stars and galaxies" and become "provision(s) for the disposal of the debris", a requirement for a steady state universe (Peebles 1993).

On one hand, gravitational force assembles individual particles of mass to form new stars. It also forms galaxies and clusters of galaxies. The same force constantly controls the motion of each individual star in our universe until the very end of the star's existence. It may take billions of years to accomplish all of these events. On the other hand, complex thermonuclear processes deep inside of each star keep them active until all the material that could be used as fuel (under various conditions) is depleted. Radiation from the surface of our sun provides us with light and thus sustains life on Earth. However, the same thermonuclear processes cause (or contribute to) the loss of mass from individual stars as soon as they begin to glow. The process of systematic "disposal of the debris" continues throughout the long lifespan of each individual star, culminating in some spectacular fashion. There is probably no better example of the removal of the "debris" than the one provided by the SN Ia explosion. During the life of a star, from the very beginning to the very end, the removal of the material from the star is always violent and at near relativistic velocities, to allow matter to escape gravitational influence of the star and of the parent galaxy. It typically takes a very long time to complete the destruction of each individual star.

Finally, it is said that the Newtonian gravitational force of an infinite number of stars in an infinite universe would be so great that it would tear individual stars apart. The fact is, however, that the same gravitational force of billions upon billions of galaxies in our presently observable "enormous" universe of more than 30 billion light years (GLyr) in diameter has failed to strip our solar system of any of its simple gravitational attachments like planets, moons, asteroids, or even distant comets. Our Sun appears to be in full control of its satellites with no obvious, observable gravitational deviations.

2.3. Signal frequency reduction process in space

There are no laws of physics stating conservation of frequency, only energy. Thus, under certain conditions, the frequency of a propagating EM wave could "slow down" gradually, but continuously, as the signal travels through an IMPERFECT vacuum of space for many years. The frequency of a radiated EM wave is not crystal-controlled, and when there is a change, it is natural that there must be a frequency reduction, representing a loss of energy.

When a propagating signal encounters a charged particle, it recognizes the particle as a discontinuity or an obstruction to its uniform motion in space. The particle causes a momentary perturbation in the EM field of the wave. Although most of the energy in the signal is transmitted through the area where the charged particle is located, a minute portion of the wave is reflected or scattered in all directions (at the signal's frequency) as EM noise. The size of the point charge encountered by the EM wave is minute compared to the signal's wavelength. It offers no preferred direction to the wave because it is spherically symmetric. Therefore, it has an identical three-dimensional effect on all the signals of the same frequency incident on the point charge, regardless of the direction of propagation of the wave and the orientation or polarization of its electric field.

Physical interpretation of the collision process can be stated as follows: the oscillating electric field of the wave momentarily subjects the charged particle to an alternating force attempting to move the particle by accelerating it along the lines of its electric field, perpendicular to the direction of propagation of the wave. The amplitude of the force is proportional to the signal's electric field and to the number of charges on the particle of mass. This force is extremely small and it exists for an infinitesimally minute, but finite interval of time. Because the force on the charged particle changes its direction with each half cycle of the signal's electric field, the particle's position or its motion in space is basically not affected.

By applying a minute force to the particle, the wave is doing work, and it is expending energy in the process. In turn, the particle exerts an equal and opposite force on the alternating electric field. This force produces a loading effect on the electric field of the wave as it momentarily deforms the wave front, causing the phase of the wave to slip ever-so-slightly in the vicinity of the charged particle. Changes in phase, in turn produce a small, initially-local stretching or lengthening of the interval of each half cycle of the wave, resulting in a minute frequency retardation at the point of discontinuity. It is a complex process involving higher-order space harmonics of the fundamental frequency of the signal to satisfy boundary conditions at the place of discontinuity caused by the point-charge singularity. The charged particle has a catalytic effect on the energy transfer from the propagating to the reflected or scattered wave of any frequency, and this process continues for as long as the charged particle is present, affecting all signals of all frequencies simultaneously. The action of one single charged particle on the propagating wave is identical to the interaction process that causes a signal to experience a propagation delay (and attenuation) in a homogenous low-density plasma field. In our case of widely separated charges, granular distribution of particles causes a lateral non-uniformity in the wave front and ultimately leads to frequency reduction in the signal with time or distance. Propagation delay in signals through areas of high local concentrations of space charge, like those near the surface of a star or in the proximity to a galaxy or cluster of galaxies should produce some focusing of the signal. The change in the direction of propagation of the signal's wave front in this environment would be similar to the focusing effect produced by a gravitational lens.

If we were to tag along a particular signal's wave front, traveling through this unusual space charge field with randomly distributed and widely separated point charges, we would observe interactions taking place over the wave front similar in appearance to the ones created by a very light rain continuously falling on the placid surface of a pond. Perturbations created by individual charges in the wave front would expand laterally over the front's surface with time and with slightly variable frequency components along the way. These minute, lateral variations in the wave front would average out or blend in with other similar disturbances produced in the same wave front at other locations with time. And, with time, after each collision, the uniformity of the signal's wavefront with an infinitesimally small frequency and amplitude changes is ultimately re-established WITHOUT distortion (a requirement of EM theory for a uniform propagation of a signal in space without any obstruction in its path), like a body of water returning to its placid state. Except for these periodic, minute energy reductions there would be no loss of information carried by each individual signal.

We know that a propagating signal can behave like a wave, but it can also behave as a particle. In 1923, Arthur Compton demonstrated that a propagating wave in a collision with an electron NOT ONLY transfers energy to the particle by REDUCING ITS FREQUENCY, but that at very high frequencies each individual transfer of energy could be in QUANTIZED AMOUNTS of energy sufficiently large to be observable in a laboratory environment (Wolfson 1998). In the case of weak signals (which are of interest to us), the removal of energy from the wave is in minute, measured, frequency-dependent increments per each half cycle of the wave, and interaction over a very long period of time is required to produce observable results. This is NOT a behavior of a "tired light".

2.4. Distance to a glowing object in space

Any signal propagating through a uniform and "continuous" (relative to wavelength), low-density plasma field will attenuate exponentially with time or distance. In this case, the signal experiences a continuous attenuation/reflection in its amplitude, but the lateral integrity of the transmitted AND reflected wave fronts are maintained at all times. Besides attenuation and propagation delay there is no change in the signal's frequency along the way. However, in our universe, filled with many randomly distributed and widely separated (compared to wavelength) point charges, presenting a local, three-dimensional non-uniformity to the wave front, there is a reduction in the signal's frequency as well as the usual amplitude attenuation and propagation delay. In this particular case, individual point charges momentarily (but continuously) disrupt the lateral uniformity of the signal's wavefront, ultimately causing frequency reduction in the propagating signal.

When there is a change in the signal's frequency in our homogeneous and isotropic universe, it is logical that it would be as a simple exponential decay and the rate of change of frequency with time or distance has to be proportional to its frequency. The equation for frequency variation in space of our universe is then given by:

$$\frac{f}{f_0} = \frac{\lambda_0}{\lambda} = e^{\frac{-d}{D}} = \frac{1}{(z+1)}, \qquad (1)$$

where $\frac{f}{f_0}$ is the frequency reduction factor which stands for the ratio of the observed frequency of the signal to its original value. It is the inverse of the ratio of the two wavelengths $\frac{\lambda_0}{\lambda}$. Its relationship to the redshift "z" (by definition) is shown above. In the exponential equation,"d" denotes the distance to any glowing object in space and "D" is a distance parameter inversely proportional to the equilibrium space charge density of our universe. Its numeric value could be determined from any available redshift and position information of any glowing object in space, which is located somewhat close to Earth.

Redshift and distance measurements were made and reported by many. A collection of these data was made by Powell (2002). From these data, for objects up to a distance of roughly 0.8 GLyr (or a redshift of about 0.06), the value of our constant D remains essentially the same and comes out to be 13.96 GLyr. In terms of redshift (z), the distance to any glowing object, for ALL values of redshift, is then given by:

$$d = 13.96 \ln(z+1) = 13.96 \ln\left(\frac{\lambda}{\lambda_0}\right) \quad \text{in GLyr.} \qquad (2)$$

Equation (1) shows that during each interval of 32.144 GLyr the wavelength of ANY propagating EM wave in our universe increases by an order of magnitude over its previous value. To demonstrate our point, let us assume that all radiation from any star in our universe is monochromatic and all of it is produced at a wavelength of 0.000053 cm (the wavelength of our Sun's peak radiation intensity). It is a good estimate of wavelength for the bulk of radiation produced by our Sun. Any star's radiation intensity drops off very quickly from its peak value for even a small deviation in wavelength. For all practical purposes, the bulk of radiation produced by each individual star originates near the peak wavelength of its radiation intensity curve. For a signal with an initial wavelength of 0.000053 cm, the wavelength would first increase to 0.00053 cm, then to 0.0053 cm and after a "mere" 128.6 GLyr (Eq. 2) of travel, the wavelength of the original signal near the visible spectrum would increase to 0.53 cm and fall into the high band of microwave frequencies. Thus the mechanism of frequency reduction in signals of our universe becomes evident. The microwave radiation we measure on Earth is due to frequency decay of signals originating near the visible frequency spectrum, produced by billions of stars in billions of galaxies in the vast spaces of our universe, which is in steady state. In this instance, redshifting of signals is NOT frequency reduction produced by the recession of glowing bodies from the observer. That is, it is not caused by the differential in their relative velocities, nor is it due to the expansion of space.

The distance to any glowing object in space of our steady state universe, given by Eq. (2), is greater than its equivalent in an expanding universe, particularly at higher values of redshift. Unlike relativistic velocity constraints in an expanding universe, the steady state model of the universe has no restriction on distance. In tabulated data by Powell (2002), one star cluster has a redshift of 0.225, 2.797 GLyr away from Earth. In a steady state universe, this same cluster would be 2.833 GLyr from our planet, or about 1.3 percent farther in space and that much larger than we presently think.

Radial separation between objects in space can easily be obtained from Eq. (2). For example, a galaxy with a redshift of 5.34 would be 25.78 GLyr from Earth. Its line-of-sight separation from its potential neighboring galaxy with a redshift of 5.340534 would be 1.2 million light years.

2.5. Definition of signal amplitude intensity

The wavelength of any signal of interest to us is much greater than the diameter of a point charge. Even near the visible frequency spectrum the wavelength of the signal is about one billion times larger than the proton's diameter. However, each point charge controls a significantly larger area of the signal's electric field in its vicinity than merely its physical size. We can refer to this coupling area near the point charge as the "effective coupling cross-section" for the signal's electric field, with this coupling being relatively more effective at shorter wavelengths.

The strength of a propagating signal is defined by its amplitude, which is directly proportional to the signal's electric field at any frequency, anywhere in space. And, because of the signal frequency's exponential variation with time or distance, the rate of change of the signal's amplitude due to scattering with time or distance in a homogeneous and isotropic universe, as well as the signal's amplitude itself, would have to have an identical exponential dependence with time or distance. Therefore, both of these amplitude variables must be proportional to their frequency (Eq. 1).

With the amplitude of the signal being proportional to its frequency, the square of the signal's amplitude, defined here as the signal's "amplitude intensity" (AI), is then proportional to the square of its frequency. This statement implies that for each interval of distance of 32.144 GLyr, or for every order of magnitude of frequency reduction, the AI of the propagating wave decreases by two orders of magnitude. For signals far away from their source of origin, a continuous scattering of a small amount of energy in the wave becomes the major mechanism for the reduction in their AI. It would be independent of and in addition to the reduction in the signal's intensity due to spherical expansion. In defining a signal's AI, which is proportional to the observed signal's radiation intensity (the amount of light) at any frequency at any one single point in space, we have not taken into account the second mechanism for the loss of signal intensity. This additional loss is due to frequency reduction in the signal from its actual original value in space.

3. Correlation between observational data and theory

3.1. Variation in magnitude of type Ia supernovae with redshift

In order to obtain the actual brightness or luminosity of a glowing object in space in the near field of our observable steady state universe (based only on the definition of "amplitude intensity" AI), its apparent brightness or luminosity must first be increased by the square of $(z+1)$ to account for the attenuation in the signal's AI due to scattering, and then corrected for its location in space, which will determine its attenuation due to spherical expansion. Thus, if we correct attenuation due only to scattering of signals, then the observed brightness of our star cluster with its redshift of 0.225 should be some 67 percent of the expected value. This argument could explain why "the High-Z supernovae (SNe Ia) are fainter than expected" (Filippenko 1998), which is currently attributed to an accelerated expansion of our universe. It is said that with a non-zero cosmological constant, "dark energy adds gravity that is repulsive and can drive the universe apart at ever increasing speeds" (Hogan et al. 2002). It was originally thought that we were a part of a "flat" universe with no cosmological constant and that the universe would ultimately experience a rapid deceleration.

Because of their ideal properties, SNe Ia are used as standard candles. A few SNe Ia were observed at a redshift of 0.4. Equation (2) places them about 4.7 GLyr from Earth. Considering only the effect of scattering, providing us with the largest error correction, the observed "relative intensity of light" for these SNe Ia should be about one half of their actual value which appears to be in agreement with published observational data (Hogan et al. 2002).

Observational data reported by S. Perlmutter (1998) show individual deviations in the apparent brightness of the High-Z SNe Ia in logarithmic values of magnitude from the "ideal magnitude" (IM), defined here as:

$$IM = 24.2 + 5\log(z) . \quad (3)$$

A plot of IM in Fig. 1 represents variation in the magnitude of SNe Ia due to spherical expansion of signals in an expanding universe for logarithmic values of redshift. In an expanding universe, the velocity of a glowing object in space is proportional to distance and its redshift (constant expansion). It is valid for small values of redshift.

Since we know how a signal's AI varies in a steady state universe with redshift, reductions in AI due to scattering at any one point in space can also be expressed in logarithmic measures of magnitude for SNe Ia as a function of redshift. This "magnitude correction" (MC) in terms of AI is given by:

$$MCAI = 5\log(z+1) \quad (4)$$

At zero redshift, and no reduction in AI, there is no correction. At a redshift of one, $MCAI$ is equal to a magnitude of 1.5. Finally, at a redshift of 9, the value of $MCAI$ caused by the reduction in AI of a signal (due only to scattering) is equal to a magnitude of 5. This result is in agreement with an expected 100 fold reduction in the AI given by the square of $(z+1)$ for a steady state universe, disregarding the effect of spherical expansion on the variation in AI. Figure 1 shows a plot of $MCAI$ as a function of redshift.

To obtain variation in the overall magnitude of SNe Ia in a steady state universe with redshift, we have to combine individual variations of amplitudes due to scattering of signals and spherical expansion. However, Eq. (3), giving us variation in the amplitude intensity of SNe Ia due to spherical expansion in an expanding universe, cannot be used for this purpose because we cannot mix variables from two models of our universe. In a steady state universe, the distance to a glowing object in space is given by Eq. (2). To obtain variation in the "apparent magnitude" (AM) for a SN Ia produced only by the spherical expansion of signals in a steady state universe, let us pick a reference point in space for which we know the magnitude of the SN Ia. Let this point be at a redshift value of 0.01, corresponding to a distance in space of 0.139 GLyr. At this redshift, the logarithmic magnitude of the SN Ia has a value of 14.2, (Eq. 3), which is about the same for both models of our universe. Thus the variation in AM due to spherical expansion of signals in a steady state universe anywhere in space, would be given by the square of the ratio of the two distances. One of these distances could be calculated at any value of redshift and referenced to the value calculated at the redshift of 0.01. With this observation, the logarithmic magnitude of AM of a SN Ia at ANY value of z is given by:

$$AM = 24.2 + 5\log[\ln(z+1)] = 18.48 + 5\log(d)\,. \quad (5)$$

Figure 1 shows a plot of AM, which is also signal radiation intensity, as a function of redshift. Note that although both AM and IM curves represent variations in the logarithmic magnitude of SNe Ia due only to spherical expansion, the results are very different for the two models of our universe because of the frequency reduction in signals with space charge in the definition of distance for a steady state universe (Eq. 2). Note the numeric relationship between redshift and distance in a steady state universe, as shown in Figure 1. Figure 1 also shows that at redshifts of about 0.2, the smaller amplitude of the AM curve begins to separate from the IM curve because at higher redshifts the distance to a glowing object in a steady state universe is no longer proportional to redshift. The separation is even more pronounced at redshifts greater than one.

At large values of redshift, the logarithmic magnitude of AM levels off and remains essentially constant, because signal attenuation due to spherical expansion becomes less effective with distance. However, its value always increases by 1.505 magnitudes with each two-fold increase in distance. It must, by definition. Had we plotted logarithmic magnitudes of AM in Fig. 1 versus logarithmic values of distance, we would have obtained a curve similar to IM in Fig. 1. In a steady state universe, where redshift is caused by frequency reduction and not by the recession velocity due to expansion of matter or space, the redshift increases exponentially with distance.

When we combine Eqs. (4) and (5) we will obtain an expression for the logarithmic "maximum magnitude" ($MMAI$) for a SN Ia in a steady state universe, based only on the variation in the signal's "amplitude intensity" (AI):

$$MMAI = 24.2 + 5\log[(z+1)\ln(z+1)]\,, \quad (6)$$

providing us with the presently observable $MMAI$ of SNe Ia at smaller values of z. The value of $MMAI$ in Eq. (6) takes into account both the spherical expansion and the amplitude attenuation of signals due to scattering in a steady state universe. However, the loss in the radiation intensity due to signal frequency reduction with time or distance was not included in Eq. 6. The $MMAI$ curve was obtained simply by the addition of individual magnitudes from $MCAI$ and AM curves.

At small values of redshift, where variation in the magnitude of SNe Ia is controlled primarily by spherical expansion, the $MMAI$ and the IM curves of the two models of our universe follow each other from $z = 0$ up to a redshift value of about 0.2, because $MCAI$ in Eq. (4) does not contribute significantly to the value of $MMAI$ at small redshifts. However, at redshifts greater than 0.2, or a distance of about 2.5 GLyr, the magnitude $MMAI$ of SNe Ia is beginning to attenuate in space at a slightly higher rate than the square of its redshift (constant expansion), given by IM. In the Big Bang universe, this slight departure in the observed maximum magnitude of SNe Ia from their ideal values (IM) is said to be due to an accelerated expansion of our universe.

3.2. Comparison of theory to observed results obtained on type Ia supernovae

Calculated values of $MMAI$ (Eq. 6) at redshifts of 0.4, 0.5, 0.6 and 0.83 appear to be in better agreement with observational data reported by S. Perlmutter (1998) than those obtainable from IM in Eq. 3. The $MMAI$ curve appears to be an extension of their curve ($\Omega_M = 0.5$ and an $\Omega_\Lambda = 0.5$) for a flat universe (S. Perlmutter 1998). The agreement between the $MMAI$ curve and experimental data obtained on very distant type SNe Ia extends to higher values of redshift. For example, a distant SN Ia (SN 1997ff) was observed 10 GLyr from Earth (Riess et al. 2001), the most distant SN Ia observed thus far. It had a redshift of about 1.7. In a steady state universe, a redshift of 1.7 would

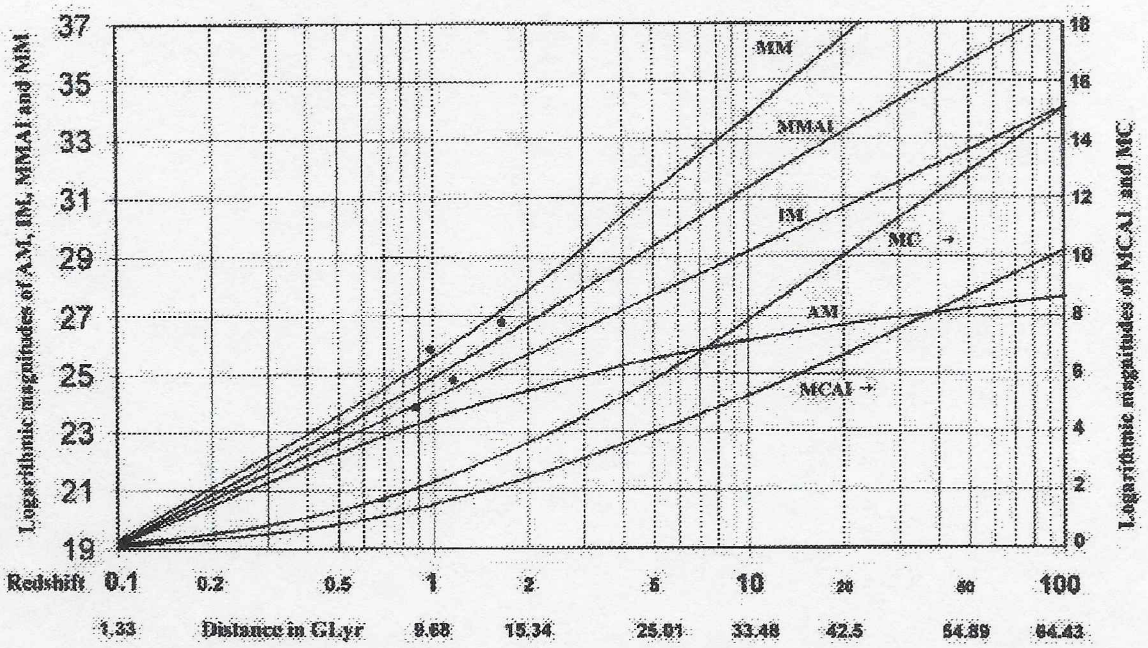

Fig. 1. Logarithmic magnitudes of type Ia Supernovae vs. redshift and distance in a steady state universe.

place SN 1997ff at a distance of 13.87 GLyr (Eq. 2), indicating that this event actually took place 13.87 Gyr ago. The observed maximum magnitude for this SN Ia should be 24.19 (Eq. 5), as a result of spherical expansion only. The correction in the maximum magnitude of the SN due only to scattering should be 2.16 (Eq. 4). Thus the total *MMAI* of this SN should be the sum of the two values, or a magnitude of 26.35 (Eq. 6). This calculated value of *MMAI* for this SN Ia is 1.6 percent under its observed magnitude of 26.77 (Barbon et al. 1999), but it is one magnitude greater than the value predicted by *IM* (Eq. 3) for an expanding universe with a constant rate of expansion.

SN Ia 1998eq with a redshift of 1.2 had a maximum magnitude of 24.80, or 2.4 percent under the value of *MMAI* obtained from Eq. (6). SN 1997fg, (statistically only 20 percent SN Ia), had $z = 0.952$ and maximum magnitude of 25.93, exceeding the value from Eq. (6) by 4.6 percent. SN Ia 1997ek, with $z = 0.86$ and maximum magnitude of 23.8, was 3.0 percent lower than the value from Eq. (6). Figure 1 shows the location of the observed SNe Ia in reference to the theoretical *MMAI* curve. These three High-Z SNe Ia are from tabulated data by Barbon et al. (1999). All of these results explain the "unusual" behavior of signals from high redshifted glowing objects in space with an apparent accelerated rate of expansion without the help of dark energy, which is said to "pervade all of the empty space" of our universe.

The SN 1997ff occurred some 10 Gyr ago. This SN Ia was most likely an explosion of a white dwarf (Riess 2003). Before becoming a dwarf however, this star, initially similar in size to our sun, was probably glowing for a period of some 10 Gyr. Its lifespan as a white dwarf is unknown, but it might have been many additional Gyr. By observing SN 1997ff, we have witnessed a spectacular death of a star that probably first began to glow some 20+ Gyr ago.

3.3. Variation in signal radiation intensity with frequency

Up to this point we have dealt only with the energy loss in the propagating wave due to the reduction in the signal's amplitude caused by the scattering of the wave. At higher values of redshift, however, the energy loss in the transmitted wave due to frequency reduction is substantial and must be taken into account. With the amplitude and frequency of all signals varying exponentially in space with time or distance, the frequency dependent component of each signal's intensity would be reduced proportionately with frequency and must have the same exponential relationship as its amplitude and its frequency. For each order of magnitude reduction in the signal's frequency, the transmitted wave incurs an additional order of magnitude loss in its radiation intensity due to frequency reduction, proportional to the energy loss experienced by one photon of its frequency. This definition of energy loss in the signal radiation intensity due to frequency reduction from its original value, together with definitions of distance (Eq. 2) and "amplitude intensity" (*AI*) provide a complete description of the behavior of signals in a steady state universe.

Putting aside the effect of spherical expansion, if we were to combine energy losses due to amplitude attenuation and frefigure 2 here

Fig. 3. Caption for figure 2

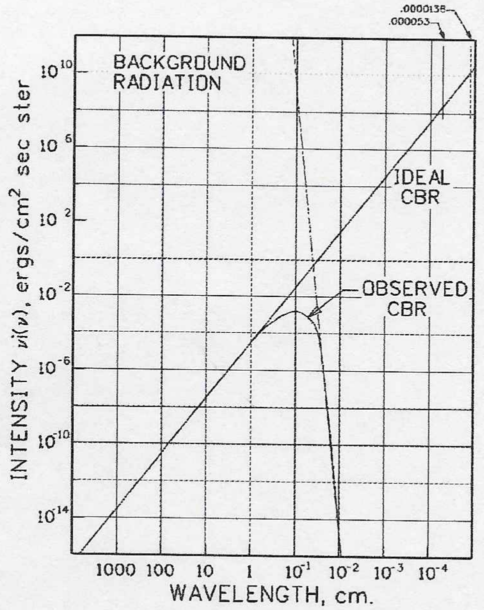

Fig. 2.

quency reduction incurred in space by a propagating wave, then for each order of magnitude reduction in the observed frequency (or 32.144 GLyr of distance), our signal's "radiation intensity" (defined here as *RI*), previously consisting only of the "amplitude intensity" (*AI*) due to amplitude attenuation of the signal, will be reduced by an additional order of magnitude for all values of frequency. With this three order of magnitude reduction in the signal's intensity, the *RI* of any signal from any area of our universe would be reduced by a total of three orders of magnitude and would vary similarly to the left side of the observed cosmic background radiation (CBR) curve in Fig. 2. This three order of magnitude variation in the *RI* with frequency can easily be seen for signals originating in the far field of space, observed on Earth at wavelengths greater than one cm. Thus, two orders of magnitude reduction in *RI* are due to amplitude attenuation of the signal and one order of magnitude is due to frequency reduction. At long wavelengths, the reduction in the *RI* with increasing wavelength is controlled entirely by amplitude attenuation and frequency reduction due to interaction of the signal with space charge. Note, we handled the loss of the signal's energy due to amplitude attenuation completely independently from the energy loss in the signal due to frequency reduction, but these two energy loss mechanisms are intimately connected. They are interdependent.

Individual values of *RI* of signals observed at any one given frequency originated in different areas of our universe that are equidistant from Earth. The lower the observed signal's frequency, the farther in space would be its source of origin. In general, the bulk of the radiation energy received on Earth was produced by various glowing bodies in space that emit energy near the visible frequency spectrum. The distance to their location would be given by Eq. (2). However, sources of infrared and ultraviolet radiation, contributing to radiation measurement at the same frequency on Earth, would be located closer to or farther away, respectively.

If we were to measure *RI* of signals from a small group of radiation sources originating in the far field of our universe (as observed on Earth at any one single frequency), then the total *RI* of this energy group would have a definite value, corresponding uniquely to that frequency. It also means that if we were to measure radiation energy from another similar group of signals originating farther in space, reaching Earth at one order of magnitude lower frequency, then the *RI* of these signals at the reduced frequency would be only one tenth of one percent of the value recorded earlier at the higher frequency. Specifically, if we were to measure *RI*s on Earth from similar groups of signals at wavelengths of 0.1, 1, 10 and 100 cm (corresponding to radiation energy originating 105, 137, 170 and 202 GLyr in space at a wavelength of 0.000053 cm), the shape of the curve connecting these points would look similar to the left side of the observed CBR curve in Fig. 2.

As the signal's frequency and its radiated energy density change slowly with time or distance in space, all signals (including high frequency signals) are SLOWLY attenuated and redshifted at the same time and no visible light emanating from the far away galaxies would ever reach Earth at observable levels. Depending on the galaxy's position in our homogeneous and isotropic universe, almost all of its radiated energy received here would be redshifted toward infrared, microwave, and ultimately, radio frequency, with an attenuated amplitude. Herein lies the explanation for the Olbers' Paradox and the "horizon problem". Also, since the change in the signal's amplitude is proportional to its frequency, lower frequency radio signals should appear to be more prevalent at larger distances (Filippenko 1998), as compared to radiation produced in the visible frequency spectrum.

3.4. Effect of frequency reduction on the maximum magnitude of Ia supernovae

We derived various magnitudes for SNe Ia based only on the attenuation of the "amplitude intensity" (*AI*) due to scattering of the signal from any point in space of a steady state universe. However, the effect of frequency reduction on the loss in "radiation intensity" (*RI*) of transmitted signals is significant, particularly at higher values of redshift and must be considered, prompting us to modify some of our previous results.

We stated that the variation in *RI* of signals in space, due to the reduction in the signal's frequency from its original value with time or distance, was proportional to its frequency. That is, it is inversely proportional to $(z + 1)$ (Eq. 1). Now, if we introduce energy loss in the signal intensity due to frequency reduction into our equations, the logarithmic magnitude correction *MCAI* in Eq. (4) becomes:

$$MC = 7.5 \log (z + 1) = 7.5 \log \left(\frac{\lambda}{\lambda_0} \right). \tag{7}$$

In Eq. (7), *MC* takes into account *RI* losses due to amplitude attenuation of the signal and losses due to the signal's frequency reduction with time or distance. It is valid for ALL values of redshift. At larger values of redshift, *MC*, representing all losses in *RI* of signals due to space charge interaction in a steady state universe, is attenuating as the inverse cube of its redshift, or a 7.5 change in magnitude for each order of magnitude change in redshift.

Likewise, when we take into account both *RI* changes in signals due to amplitude attenuation and frequency reduction, the variation in the logarithmic "maximum magnitude" (*MM*) for a SN Ia in a steady state universe becomes:

$$MM = 24.2 + 5 \log \left\{ \left[(z + 1)^{1.5} \right] \ln (z + 1) \right\} \tag{8}$$

$$= 18.48 + 5 \log \left[d \left(\frac{\lambda}{\lambda_0} \right)^{1.5} \right]. \tag{9}$$

The *MM* in Fig. 1 always has a higher attenuation value than *MMAI*, following the *IM* curve from $z = 0$ to a z of about 0.2. However, at higher values of redshift, *MM* attenuates in space as the inverse cube of its redshift. Both of these variables are radiation intensities, except that *MM* takes radiation intensity reduction in the signal due to frequency reduction from its original value into account, while *MMAI* does not. The total attenuation of *RI* in the far field of our universe is due primarily to amplitude attenuation and frequency reduction of signals as embodied in the *MC* curve (Eq. 7).

If we were to measure the apparent maximum magnitude of SN Ia in space, without correction of the observed value for frequency reduction from its original value, we should compare experimental data to the logarithmic magnitude on the *MMAI* curve in Fig. 1. This would give us the least attenuation a SN Ia can have at this value of redshift in a steady state universe. However, if we were to measure the maximum magnitude of a distant SN Ia while correcting its *RI* for the signal's frequency reduction in space from its original value, the maximum magnitude should be compared to the value given by *MM* curve in Fig. 1. These two curves in Fig. 1 define a range of maximum magnitude of SNe Ia from the least attenuation value (given by *MMAI*) to the highest possible observable attenuation value (given by *MM*) that could be obtained in a steady state universe at a given value of redshift. The two curves depend only on how the effect of frequency correction in the measurement of the *RI* value of a type SN Ia was implemented. However, the *MM* curve in Fig. 1 provides the true logarithmic maximum magnitude value for a SN Ia at ANY value of redshift, whereas the *MMAI* curve gives only a good approximation at smaller redshifts. The *MM* curve in Fig. 1 appears to be an extension of the curve reported by S. Perlmutter (1998) for $\Omega_M = 0$ and $\Omega_\Lambda = 1$ (dark energy equal to one) in a flat, expanding universe. In the case of SN 1997ff, the reported maximum magnitude was 26.77 (Barbon et al. 1999). This value happened to be located in the middle between the two curves in Fig. 1.

3.5. Relationship between *MC* and *AM* attenuation curves and the observed CBR curve

Figure 1 shows that at modest values of redshift, the contribution of *MC* on signal attenuation is very small compared to that of *AM*. Both of these variables contribute to the overall signal attenuation *MM*. However, at redshifts greater than 100, the large value of the logarithmic magnitude of *AM* changes very little with redshift and remains essentially flat, keeping the rate of attenuation of signals due to spherical expansion in check. The magnitude of *MC* due to space charge interaction, on the other hand, increases as the cube of its redshift. At this high rate of change, a point will soon be reached when *MC* will match attenuation levels comparable to those of the *AM* curve. For a short period of distance in space, both curves would produce nearly the same attenuation in the total *RI*. However, attenuation due to *MC* will continue to increase, rapidly becoming a dominant factor for attenuation of signals originating in the deep space of our universe. The crossover point in space for the two curves will take place when the *AM* in Eq. (5) is equal to the *MC* in Eq. (7), (about 28.9 magnitudes each), or at a value of z of about 7229.

We stated that most of the radiation in our universe was produced by stars in a narrow band of frequencies and that signals of different frequencies (as measured on Earth) originated in different areas of our "enormous" steady state universe. The lower the frequency of the signal, the farther away was the source of its origin. Predicated on these facts, the value of redshift of 7229 places the crossover point of the two curves at a distance of about 124 GLyr (Eq. 2) from the source of radiation, independent of the original signal's frequency. For example, a signal originating 124 GLyr in space at a wavelength of 0.000053 cm (corresponding to the peak wavelength of our sun's *RI*) would have a crossover point at a wavelength of about 0.38 cm as observed on Earth. This crossover point appears to occur slightly to the left, but near the very top of the observed cosmic background radiation curve in Fig. 2. If the peak wavelength for the bulk of radiation intensity from all the stars in space were shorter, a characteristic of radiation which is typically produced by stars with higher surface temperatures, our crossover point would move slightly to the right, approaching the peak of the observed cosmic background radiation curve in Fig. 2.

We stated that luminosities of many stars in our universe could exceed that of our sun by several orders of magnitude. A few giant blue stars could easily outshine many older yellow stars like our sun. If we were to assume that a good portion of radiation in our universe was produced by the higher temperature stars, then the peak wavelength of the bulk of radiation received on Earth would have to approach the 0.1 cm peak wavelength of the observed CBR frequency spectrum in Fig. 2. With some of this radiation emitted at a wavelength of 0.0000138 cm, the crossover point for this frequency would occur at the very peak of the observed CBR curve in Fig. 2.

However, some of the radiation emitted at the wavelength of 0.000053 cm would also contribute to the total radiation intensity observed at 0.1 cm. This radiation would be originating 105 GLyr in space. In fact, radiation intensity measured on Earth at the wavelength of 0.1 cm consists of radiation produced by billions of stars at wavelengths of approximately 0.000053 to 0.0000138 cm, extending over an interval of space from about 105 to 124 GLyr.

The crossover point between the *AM* and the *MC* curves is just a distance indicator in space. It shows us where signal attenuation due to spherical expansion of radiation from any glowing object in space is equal to that produced by space charge interaction. The distance to the crossover point is independent of the original frequency of the signal, but crossover points for signals of different frequencies occur at different wavelengths. They do not have to be exactly at the peak wavelength of the observed CBR frequency spectrum in Fig. 2. The two values have only to be in the proximity of each other. Keep in mind that recombining of signals of lower frequencies (longer wavelengths) from individual sources into common wavefronts will occur before those of higher frequency signals originating in the same area of space, after having traveled an equal distance. A longer wavelength allows for a more sustained interaction period between phases of individual wavefronts. For example, radiation originating at longer wavelengths of 0.000053 cm, 124 GLyr in space has passed the 0.1 cm mark and has just reached the left side of the observed CBR curve on Earth at a wavelength of 0.38 cm. At distances greater than 124 GLyr, this radiation will continue in space as a fully formed wavefront, attenuating as a cube of its continuously decreasing frequency. Radiation originating at even longer wavelengths will attain fully formed wavefronts before reaching the 124 GLyr point in space. Likewise, the wavelength of 0.38 cm will be reached within the interval of time of 124 Gyr. By the time these signals have traveled 124 GLyr, this radiation would have been continuously attenuating as a cube of its frequency, with its magnitude following the left side of the observed CBR curve in Fig. 2. Its wavelength would have exceeded the 0.38 cm value. On the other hand, radiation energy originating at shorter wavelengths of about 0.0000138 cm, 124 GLyr in space has just reached the peak wavelength of the CBR curve in Fig. 2 and would have to travel an additional distance of about 19 GLyr before becoming a fully formed wavefront, finally reaching the left side of the CBR curve. It will then be observed on Earth at a wavelength of about 0.38 cm. Beyond this point in space, it will follow the same attenuation path as that of the signals originating at wavelengths of 0.000053 cm and longer.

As expected, the behavior of radiation energy originating in space in the range of wavelengths from 0.0000138 to 0.000053 cm (124 GLyr away) and observed on Earth at wavelengths of 0.1 to 0.38 cm, is very different from those originating anywhere else in space. This is the transition area for radiation energy. Signals originating near longer wavelengths of 0.000053 cm which are observed on Earth at about 0.38 cm have already passed the 0.1 cm wavelength point in space by the time they have reached the Earth and they have begun their never-ending attenuation journey in space. At the other end of the energy spectrum, signals originating near wavelengths of 0.0000138 cm, in the same general area of space 124 GLyr away, have only reached the peak wavelength of the observed CBR curve in Fig. 2 and are just about to reach the left side of the observed CBR curve. The significance of the 0.1 cm wavelength point, corresponding to the peak wavelength of the observed radiation on Earth, will become clearer when we consider the nature of background radiation from the near field of our universe. Furthermore, with the wavelength for the peak radiation intensity occurring at 0.1 cm, it appears that the bulk of radiation produced in our universe consists of signals originating at shorter wavelengths of the radiation spectrum. It is dominating the behavior of energy of the whole spectrum, because radiation originating near shorter wavelengths 124 GLyr in space is still in the process of creating fully formed wavefronts as it passes the 0.1 cm wavelength in space. It determines the shape of the observed CBR curve in Fig. 2 at the wavelength of 0.1 cm.

The observed CBR spectrum in Fig. 2 is a composite of all *RI*s from all radiation sources in our universe. Space charge interaction of signals transforms the frequency spectra of the huge number of stars down into the microwave range. In a sense, the original "black body" frequency distributions of radiation from individual stars with slightly different peak wavelengths (anywhere from 105 to 124 GLyr away) was "transposed" down in frequency, but the overall relationship of the original frequency spectrum with wavelength of any one star has remained essentially the same. The variation in *RI* on the observed CBR curve near the peak appears to be the same as would be produced by a glowing body of matter in space at one single temperature. Also, the slope of our *RI* curve in the microwave range of frequencies, controlled by *MM* (Eq. 8), is clearly defined and follows exactly the slope of the observed CBR curve in Fig. 2.

We believe that radiation received on Earth from glowing objects in the near field of an inhomogeneous and unisotropic space is primarily from individual objects and is controlled by spherical expansion of signals unable to form coherent isotropic radiation fronts. It basically determines the shape of the cosmic background radiation curve in Fig. 2 at wavelengths less than 1 mm. The shape of the radiation curve at long wavelengths is determined by space charge interaction of signals from a continuous distribution of glowing matter in the far field of space. It is controlled by *MM* (Eq. 8) and attenuates in space as the inverse cube of its wavelength. In reference to Earth, the dividing line between the two areas of radiation sources in our universe is roughly 124 GLyr in space. Spherical expansion and space charge interaction of signals from billions of galaxies in our universe appear to produce a radiation spectrum similar to that from a warm body of matter which is controlled by the quantum mechanical concept. However, mechanisms used to produce the two radiation spectra are not the same.

3.6. Effect of signal attenuation in space on luminosity of distant galaxies

We have shown that at very High-Z values, the magnitude of SNe Ia decreases rapidly with redshift (or distance). The overall reduction in *RI* of signals due to space charge interaction is inversely proportional to the cube of $(z + 1)$ and is in addition to the reduction in *RI* due to spherical expansion. This observation applies for all individual glowing objects in space. For example, the galaxy 0140+326RD1 has a redshift of 5.34 and is 12.22 GLyr from Earth (Dey et al. 1998). But in a steady state universe it would be 25.78 GLyr from our planet (Eq. 2). That is, it would be 2.11 times farther in space and 2.11 times larger than we presently think. The luminosity of this galaxy in the steady state universe was reduced from its original value by a factor of 255 due to interaction of its signals with space charge.

From the total value of brightness for the Galaxy 0140+326RD1, 6.02 magnitudes would represent a reduction in brightness due to space charge interaction (Eq. 7) and the balance would be due to the spherical expansion of signals from the galaxy 25.78 GLyr away. If we did not take into account radiation energy loss in the propagating wave due to space charge interaction, then we would be underestimating the luminosity of this galaxy by a magnitude of 3.71. In an expanding universe, this difference would have to be attributed to the presence of dark energy in space. A potential SN Ia in this galaxy would have a *MM* of 31.55 (Eq. 8). From this total, 6.02 magnitudes would be from attenuation due to space charge interaction and the bulk of it (25.53) would be from spherical expansion (Eq. 5), a ratio of intensity reduction of about one to 64 million at this value of redshift. The apparent brightness of this SN Ia would be 3.71 magnitudes lower, or only 3.3 percent of the expected value, if it were presently observed on Earth. Disregarding the energy loss in *RI* of this SN Ia due to frequency reduction from its original value, it would be 1.7 magnitudes lower, or only 21 percent of the expected value in an expanding universe.

By itself, the additional signal attenuation due to space charge interaction, at modest values of redshift represents only a very small additional loss when compared to the loss in the signal's intensity due to spherical expansion. However, because of attenuation due to space charge interaction, and because of the increased distance to a glowing object in space of a steady state universe, very distant galaxies of normal size would appear smaller and not as bright than they actually are when observed in an expanding universe. Observational results of the deep space confirm this conclusion. It is said that these smaller, "younger" galaxies of the early universe are the building blocks for the larger present-day galaxies, like those closer to Earth. In a steady state universe, there should be no variation in the average size of galaxies with distance. Their average size is determined only by the galactic density in space, which is at equilibrium.

Recent observations of the Hubble Ultra Deep Field (HUDF), completed in January 2004, found galaxies ranging in redshift from 7 to 12, some of which were stated to be 0.4 Gyr old at the time of radiation emission (Wilson 2004). Initial releases of photographs made public and available on the Internet in March 2004 showed that these "ultra young" galaxies of the expanding universe looked similar to those of Hubble Deep Field-North (HDF-N) or HDF-S. In a steady state universe, some of them would be 35.81 GLyr from Earth. Their light, which we observe on Earth today, would have departed from there 35.81 Gyr ago. An estimated 10,000 galaxies were found in an area of space equal to about one tenth of our moon's diameter. This small area of our universe showed just a few galaxies in the earlier HDF photographs.

Subsequent HUDF data released in September 2004 show that as we manage to look deeper into space, we find nothing unusual but more of the smaller, "high redshift" galaxies (Windhorst & Yan 2004). Photographs of space show a few tiny, compact red dots, widely separated in space. Each distant galaxy was circled for ease of identification. All of these galaxies date back to approximately 0.4 Gyr, or nearly the beginning of time (Windhorst & Yan 2004), and it is reasonable to expect that we would find even more distant galaxies in deeper space. If we were to look the same distance in the opposite direction, we probably would obtain an identical picture of space as was the case for HDF-N and HDF-S (Gribbin 2001). In a steady state universe, the luminosity of these galaxies with a redshift of 12 would be reduced by a factor of 8.35 magnitudes due to signal and space charge interaction (over and above its value from spherical expansion). However, it would be a 5.0 magnitude reduction in luminosity (99%) than would be observable in an expanding universe. This would make them appear fainter than expected. Their size would be three times smaller than what we would expect to see in an expanding universe at this value of redshift with no space charge interaction.

The High-Z galaxies in the far field of space soon become "essentially unobservable" by optical means, because of amplitude and frequency attenuation of signals in a steady state universe and because they are farther away than previously thought. The very few galaxies, which we are still able to detect in this area of our universe with present equipment, at reasonable values of redshift, are probably the largest in size, or the brightest, or both. But, in spite of the increasing number of galaxies that should have appeared in our view at these larger distances, the majority of them are "lost in space" to our view as if we have reached the edge of the presently-observable, expanding universe with a radius of some 13 to 15 GLyr all around us.

4. Cosmic background radiation curves

4.1. Ideal cosmic background radiation curve

Up to now we were concerned only with the behavior of radiation emanating from "individual" glowing objects in space. However, in order to obtain a complete picture of behavior of radiation in space, we must also analyze variation in radiation intensity from a continuous sea of glowing matter. We have to determine how this type of radiation, which usually originates in distant areas of our universe, would appear to an observer on Earth as a function of frequency.

In defining our radiation intensity (*RI*), we assumed that all radiation in our homogeneous and isotropic space was produced by individual energy sources radiating energy at one single frequency. Signals from each source expanded independently from each other and *RI* from each point source in space diminished as the square of the distance. In addition, we established that the signal's frequency was reduced exponentially with distance due to interaction of the signal with space charge, thereby reducing its amplitude intensity (*AI*) by scattering a very small portion of the signal's energy, proportional to the square of its frequency. Energy loss in the signal due to frequency reduction from its original value caused an additional order of magnitude reduction in its *RI*, proportional to its frequency. We stated initially that these results were applicable to all individual radiation sources in space that were radiating energy at one single frequency or a "narrow band of frequencies." However, these attenuation concepts are applicable to all radiation sources in our universe, radiating energy at all frequencies simultaneously. That is, besides SNe Ia, these concepts also apply to a collection of stars, individual galaxies and clusters of galaxies, or any other collection of glowing matter in space that could be considered to constitute an entity.

To observe radiation emanating from a very distant area of our universe, we typically look at a very small area of space. In a homogeneous, isotropic and unchanging universe, luminosity, or the amount of radiation power per unit radius, produced in each small area of space under observation increases as a square of the distance from Earth. However, the total luminosity per unit volume of space at any distance in our view is constant. On a large scale, our universe has a constant radiation density. This implies that radiation intensity (*RI*), or the amount of light produced per unit volume of space (radiation density) under observation, is also independent of distance and remains constant. This conclusion is a restatement of the Olbers' paradox. Therefore, if there is a variation in the signal's radiation intensity and frequency taking place in space, it must be due only to energy loss caused by amplitude attenuation and frequency reduction in the propagating signal. This statement implies that maximum correction of radiation intensity, *MC* (Eq. 7) alone (unaffected by spherical expansion) determines signal attenuation from these homogeneous bodies of glowing matter because these signal attenuation concepts apply to all radiating objects in space, in our view.

Let us assume that all of the glowing matter in space consisting of stars, galaxies, and clusters of galaxies, were subdivided into an astronomically large number of smaller glowing particles of matter, uniformly distributed throughout all space. Furthermore, let us assume that all of these particles were producing homogeneous and isotropic radiation at one single wavelength of 0.0000138 cm, such that the amount of radiation energy produced by any unit volume in space would be equivalent to the total radiation currently produced by all of the galaxies in the same, identical unit volume of space. Variation in *RI* with redshift from any one of these smaller volumes would then be uniquely defined by *MC* (Eq. 7) as a function of redshift.

With these constraints, we can now calculate variation in *RI* from a continuous body of glowing matter in our universe. Since Eq. 7 for *MC* is logarithmic with redshift, keeping in mind that $(z+1)$ is a ratio of the signal's observed wavelength to its original value (Eq. 1), our "ideal" cosmic background radiation curve would then appear as a straight line in Fig. 2. This straight line would have to have a negative slope and vary by three orders of magnitude in *RI* for each order of magnitude change in its wavelength. In order to be able to draw this curve in Fig. 2, we have only to determine its location in reference to the observed CBR curve. Since we claim that our "ideal" CBR curve must be equivalent to the observed CBR curve (at least at large values of redshift), the slope of our "ideal" radiation curve must be identical to that of the observed CBR curve at longer wavelengths. Radiation received at these longer wavelengths would be from galaxies and clusters of galaxies in the far field of our universe. It should appear to the observer on Earth as radiation produced by a homogeneous and isotropic body of glowing matter, because at higher redshifts there should be no distinction between the "ideal" and the observed CBR curves.

If we were to draw our "ideal" CBR curve as a tangent to the observed CBR curve at longer wavelengths (Fig. 2), then the intersection of our "ideal" CBR line with the vertical line, corresponding to a wavelength of 0.0000138 cm would give us the value of *RI* produced in our "ideal" universe, if the bulk of radiation was produced at that wavelength. This *RI* value appears to be approximately 10^{10} ergs / sec ster cm^2. It represents an average value of *RI* for this "ideal, continuous glowing medium" in the proximity of the observer anywhere in space, before any attenuation. If the bulk of *RI* in space was produced at a wavelength of 0.000053 cm (the peak wavelength of our Sun's radiation), the value of average *RI* would be only about 3 x 10^8 ergs / sec ster cm^2 (or 30 watt / ster cm^2), giving us the lower end of the potential range of average *RI* in our universe.

4.2. Variation in cosmic background radiation intensity with redshift

Variation in the background radiation intensity with wavelength (derived in the previous section), applies only for radiation produced in the very deep space. To the observer on Earth, the astronomical number of galaxies, clusters of galaxies, and other glowing objects at very great distances would appear as a continuous sea of homogeneous and isotropic matter, and the attenuation concept applicable to this type of radiating matter would apply. However, when we consider background radiation emanating from glowing objects closer to Earth, where the universe is very inhomogeneous and unisotropic on a smaller scale, we have to deal with radiation produced by individual bodies of matter, forcing us to use a different approach.

If we were to look through a telescope into a very small area of space beyond our galaxy, we would see only a few stars and some distant galaxies separated by large lateral distances of empty space. We could confirm this by positioning our scope to view a section of the sky seemingly empty of stars and galaxies. For example, let us look at the side-by-side view of the HDF-N or HDF-S (Gribbin 2001). We can see that there are many areas where we could peer a distance of some 10 GLyr into the deep space, without observing even a single galaxy. The amount of radiation emanating from within these small areas of space in our view at these distances would be nearly zero. And, in some instances, we would expect to find similar results if we were able to look somewhat deeper into the very same areas of deep space. Recent observations of the HUDF of space (Wilson 2004) confirm this conclusion. In this case, at a redshift of about 12, we would be looking at an area in space

35.8 GLyr away. But even in slightly deeper space, the granular distribution of individual galaxies in our view would not contribute significantly to our radiation intensity measurement. Note that we are looking for some measurable isotropic radiation intensity of any frequency originating in this area of our universe that could be considered background radiation, and we are not concerned with radiation from individual widely separated galaxies.

At some point farther into space, however, we should find that the number of glowing galaxies in our view per unit radius would increase. Ultimately, their number would be substantial and the radiation intensity of their glow could now be detected and measured on Earth. At some point, in spite of the distance, we would expect to detect an increase in the galaxies' light intensity with increasing distance in space, but with a significant redshift. We might initially measure this background radiation on Earth at a wavelength of 0.01 cm (Fig. 2). Some of this isotropic radiation would be originating from stars at a wavelength of 0.000053 cm about 73 GLyr away, but some of it would be produced by other stars at shorter wavelengths all the way to 0.0000138 cm, about 92 GLyr away. At these distances, the "continuous" or homogeneous sea of galaxies would finally be producing some coherent, isotropic radiation detectable on Earth as background radiation, with a common, unified wavefront at the shortest observable wavelengths of 0.01 cm. This point in space, producing detectable radiation, appears to be about twice as far as the maximum distance to distant objects in our presently observable universe. With higher galactic densities in our universe, we would have been able to observe coherent isotropic radiation of the same intensity at even shorter wavelengths, from galaxies closer to Earth.

If we were to peer still deeper into space (beyond 73 or 92 GLyr depending on the value of the original frequency), *RI* from galaxies in the deeper universe would increase rapidly with distance. The variation of *RI* appears to have a slope with a 24 order of magnitude change for each order of magnitude increase in wavelength (Fig. 2). At this high rate of rise in *RI*, the transition period is very brief. Even before reaching its maximum allowable value, as established by the "ideal" CBR curve (Fig. 2), background radiation emanating from deeper space would soon begin to show the effect of reduction in its *RI* due to interaction of its signals with space charge. At these high redshifts, effects of amplitude attenuation and frequency reduction in the signal (as viewed from Earth) will begin to dominate its unchanging amplitude from spherical expansion, similar to behavior of *RI* from an individual glowing body in space, thereby providing a smooth transition into the "ideal" CBR curve in Fig. 2. In this case, the "ideal" CBR curve serves as the upper limit on maximum background *RI* originating in deeper space (as observed on Earth at any wavelength), and this value cannot be exceeded.

Therefore, we would expect background *RI* originating in the far field of our universe to increase beginning at shorter wavelengths at first, from an essentially negligible value, reach a maximum and then attenuate as a cube of its frequency, because sooner or later, the amplitude of the observed background radiation (with increasing wavelength) would have to transition from an essentially zero amplitude to its maximum allowed value defined by the "ideal" CBR curve in Fig. 2. The peak value was measured on Earth at a wavelength of about 0.1 cm (Fig. 2) and would be from radiation produced by stars in a range of wavelengths of approximately 0.000053 to 0.0000138 cm, 105 to 124 GLyr in space.

Radiation from galaxies at distances greater than 156 GLyr in our universe would produce a negative slope on the *RI* curve proportional to the cube of its frequency, which is observable on Earth in signals at wavelengths greater than one cm (Fig 2). In theory, if we were to measure and plot all values of OUR radiation intensities (*RI*s) at all observable wavelengths from all sources of radiation energy of our universe, beginning near our galaxy and extending to areas of the universe with undetectable radiation as a function of wavelength, our total CBR curve would be IDENTICAL in shape to the observed CBR curve in Fig. 2.

4.3. Nature of background radiation from the near field of space

We have shown that after some 124 GLyr of travel, the amplitude of any signal due to spherical expansion from an individual glowing object in space remains essentially unchanged with distance. After travelling such a long distance, radiation from any individual energy source in space becomes merely a plain propagating wave. For this reason, we would expect "the sky to be blazingly bright, even at night" (Filippenko 1998). But it is not the case, because of interaction of signals with space charge.

Figure 2 shows that a very small amount of background radiation should be detectable at a wavelength of 0.01cm. We stated that some of this radiation was produced at 0.000053 cm approximately 73 GLyr away, but then others at shorter wavelengths down to 0.0000138 cm, (92 GLyr away) by a collection of a large number of stars of different surface temperatures located somewhere within our view. After a long period of time, wavefronts from all of these energy sources will have traveled essentially in parallel to each other over long distances. Their individual wavefronts of the same reduced frequency would have been interacting with each other (IN PHASE) over longer periods of time (ESPECIALLY WITH INCREASING WAVELENGTHS). They would ultimately blend in, then would combine and add in amplitude to form one common wavefront of background radiation of one definite value, observable on Earth at one particular wavelength. Radiation energy emanating from signals in this same general area of space, but of lower or higher frequencies, would combine with wavefronts originating in adjoining areas of space located closer to or farther away respectively. Therefore, the observed isotropic radiation (as measured on Earth at one particular wavelength) would include a component of energy of any one particular wavelength originating in one particular area of space, given by Eq. 2. That is, it would always consist of many individual energy components of signals of many different original frequencies from many adjoining areas of space (also given by Eq. 2) in its vicinity, sorted and grouped into one single observable frequency. The separation between these individual original sources of energy in space could be many GLyr apart, indicating that components of many individual wavelengths (as measured on Earth at any one time at one single wavelength) would have originated many Gyr from each other in time, but all of them would be in our view.

Radiation energy emitted at or near the wavelength of 0.0000138 cm (about 92 GLyr away) would probably contribute the most to the energy content at the observed wavelength of 0.01 cm, because radiation produced at these shorter wavelengths would have already traveled about 19 GLyr on its way to Earth before reaching the 73 GLyr point in space. By this time, the wavelength of this radiation intensity would have increased to 0.000053 cm (Eq. 2) and its wavefront would be "pre-conditioned" toward a common unified wavefront, while at the same time, radiation was just being emitted randomly by individual radiation sources at 0.000053 cm in the same general area of space in our view, 73 GLyr away. For this reason, not all of the radiation energy in signals with a wavelength of 0.000053 cm (73 GLyr away) would be observable on Earth at the wavelength of 0.01 cm. Only energy components with shorter initial wavelengths originating at or near 0.0000138 cm, 92 GLyr in space, would probably be detectable at first.

If we were to look into the energy content of background radiation on Earth at slightly longer wavelengths than 0.01 cm, we would find that their signals would have originated in a slightly deeper space. The distance to their original energy sources would be given by Eq 2. We would also find that the amplitude of the observed radiation intensity would be slightly larger than the value previously recorded at the wavelength of 0.01 cm, because a similar amount of radiation energy produced in the same range of wavelengths of 0.0000138 to 0.000053 cm in deeper space has travelled a longer period of time and was able to produce a larger unified wavefront before reaching Earth with a slightly increased wavelength. Again, the higher frequency components of signals originating in deeper space would be favored.

If we were to repeat our analysis of combining wavefronts from signals of different frequencies from different areas of deeper space, reaching Earth at even longer wavelengths, we would find that the amplitude of the observed radiation would be continuously increasing with wavelength. Radiation from an area of space some 30 GLyr deeper would produce background radiation on Earth very close to the peak of the observed CBR curve in Fig. 2, because radiation would now be originating approximately 103 to 122 GLyr in space. In this fashion, radiation originating at greater distances than 73 to 92 GLyr (depending on the wavelength) would gradually produce more recombining of individual wavefronts, observable on Earth at longer wavelengths, slowly encompassing more and more radiated energy in the total viewing area. This *RI* would be observable on Earth (or anywhere else in space in any direction) with an ever-increasing magnitude with distance up to its peak value at the wavelength of 0.1 cm (Fig. 2). Shortly after reaching its maximum value, the observed background radiation emanating from areas of space greater than 124 GLyr away would behave as a plain propagating wave and would have to follow the "ideal" CBR curve in Fig. 2.

In our discussion, we have estimated that the bulk of radiation energy in stars was produced primarily by signals near the visible frequency spectrum in the range of wavelengths of approximately 0.0000138 to 0.000053 cm. These two wavelengths were chosen strictly for convenience, representing a range of wavelengths with a significant amount of radiation energy emanating in space from various stars. However, the total amount of radiation intensity observed at the wavelength of 0.01 cm (or at any other wavelength) would also include some radiation energy components originating at shorter wavelengths down to 0.0000058 cm, from a decreasing number of distant very high intensity stars, and from radiation produced by a relatively large number of stars with lower luminosities than our sun, all the way to a wavelength of 0.00013 cm (Moore 2002), located closer to Earth. If we were to take into account the fact that radiation was being produced by varying concentrations of stars with many different surface temperatures and luminosities, as indicated on the Herztsprung-Russell diagram (Moore 2002), our analysis would have been more complicated, but the end result would have been the same.

4.4. A few comments on the observed cosmic background radiation curve

Figure 1 shows the behavior of radiation from isolated glowing objects primarily in the near field of our universe, as observed on Earth, whereas Figure 2 shows behavior of radiation in our view, originating primarily in small areas of the far field of space. In reference to Fig. 2, we can make the following observations:

Variation of our total cosmic background radiation intensity with frequency, like the variation of the observed CBR curve in Fig. 2, is determined by the signal's radiation density from all energy sources in our homogeneous and isotropic universe (consisting primarily of galaxies) and by the concentration of the bulk of its radiation energy in a "narrow band of frequencies." However, changes in the signal's amplitude due to spherical expansion of signals (so dominant near their source of origin) and the amplitude attenuation of signals with frequency reduction due to space charge interaction (controlling attenuation of signal intensity in the far field of space), play a crucial role in the shaping of our theoretical CBR curve. Based on our findings of the behavior of background radiation from various areas of space, our theoretically derived CBR curve has to be one and the same as the observed CBR curve in Fig. 2.

The observed CBR curve represents all of the observable cosmic background radiation in space as a function of wavelength. Its frequency spectrum (as observed on Earth) extends from 0.01 cm to over 1000 cm in wavelength (Fig. 2). By definition, the microwave portion of the EM spectrum covers only the range of frequencies from 0.1 cm to about 30 cm (Moore 2002). However, the bulk of the cosmic radiation intensity is near the microwave range of frequencies. This frequency range represents almost the entire left side of the observed CBR curve in Fig. 2. For this reason, the cosmic background radiation in space is often referred to as the cosmic microwave background (CMB) radiation.

Our "dark and cold-looking", homogeneous and isotropic universe is like a huge "bottomless black box", and, due to the signal's frequency transformation of radiation energy from all glowing objects in space, its energy spectrum appears to have a black body frequency distribution with a low temperature value shown in Fig. 2. After all, there is some radiation energy being produced continuously in our universe per unit volume of space which, in turn, would have to raise the average or the equivalent temperature in space by some small amount above the absolute zero. This radiation energy permeates all space, so we should be able to detect some of it on Earth.

By looking at the observed CBR curve in Fig. 2, it is natural to conclude that this radiation spectrum, with a peak intensity wavelength of 1 mm, was produced by a glowing body of matter somewhere in space all around us at a nearly identical temperature of 2.73° K (Silk 1989). However, the observed CBR spectrum in Fig. 2 represents a signature of all radiation produced by billions upon billions of stars in an IMPERFECT vacuum of our universe, which is in steady state. The peak of the observed isotropic radiation temperature of 2.73° K was produced by distant stars radiating energy some 124 GLyr away in space with surface temperatures corresponding to radiation in a range of wavelengths from 0.0000058 to 0.00013 cm. A larger galactic density in our universe would have produced a higher temperature value on the observed CBR curve and would have moved the location of its peak to a higher frequency, with all of its radiation originating closer to Earth.

If it were not for the process of amplitude and frequency attenuation of signals in space that produces redshift in a steady state universe, radiation energy from billions of stars in billions upon billions of galaxies would have been received on Earth at their original frequencies. Their observed radiation spectrum would have been that of galaxies, and would have looked similar to the "integrated extragalactic starlight" intensity (Peebles 1993). However, the two are not the same. Without signal attenuation and frequency reduction in our universe, we would not be dealing with the Olbers' paradox today.

Finally, if we were to accept the theory of an expanding universe, we should find that all of the observable radiation from all glowing objects in the far field of space would produce increasing redshift with distance. However, we are told that the observed CBR intensity in Fig. 2 (representing a significant amount of radiation energy in space), was produced by some isotropic glowing medium as some "faint afterglow from the Universe's hot past" (Filippenko 1998). This radiation originated in the same general areas of deep space all around us, and was received on Earth with a frequency distribution characteristic of a black body radiation at a nearly identical temperature of 2.73° K. This CBR intensity apparently produced no redshift on its way to Earth. This observation implies that as glowing matter in space expanded at the very beginning of time, radiation from almost all of the expanding matter in the presently observable early universe as far back as 0.4 Gyr from its very beginning (Windhorst & Yan 2004), produced redshift in the emitted radiation, but that radiation from the glowing medium, responsible for the CBR intensity on Earth does not show signs of expansion at the time of radiation emission. It is said that "the cosmic microwave photons come from an opaque wall" and that "as space expanded, the photons stretched. They maintained the spectrum of black body, but of progressively lower temperature" (Filippenko 1998). Apparently, these events took place in spite of the fact that all of this radiating matter in the deep universe had one common origin, because in a sense it was all a part of the same event.

All matter in the early universe expanded, probably including all of the glowing media up to at least an age of 300,000 years, or to the beginning of the opaque region when matter and radiation first "decoupled" from each other (Filippenko 1998). All of this radiation emitted in various areas of space should have been redshifted with increasing distance. However, with radiation being emitted at different frequencies due to increasing redshift with increasing distance, radiation from glowing media should have appeared on Earth as if it were produced at many different temperatures. The farther out into space was the origin of this radiation, the larger would be its redshift, and the lower should be its equivalent temperature, as observed on Earth. This conclusion appears to lead us to a contradiction of the accepted theory that the closer in time we would approach the very beginning of our universe, the hotter the temperature of the medium would have to have been.

The explanation of redshift in space by the concept of expansion of matter serves reasonably well at lower values of redshift. But this concept becomes increasingly complex and unmanageable towards the early, presently observable universe, as we are approaching its very beginning in time. On the other hand, by utilizing frequency and amplitude attenuation concepts for propagating EM waves in a steady state universe filled with randomly distributed and widely separated point charges, many troublesome issues arising from the theory of creation of the universe by the Big Bang can be explained.

5. Conclusion

Formulation of the concept of relativity was slow in coming because this subject dealt with propagation of signals at the speed of light, or a velocity that was nearly infinite compared to other events familiar to scientists. Likewise, the concept of quantum mechanics was also difficult to conceptualize initially because this subject dealt with an unfamiliar, fundamentally granular behavior of energy exchange in nature on the atomic level. The observed energy transfers were at infinitesimally small, quantized amounts, as compared to other continuously varying, familiar events (Wolfson 1998).

Redshifting and attenuation of signals in space due to space charge interaction is also difficult to conceptualize, because we are dealing here with frequency-dependent, incremental removals of energy in infinitesimally small, quantized amounts from propagating EM waves. Although the space charge density in the universe, the amplitude of the signal, and the length of the interaction cycle between them are all individually small and almost negligible, their effect on any propagating signal is finite, cumulative over many years, and cannot be neglected. Since we calculate many small-scale events taking place in nature to a large negative power, why make an exception here?

It would appear to be much more reasonable for us to be a part of an existing "enormous" universe (of questionable beginning) in steady state, than to be momentarily a part of an expanding universe (also of questionable beginning) created at some arbitrary point in space, in one arbitrary moment, and from nothing into a homogeneously and isotropically expanding hot Big Bang. Thus we can state that we are living in a dynamic universe of some "enormous" size, which is in steady state. In spite of exhibiting an unusually exotic, and at times, local, violent behavior of matter in space, our universe is homogeneous and isotropic because it is "infinitely old." As it is claimed by the proponents of the steady state theory, "its average properties never change with time" (Filippenko 1998). Unlike our solar system or our galaxy, our universe shows no traces of a beginning and there is no end in sight.

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