What's Beyond HUDF? - An Alternate physical model for our universe

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Abstract
The model of an expanding universe raises many unanswered questions that can be explained via an alternate physical model, presented herein. The 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 in better agreement with experimental data 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 near a wavelength of about 1 mm and estimates the level of average radiation intensity in our steady state universe.

Subject headings: steady state universe – plasma cosmology – Big Bang – redshift and distances in space – galaxies – supernovae Type Ia – dark energy – cosmic background radiation (CBR) – cosmic microwave background (CMB)

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1. Introduction

As we observe nature, we try to define its behavior 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 (the Big Bang theory), many questions about the state of our universe were explained. However, a few puzzling questions remain unanswered, with some of these questions leading to fundamental comprehension difficulties. Even the exact nature of the initial explosion, which initiated the expansion of matter shortly after the Big Bang is subject to some difficulties of interpretation (Filippenko 1998 and Weinberg 1976).

As we explore our homogeneous, isotropic and at the same time 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 and Perlmutter 2003). Introduction of the "cosmological antigravity" concept (Krauss 2002) together with the "quintessence" concept (Ostriker & Steinhardt 2002), "inflation" (Guth 1997), "reionization" (Villard, et al. 2004) 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 puzzling aspects of the expanding universe is long (Lerner 1990, 2005).

In spite of these difficulties, the Big Bang theory (or as it became known: "the standard model") 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 in astronomy have not always been right. This paper presents an alternate choice for the physical model of our universe, which also satisfies these three requirements, and explains previously unanswered questions, revealing the universe to be in a dynamic steady state. This paper is a comprehensive analysis of the radically new concept for the state of our universe.

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 4.6 billion years (Gyr). Radiation power (luminosity) of other individual stars could be many times greater. One giant star in our galaxy, LBV 1806-20, is some 150 times larger and 5 to 40 million times brighter than our sun. "Next to LBV 1806-20, the Sun would appear just as miniscule as Mercury does next to the Sun" (Chang 2004). 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 (Wolfson 1998). 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.

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 a significant amount of mass being recycled in space just by glowing stars, particularly if the 15 Gyr time interval for the age of our universe was allowed to be extended. 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 believed that elements heavier than iron, but also lighter elements, are created during a supernova explosion (Moore 2002). The issue of lightest elements in space was extensively examined by Lerner (2008). In any case, no matter what the mechanism for the creation of space charge might be, low density plasma field does exist in the extremely cold intergalactic space (Thompson 1962). It is not the result of an event that just happened to occur spontaneously some15 Gyr ago.

2.2 Proposal for a dynamic universe in steady state

The apparent brightness of a star, the luminosity of a galaxy, the 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 there are many small, volumes of space containing matter in a dynamic state as part of a larger universe of an indeterminate size subject to the same conditions. Matter in any of these smaller areas of space anywhere in the universe may not stay put in one place over time, but would have to either expand or contract or even oscillate independently - and it does. 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. However, our universe as a whole could be in a dynamic steady state.

Albert Einstein originally introduced a cosmological constant into his general relativity equations to "preserve a picture of a stable universe." After learning that the universe appeared to be expanding, he discarded this constant, referring to it as "the biggest blunder" (Perlmutter 2003). Recently another constant was reintroduced into the general relativity equations to account for the mysterious dark energy in space. It appears as if general relativity equations would require a constant when the steady state universe is viewed on a macroscopic scale, however no constant would be needed for a microscopic view of space. This could not be the case.

The steady state universe is inherently unstable throughout all of space. The instability of matter in space is clearly visible in the near field of our universe on the microscopic scale. However, the bigger picture, which would have shown instability in the larger space of the far field of the universe is obscured by various thermonuclear processes, which continuously regulate the build up of total mass in all areas of the universe, and including in areas of space with excessive accumulations of mass. Redistribution of mass from these areas of space occurs automatically as soon as these accumulations of matter manifest themselves and long before they become uncontrollable. This is a natural, self-regulating mass conversion process, which provides stability to all matter throughout all of space. Such a dynamic steady state universe could exist and at the same time be homogeneous and isotropic on a macroscopic scale of space. In this model of the steady state universe there is no preferential point in space into which all of the matter in the universe could ultimately collapse.

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 (visible and dark) 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 seems that this converging matter in space, once subjected to a mutual gravitational attraction, is destined eventually to combine into one, or one of several individual black holes that are usually found 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 the bulk of all the mass of assembled glowing bodies anywhere in space is being recycled over time, while in the process of trying to merge into one single entity. This continuous mass conversion process is independent of any observed violent activity, which might be taking place in isolated areas of space, including black holes. Nearly all bodies of matter in various areas of space appear to have been assembled naturally, as if by “purely a material process of self organization”, a terminology used by Stenger (1992) to describe a similar event in nature. These bodies were assembled 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.

Observe the behavior of stars in the case of a simulated collision of two colliding galaxies forming one single, larger galaxy. Suspension of stars in spiral and even elliptical galaxies would be good examples of entrapment of mass in very close proximity to each other essentially in a timeless fashion, thereby greatly contributing to a state of relative tranquility of all the accumulated matter in various areas of space, even in areas of excessive accumulations of matter. Even the Pinwheel Galaxy, an unusual-looking structure in space, is a stable rotational star system. 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 4.6 Gyr.

All stars in various bodies of matter in space are individually in a dynamic 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. Originally, each star was assembled by gravity over a very long period of time by accumulation of small particles of matter, only to be disassembled by the thermonuclear process in the same fashion. There are other more violent thermonuclear mass conversion processes in place for stars, 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, probably all of 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 two or three times every millenium (Perlmutter 2003) for billions of years. With other types of supernovae, novae and planetary nebulae, that "cast off their outer layers of material into space" (Hubble site 2007) would be examples of instantaneous removal of large amounts of mass from stars in our universe. As new matter from other, similar events in space is accumulated in each 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 all matter from merging or simply collapsing into one.

Direct collisions of stars in our universe would most likely be similar in intensity as supernovae explosions, but probably are occurring only rarely, simply because we are dealing here with relatively small bodies of mass in motion and such inordinately large areas of space. Even colliding galaxies with hundreds of billions of stars appear to produce no actual collisions. Supernovae, typically not very homogeneous and isotropic "Mini Bangs" from a point source (mini versions of the Big Bang) are not caused by direct collisions of stars. Only in the galactic centers where planes of rotation of stars typically become less organized, and where older stars and remnants of their burned out cousins slowly converge and approach each other with time, a violent activity between stars is beginning to escalate. As individual stars approach the virtual center of a galaxy populated with many other stars and not a single large body of matter, their angular velocity slows down because of the constantly decreasing number of stars near the center. It is not like the motion of planets in our solar system.

Depending on the relative density of the remaining number of stars near the center of the galaxy, the speed of rotation of the whole system is maintained at about the same rate. The Pinwheel Galaxy would be a good example describing this behavior, where the speed of rotation throughout the galaxy appears to be essentially the same. The increasing density of stars due to the reduction of their angular velocity near the core 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 individually reduced, probably initiated by accretion of matter from a glowing companion star, a process similar to the type Ia supernovae but without ever reaching conditions suitable for a supernova type explosion. 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.

No matter how complex or strange individual mass conversion processes might appear, one way or the other all of the accumulated matter is slowly converted to smaller particles and radiation, and is ultimately ejected from the core of the galaxy, with new matter continuously streaming into the same area of space. It does not matter that a good portion of the ejected mass might never escape the gravitational pull of the parent galaxy. This process continues for the life of the galaxy, extending over billions of years, independent of the life span of individual stars.

Note that in the process of converting matter to smaller particles and radiation, only a relatively small amount of recycled mass would be needed at any one time to maintain the process of gradual redistribution of mass anywhere in space. The much larger amount of residual mass is left behind, but in a state of enhanced balance in the same general area of space, as this process continues with no end in sight. And the larger the accumulation of unbalanced mass in any one area of space, the greater would be the resulting mass conversion process to restore a dynamic balance of matter in space, extending over billions of years. But eventually all matter in all areas of the universe will be recycled. It is a very slow but efficient mechanism of keeping the inherent large-scale instability of mass in our steady state universe under perpetual control, maintaining all matter in the whole universe in a dynamic equilibrium. And all it takes, is time, which in this case is a readily available commodity. This mass conversion process in space is another marvel of nature.

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. The above described mass conversion processes serve as an "eternal source of material for new stars and galaxies" and become a "provision for the disposal of the debris" (Peebles 1993), thereby satisfying the more difficult requirement for the existence of a steady state universe, that of “continuous creation” of matter in space.

Thus, on one hand, gravitational force assembles individual particles of mass consisting of gas, dust and other dark matter from the far reaches of space 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 some of these events. On the other hand, complex thermonuclear processes deep inside of each star keep them active until all the nuclear fuel is exhausted. Radiation from the surface of our sun provides us with light and thus sustains life on Earth. However, the same thermonuclear processes are responsible for 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” from the areas of excessive accumulation of matter than the one provided by the SN Ia explosion. During the life of a star, from the very beginning to the very end, the loss of mass is always violent and at or near relativistic velocities, to allow matter to escape gravitational influence of the star and probably to a large extent of the parent galaxy. It typically takes a very long time to complete the destruction of each individual star. The recycling of mass serves as a limiting factor on the accumulation of matter in any one galaxy or in any one area in space, thus maintaining the average mass density in space at a constant level.

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 our solar system apart. The fact is, however, that the same gravitational force of billions upon billions of galaxies in our presently observable “enormous” universe (Filippenko 1998) already 30 billion light years (Glyr) in diameter 15 Gyr ago and still rapidly expanding in size, 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 over a period of 4.6 Gyr.

2.3 Life span of a galaxy in a steady state universe

We have been observing the behavior of stars for hundreds and even thousands of years, but only recently have we learned how to distinguish between different types of supernovae. We have finally discovered the existence of microwave background radiation and the apparent expansion of space. Looking outside of our galaxy, for example, we have observed how our neighboring galaxy, Andromeda, is slowly approaching ours under the influence of gravitational forces. However, from our present location within our galaxy, we did not observe any rapidly changing conditions between individual bodies in space or any other unexplainable behavior of celestial bodies. All of the observed movements of objects inside and outside our galaxy, representing changes in their positions, appear to be taking place in space very gradually and in a very controlled manner. This observable behavior of matter in space appears to be always slow and explainable by the laws of physics.

The estimated glowing life span of each star could be several Gyr depending on the type, but it typically would not exceed 15 Gyr. However, not every star ends its existence at the end of its glowing life. Some stars may continue their motion through space as dark bodies of matter for much longer periods of time, in some cases probably greatly exceeding their glowing lives. For example, a white dwarf, which is no longer capable of sustaining fusion, could possibly exist for billions of years before its final rendezvous with another glowing star, leading ultimately to its demise. In the presently observable steady state universe, any galaxy most likely would contain many of these dark star remnants, thus appreciably increasing the total number of stars in the galaxy. The presence of inactive dark matter and its longevity could easily extend the life of a galaxy, probably greatly exceeding the 15 Gyr time limit imposed by the theory of an expanding universe.

Our solar system is about 4.6 Gyr old. At the present time it occupies a position somewhere to one side near the center of our spiral galaxy's disk. It probably was much closer to the outside edge of our galaxy when our sun had first begun to glow. This is the area of a spiral galaxy where one would typically find large accumulations of small particles of dark matter suitable for the formation of new stars. These accumulations of dark matter are clearly visible when the orientation of the spiral galaxy is such that it could be viewed on edge. In 5 more Gyr our solar system would probably reach the end of its glowing life to begin a new chapter in its long life cycle as a white dwarf. At this time our star would have probably reached the galactic core. It is the destiny of a star of any type and in any state of its life cycle that it cannot escape. For all of these hypothetical events to have taken place within a galaxy as stated, it would appear that a galaxy had to have existed long before the beginning of the glowing life of any star and would have to continue its existence long after it ends.

The Andromeda galaxy presents a very good example of how the slow motion of celestial bodies impacts the lifespan of galaxies. Andromeda is a beautiful spiral galaxy, designated M31, composed of nearly one trillion stars assembled into one single celestial body over a period of time probably extending many Gyr. The proximity of this galaxy to our own galaxy and their mutual isolation in space makes them ideal candidates for the study of motion of isolated bodies in space.

The Andromeda galaxy is only about 2.5 million light years (Mlyr) away from our galaxy. Its present relative velocity is estimated to be 100 to 140 km/sec, so it will take approximately 2.5 Gyr for the two galaxies to approach and to finally merge into one giant elliptical galaxy (Wikipedia). The accuracy of this data is not very important for this discussion, however this does lead to a couple of intriguing questions. First, how much time did it take both galaxies to cover an additional distance of separation of 2.5 Mlyr before reaching their present positions in space? Keep in mind that the strength of the gravitational force between two isolated bodies in space falls off as the square of their distance and is proportional to the second derivative of distance with time. A mere doubling of the distance in space severely impacts the interval of time required for celestial motion. Clearly, it should have taken both galaxies more than just 2.5 Gyr to cover this additional distance of 2.5Mlyr. Then, how long ago did both galaxies pass the 10 Mlyr separation point in space? Again, this event had to have taken place more than just 7.5 Gyr ago – a substantial interval of time considering the fact that in this case both galaxies were already in motion towards each other.

The differential equation defining the motion of two isolated bodies in space, as stated above, could actually provide us with a more accurate estimate of time needed for the motion of galaxies in our example. It appears that in this case the time required for celestial motion is directly proportional to the 3/2 power of their distance of separation. Therefore, we can state that if it will take 2.5 Gyr for the two galaxies to merge from a distance of 2.5 Mlyr, then it will take them 7 Gyr to merge from a distance of 5 Mlyr. By the same token, it will take the two galaxies roughly 20 Gyr to merge from an initial separation in space of 10 Mlyr. This result indicates that the interval of time required for the galaxies to move from a separation of only 10 Mlyr to reach their present position of 2.5 Mlyr apart is greater than the total life span allowed by the theory of the expanding universe. These are very serious timing discrepancies, which need to be resolved.

A few more hypothetical questions also come to mind on the subject of celestial motion. These new questions deal with celestial motion events taking place in space where individual bodies are initially at rest with respect to each other. The resulting motions due to gravitational forces would be much more time consuming than in the previous cases of two isolated bodies already in motion. For example, how much time would it take Andromeda galaxy to reach our galaxy, just 2.5 Mlyr away, if the initial approach velocity between the galaxies were zero? Clearly, it would take them significantly longer to merge than the previously estimated value of 2.5 Gyr for the two galaxies already in motion at a present rate of about 100 to 140 km/sec. Even maintaining this velocity at a constant value, that is excluding the effect of the additional acceleration with time or distance, it would take only slightly longer than 2.5 Gyr for the two galaxies to merge. This observation implies that to reach their present approach velocity of 100 to 140 km/sec, the two galaxies had to have been moving and continuously accelerating towards each other for a very long period of time.

The previously used differential equation can be used again to obtain more accurate information on velocity. It states that the approach velocity between two isolated bodies in space is inversely proportional to the square root of their distance of separation. Thus, with the approach velocity of 100 to 140 km/sec at their present distance of 2.5 Mlyr, the velocity at the 10 Mlyr separation point in space had to have been about 50 to 70 km/sec. The approach velocity at a distance of 20 Mlyr had to have been about 35 to 50 km/sec and this event might have taken place an extremely long time ago.

Other more complicated and even more time restrictive expamples of celestial motion would be: How much time would it take Andromeda to reach our galaxy from 2.5 Mlyr away if both galaxies were surrounded by many other similar galaxies, with all of them nearly equidistant from each other and all of them initially at rest? And finally, the ultimate question, if it will take Andromeda 2.5 Gyr to approach our galaxy moving at a reasonably high and a constantly increasing velocity, how much time did it take our two major galaxies of our local group to accumulate hundreds of billions of stars or even smaller galaxies into two orderly and well-defined celestial bodies and to attain their present, relatively close, positions in an essentially empty and isolated area of space?

When one considers the significance of the element of time during Andromeda's final, but still gradual approach to our galaxy, it is very reasonable to conclude that hundreds of billions of stars in each galaxy had to have been assembled from very large areas of space greatly exceeding the 2.5 Mlyr in distance presently separating the two galaxies. The accumulation of stars into two individual galaxies had to have taken place independently and long before the galaxies began their final approach towards each other.

The point being made here is that it takes an inordinate amount of time to initiate motion and to produce changes in positions between celestial bodies, particularly if these bodies are located in an area of space populated with many other uniformly distributed bodies of matter that are subjected only to conventional gravitational forces. The relative size of objects would be immaterial as long as they are of similar mass, are initially at rest, and nearly equidistant from each other. In each case we are dealing with relatively slow moving bodies over such huge distances. The life span of any one individual star in the system is of no consequence in the ongoing process, but surely the life span of our two galaxies has to be greater than 13 to 15 Gyr.

For all of these reasons, it is very difficult to comprehend how stars, much less widely-separated distant galaxies at the fringes of our presently observabale universe, could have formed in the reported time span of less than 0.4 to 0.8 Gyr (Wilson 2004), shortly after the initial rapid expansion of space has presumably ended. From the observed behavior of matter in our universe, the formation of these few galaxies from an initially uniform distribution of matter in such a short interval of time would be very unlikely, which implies that the determination of the reported time span of 0.4 to 0.8 Gyr allotted for the formation of new galaxies may not have been accurate or the model of our 13 to 15 Gyr old expanding universe may not be correct. Further observations even deeper in space would be of utmost value to resolve this issue.

2.4 Signal frequency reduction process in space

We know that under certain controlled conditions EM fields can parametrically increase or decrease the velocity of charged particles, thereby allowing a bi-directional exchange of energy levels between the two interacting media. The process of frequency perturbation in EM waves with time or distance is not as obvious, but it does take place in signals as they are propagating through an imperfect vacuum of space containing a large number of widely separated charged particles. A continuous frequency perturbation ultimately leads to gradual frequency reduction, representing additional loss of energy in the propagating wave. Long periods of interaction time between the two media would be required to produce observable results.

There are no laws of physics stating conservation of frequency in space, 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 billions of years. The frequency of a radiated EM wave is not crystal-controlled, and when there is a change in frequency, 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 obstacle 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 (primarily 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 any 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 performing work, and it is expending a small amount of its 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 delay or retardation in the signal's wavefront at the point of discontinuity. The small delay in propagation time of the wavefront near the singularity point will ultimately cause local frequency retardation.

At first, the bulk of the energy in the signal’s wavefront around the collision point is transmitted without being affected. But after transitioning the singularity point, the phase of the wavefront with an initially small local distortion near the collision point will begin to expand in an attempt to re-adjust itself to one common value, thereby ultimately decreasing the original frequency of the whole wavefront by a minute amount. Any changes in each individual wavefront are independent of the essentially identical changes taking place in the preceding and following wavefronts of the same signal. These changes in individual wave fronts occur independent of the frequency periodicity between the wave fronts, which continuously readjust themselves to the reduced frequency of the signal’s wavefronts, producing infinitesimally small frequency reductions throughout the whole propagating signal. These frequency reductions are merely a result of minute but continuously occurring perturbations in the wavefronts experienced by the essentially uniform EM waves of the signal propagating through the imperfect vacuum of space. Long periods of time would be required to observe these changes in the signal.

As Filippenko (1998) pointed out, “photons easily scatter off of free electrons.” The collision of the signal with each charged particle is a complex process involving higher-order space harmonics of the fundamental frequency of the signal to satisfy boundary conditions at the area of discontinuity caused by the point-charge singularity. The charged particle has a catalytic effect on the energy transfer from the propagating to the 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. This is a microscopic view of the interaction process between an EM wave and a single point-charge in space. 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 (Goldston et Rutherford 1995). In this particular case, the wavefront, colliding with a uniformly distributed space charge field, remains essentially intact over the lateral surface of the wavefront causing an uniform reflection of the signal with time. In our case of widely separated charges, granular distribution of particles causes a significant lateral non-uniformity in the wave front at the point of collision. One single isolated distortion created in the wavefront, when added to many other similar distortions in the shape of the wave front at other locations with time, ultimately leads to frequency reduction in the signal with time or distance.

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 ultimately 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 infinitesimally small frequency and amplitude changes will attempt to re-establish itself without distortion, like a body of water returning to its placid state. The uniformity of the wavefront is a requirement of EM theory, for a uniform propagation of a signal in space without any obstruction in its path. But with time each wavefront will continue to collide with other particles in its path as this process continues. Except for these periodic, minute energy reductions in the wavefront, there would be no loss of information carried by each individual signal.

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 would 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.

An alternate view of the collision process could be stated as follows: We know that a propagating signal can behave like a wave, but it can also exhibit particle-like behavior (duality principle). The quantum interpretation of light states “If you don’t detect it, light behaves like a wave and exhibits interference effects.” … “light behaves as a particle, delivering its energy in discrete particle-like bundles” … “waves and particles are related, but only statistically” (Wolfson 1998). A collision of an electron with a signal cannot always be classified as an interference and we would expect some particle-like transfer of energy to take place during each collision.

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). One would typically expect that during each individual collision of a signal with a charged particle, particularly at higher levels of frequency and signal intensity, a few photons would be ejected from the wave and scattered, ultimately causing a reduction in the signal’s amplitude. But, as a result of the collision, a small number of photons from the collision area would continue their motion through space as parts of the original wavefront with slightly reduced frequency components. Subsequent collisions of this particular wavefront with other charged particles at other locations with time would increase the number of photons with slightly reduced frequency components in the wavefront. These few photons will merge later with the signal’s wavefront, ultimately causing a slight frequency reduction in the wavefront, as previously stated. In the case of weak signals (which are of interest to us), the removal of energy from the wave is also in minute, measured, frequency-dependent increments per each half cycle of the wave. The increments of energy removed from the wave would probably be confined to wave and particle interaction, which would require very long periods of time to produce observable results. This parametric process of frequency decay with distance is sometimes referred to as “tired light.” Observations of distant signals typically occur at very low signal levels. For example, the HUDF photograph was obtained by recording signals from distant objects at a rate of one photon per minute by the Hubble telescope (Wilson 2004).

2.5 Distance to a glowing object in space

We have stated that in our universe, which is 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 amplitude attenuation due to scattering 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 and attenuation in the propagating signal.

Thus, when there is a change in any signal’s frequency taking place 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:

$$f / f_o = e \wedge (-d / D) = \lambda_o / \lambda = 1 / (z + 1), \qquad (1)$$

where f / f_o 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 (λ_o / λ). 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. At small values of z, D is given by the ratio of the distance to a glowing object to its redshift. Thus, the numeric value of D could be obrained from any reliable redshift and position information of any glowing object in space, which is located somewhat close to Earth.

A collection of data showing variation of redshift with distance for an expanding universe with the Hubble constant value of 70 km/s/Mpc 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 about 13.96 Glyr. In terms of redshift (z), the distance to any glowing object, for all values of redshift, is then given by:

$$d = 13.96 \ln(z + 1) = 13.96 \ln(\lambda / \lambda_o) \quad \text{in Glyr.} \qquad (2)$$

Equation 1 shows that during each interval of 32.144 Glyr the wavelength of ANY propagating EM wave in our universe increases by one 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. A signal with an initial wavelength of 0.000053 cm would first increase its wavelength to 0.00053 cm after travelling 32.144 Glyr. The wavelength would then increase to 0.0053 cm and after a "mere" 128.6 Glyr (Eq. 2) the wavelength of the original signal in 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 produced by an expansion of matter or space.

The distance to any glowing object in space of our steady state universe, given by Equation 2, is valid for all values of z. Unlike relativistic velocity constraints in an expanding universe, the steady state model of the universe has no restriction on distance. As previously stated, Equation 2 shows that at small values of z, the distance to a glowing object in space is directly proportional to its redshift, with 13.96 Glyr being the proportionality constant. At small values of redshift, this constant should be equivalent to the product of the velocity of light and the Hubble time constant in an expanding universe (Filippenko 1998). An attempt to check the value for the Hubble constant, based on "observational data" used to determine our constant "D" resulted in an essentially identical value for the constant. This finding implies that even at very small values of redshift, the Hubble constant was probably used by Powell (2002) to obtain distance information. Therefore the value of our constant "D" could have been obtained directly from the Hubble time constant.

The recession velocity of a glowing object in space, in an expanding universe, is proportional to its distance and redshift (constant expansion), but only for smaller values of redshift (Filippenko 1998). At larger values of redshift, the velocity of the object is related to its redshift by the relativistic formula (Silk 1989). The distance to the object is then equal to the product of its recession velocity and the Hubble time constant (Filippenko 1998).

Radial separation between objects in space in a steady state universe can easily be obtained from Equation 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 Mlyr.

2.6 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 billions of times larger than the diameter of the point charge. 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 any propagating signal is defined by its amplitude, which is directly proportional to the signal’s electric field of any frequency, anywhere in space. With 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 containing plasma, as well as the signal’s amplitude itself, would have to have an exponential dependence with time or distance. Indeed, both of these amplitude variables must vary proportionately with frequency (Eq. 1). These are all products of the same signal scattering process taking place in the imperfect vacuum of space.

Since the amplitude of the signal varys proportionally with its frequency, the square of the signal's amplitude, defined here as the signal's "amplitude intensity" (AI), must also vary proportionally with 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, scattering of the signal causes the AI of the propagating wave to decrease by two orders of magnitude. For signals far away from their source of origin (with decreasing effect of spherical expansion), 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) of 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, also caused by scattering of the signal, 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

We have shown that attenuation decreases the amplitude intensity of a signal (AI) from any glowing object in space as the square of its frequency. That is, the signal intensity from any galaxy or a type Ia supernova (SN Ia) or any other glowing object in a steady state universe decreases proportionately as the square of (z + 1). This reduction in the signal intensity is independent of and in addition to the reduction in magnitude of the signal produced by spherical expansion.

Application of this concept to observational data leads to interesting results. For example, a few SNe Ia were observed at a redshift of 0.4. Equation 2 places them about 4.7 Glyr from Earth. When we consider only the effect of amplitude attenuation, which provides us with the largest error correction, then the observed “relative intensity of light” for these SNe Ia should be about one half of their expected value. This adjustment in the maximum magnitude of the observed SNe Ia appears to agree with published observational data (Hogan et al. 2002). This argument could explain why “High-Z type 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 have been used as standard candles since the early 1980's. They all have the same intrinsic brightness (Perlmutter 2003). Observational data reported by Perlmutter et al. (1998) show individual deviations in the effective or the observed magnitude of the High-Z SNe Ia in logarithmic values of magnitude from the "ideal magnitude" (IM), which we can define here as:

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

Figure 1 shows a plot of IM versus logarithmic values of redshift and the corresponding distance in a steady state universe (Eq. 2). Variation of IM with redshift appears to be a fairly good approximation for the effective magnitude curve for SNe Ia when $\Omega_M = 1.5$ and $\Omega_\Lambda = -0.5$ in an expanding, flat universe (Perlmutter, et al. 1998). At smaller values of redshift, the IM curve represents attenuation of SNe Ia due to spherical expansion with z.

Since we know that a signal's amplitude intensity (AI) varies in a steady state universe as the inverse square of (z + 1), reductions in AI from any glowing object 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 only is given by:

$$MCAI = 5 \log(z+1) = 5 \log(\lambda / \lambda_o) \, . \qquad (4)$$

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

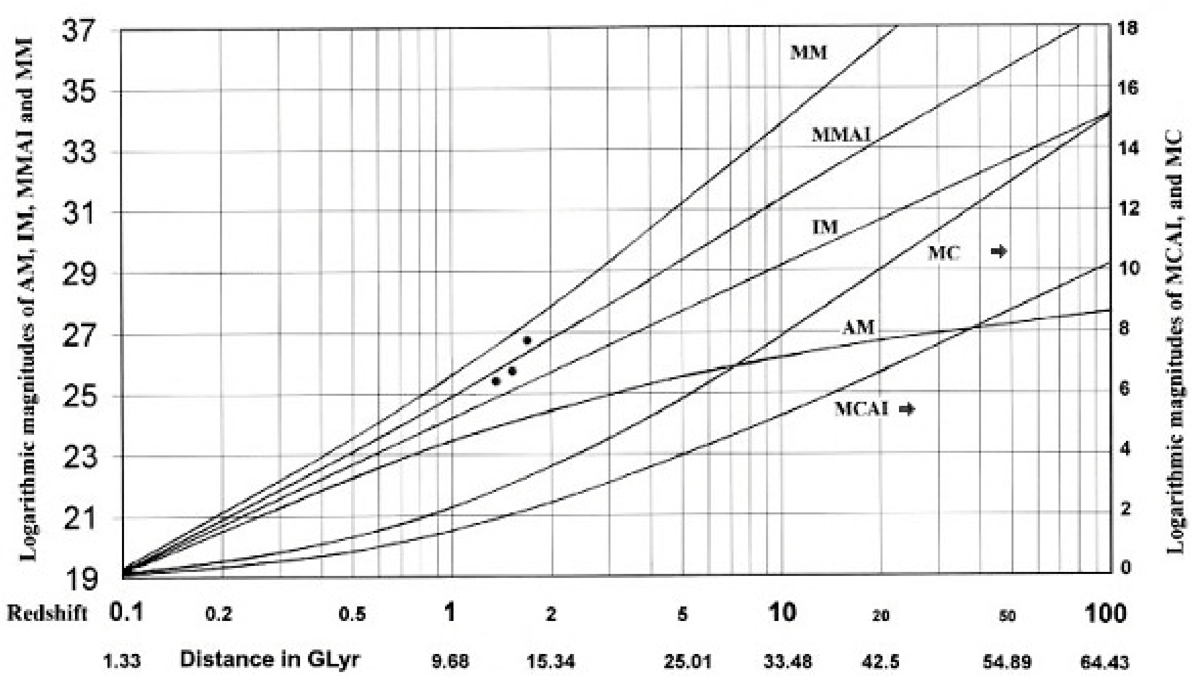

Figure 1 Logarithmic magnitudes of type Ia Supernovae vs. redshift and distance in a steady state universe. In this case, distance values were based on the Hubble constant of 70 km/s/Mpc.

(due only to amplitude attenuation) 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. Figure 1 shows a plot of MCAI as a function of redshift and distance, given by Equation 2.

To obtain variation in the overall magnitude of SNe Ia in a steady state universe with redshift, we have to combine individual variations of magnitudes due to amplitude attenuation of signals and spherical expansion. To obtain variation in the 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 (Eq. 2). At this redshift, the logarithmic magnitude of the SN Ia has a value of 14.2, (Eq. 3), which would be about the same for both models of our universe. The variation in AM due to spherical expansion of signals in a steady state universe anywhere in space, could now be obtained from the square of the ratio of the two distances. One of these distances would 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:

$$AM = 24.2 + 5 \log [1n (z + 1)] = 18.48 + 5 \log (d) . \qquad (5)$$

That is, to obtain the expression for the logarithmic magnitude AM, we could have simply stated at the beginning that AM must vary in space as the product of five times the log of d and it must have the value of 14.2 at d = 0.139 Glyr.

Although both AM and IM curves in Figure 1 represent variations in the logarithmic magnitude of SNe Ia due only to spherical expansion of signals with redshift, 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). Figure 1 shows that at smaller redshifts both curves follow each other rather closely and both agree with observational data. However, at redshifts of about 0.2, the consistently smaller amplitude of the AM curve begins to separate from the IM curve, with this separation becoming more pronounced at redshifts greater than one. The smaller value of the AM curve denotes that in a steady state universe, the maximum magnitude of SNe Ia due to spherical expansion (for a given value of redshift) is always greater than its equivalent in an expanding universe. This is an important fact of the Steady State theory based on space containing plasma. In this instance, the luminosity of the SN Ia must be greater to begin with, because scattering will further reduce the magnitude of the signal on its way to Earth, where the residual magnitude will then be observed as the maximum magnitude of the supernova.

At very large values of redshift (which are of special interest to us), 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 attenuation always increases by 1.505 magnitudes with each two-fold increase in distance. That is, radiation intensity due to spherical expansion varies as the inverse square of the distance. It must, by definition. Had we plotted logarithmic magnitudes of AM in Figure 1 versus logarithmic values of distance in a steady state universe, we would have obtained a curve identical to IM in Figure 1. In a steady state universe, the redshift increases exponentially with distance, with no limitations for either variable.

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

$$MMAI = 24.2 + 5 \log [(z + 1) \ln (z + 1)] = 18.48 + 5 \log [(\lambda / \lambda_0) d], \qquad (6)$$

providing us with the actual maximum magnitude of SNe Ia at small values of z. The value of MMAI in Equation 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 Equation 6. The MMAI curve was obtained simply by the addition of individual logarithmic 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, (Fig. 1). 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 one given by IM. Calculated values of MMAI, agree very well with observational data obtained by Perlmutter et al. (1998) at redshifts of 0.4, 0.5, 0.6 and 0.83 in an expanding universe. The MMAI curve provides a comparison between theoretical and observational data obtained on SNe Ia at different values of redshift. These experimental maximum magnitudes of SNe Ia are not shown in Figure 1. However, the MMAI curve appears to be one and the same as the Perlmutter et al. (1998) curve for $\Omega_M = 0.5$ and $\Omega_\Lambda = 0.5$ for a flat universe.

We stated earlier that uniform low-density plasma exists in the extremely cold intergalactic space and that any signal propagating in such a homogeneous and isotropic plasma field will attenuate exponentially with time or distance. This statement applies to our universe regardless of which of the two models we choose to represent it. Note that the attenuation of signals, no matter how infinitesimal it might appear, is appreciable considering the fact that interaction between signals and space charge is taking place over billions of years. Thus, we can state that signal attenuation would also have to take place in space of an expanding universe model and the evidence of this attenuation of signals with redshift or distance should again be presently detectable on distant SNe Ia.

In fact, had we begun our investigation by stating that the amplitude of any signal in space and its amplitude intensity (AI) were exponentially decreasing with redshift or distance (regardless of which model of universe we consider) then the combination of the amplitude intensity and the attenuation due to spherical expansion of the signal would have resulted in a curve similar to MMAI (Eq. 4), as we have shown to be the case for a steady state universe. The experimental data obtained by Perlmutter, et al. (1998) would have then provided the necessary rate of attenuation adjustment. Therefore, nearly identical results could be obtained for an expanding universe since variations in distances to objects in space are essentially the same for the two models of our universe at lower values of redshift. It appears that even in an expanding universe, some dimming of distant supernovae would be due to signal and space charge interaction and would not be caused by the presence of dark energy in space.

3.2 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 intensity caused by the amplitude attenuation of the wave. At higher values of redshift, however, the energy loss in the transmitted wave due to frequency reduction from its original value is substantial and must be taken into account. It is a similar issue as the K-correction used for maximum magnitude adjustment when observing distant SNe Ia in an expanding universe (Perlmutter 2003).

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 also be reduced proportionately with frequency and must have the same exponential relationship as its amplitude and its frequency. That is, 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 spherical expansion, 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 frequency 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 due to scattering, 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 **Figure 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 over and above the reduction in radiation intensity due to spherical expansion. At long wavelengths, with decreasing effectiveness of AM on radiation intensity (Fig. 1), 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 that 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, which are caused by continuous scattering of a small portion of the propagating wave in an IMPERFECT vacuum of space, are intimately connected. They are interdependent.

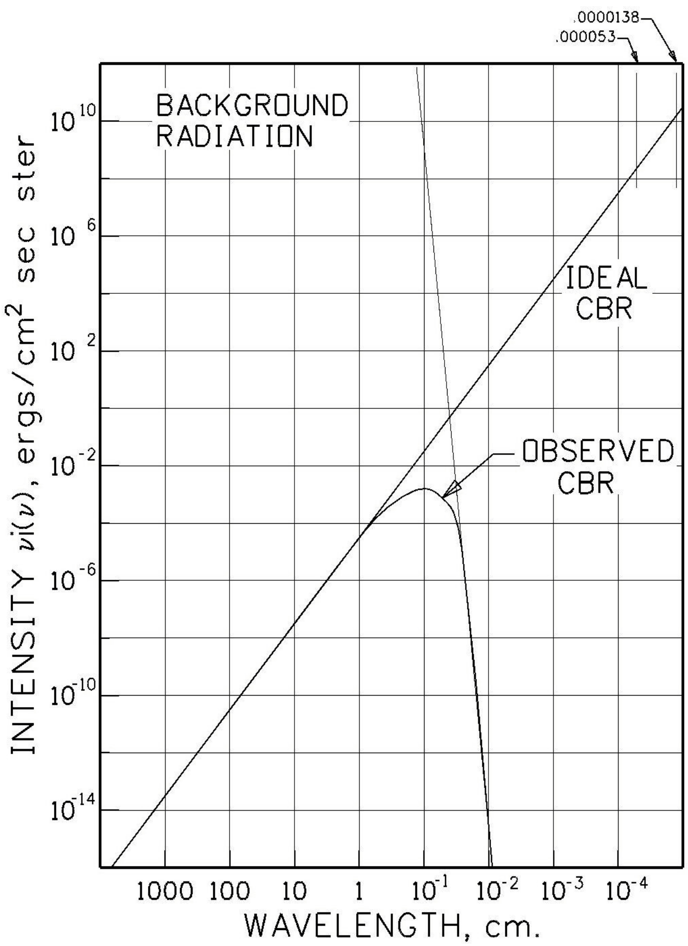

Figure 2 Ideal and the observed CBR curves. The observed CBR curve shown here is based on the CBR curve by P.J.E. Peebles (1993).

Individual values of RI from signals of the same original frequency, when observed at any one given frequency, may have originated in different areas of our universe that are equidistant from Earth. By the same token, the lower the observed signal’s frequency, the farther in space would be its source of origin if both signals were of the same original frequency. In general, the bulk of the radiation energy received on Earth is from various glowing bodies in space that emit energy near the visible frequency spectrum. The distance to their location would be given by Equation 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 in our view but originating farther in space, and 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 RIs 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 Figure 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 Olbers' Paradox. 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.

3.3 Effect of frequency reduction on the maximum magnitude of Ia supernovae
We derived several magnitudes for SNe Ia defining their behavior in space based only on the variation of the amplitude intensity (AI) due to amplitude attenuation 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 at higher values of redshift becomes significant 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 only 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). Its logarithmic value is given by the product of five times the log of the square root of (z + 1). For example, a SN Ia with a redshift of 1.5 will incur an additional loss in its magnitude equal to 0.995 due to the signal's frequency reduction from its original value. This redshift related frequency reduction issue is similar to the K-correction used for the adjustment of maximum magnitudes of SNe Ia in an expanding universe (Perlmutter 2003).

If we introduce this additional energy loss in the signal intensity due to frequency reduction into our equations, the logarithmic magnitude correction MCAI in Equation 4 becomes:

$$MC = 7.5 \log (z + 1) = 7.5 \log (\lambda / \lambda_o) . \qquad (7)$$

In Equation 7, MC takes into account all RI losses caused by scattering of a small amount of energy in propagating signals; that is, losses due to amplitude attenuation of the signal and losses due to the signal's frequency reduction with time or distance in a steady state universe. Equation 7 is valid for all values of redshift. At larger values of redshift, MC is attenuating as the inverse cube of its redshift, or a 7.5 reduction in magnitude for each order of magnitude change in redshift or wavelength.

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

$$MM = 24.2 + 5 \log \{[(z + 1) ^{1.5}] \ln (z + 1)\} = 18.48 + 5 \log \{[(\lambda / \lambda_o) ^{1.5}] \; d \}. \qquad (8)$$

The MM in Figure 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 controlled primarily by amplitude attenuation and frequency reduction of signals as embodied in the MC curve (Eq. 7). Spherical expansion plays only a minor role.

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 MM in Figure 1. This would give us the greatest 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 MMAI in Figure 1. These two curves in Figure 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. The MM curve in Figure 1 appears to be an extension of the curve reported by Perlmutter et al. (1998) for $\Omega_M = 0$ and $\Omega_\Lambda = 1$ (dark energy equal to one) in a flat, expanding universe. Note that in an imperfect vacuum of space with low density plasma (and no dust) the MM curve represents the absolute maximum attenuation a SN Ia can have for a given value of redshift. In theory, this value cannot be exceeded.

In our discussion we have assumed the Hubble constant to have a vlue of 70 km/s/Mpc (Powell 2002). A smaller value of the Hubble constant, for example, of 65 km/s/Mpc as suggested by Filippenko (1998) would not affect the graphical results shown in Figures 1 and 2, because all the derived magnitude variables are functions of the redshift only. The actual magnitude of the Hubble constant appears only in the definition of distance in Equation 2. A smaller Hubble constant affects only the physical distribution of matter in space, resulting in a universe, which is more conpact. The relative distances to objects in space are directly proportional to the Hubble time constant.

3.4 Comparison of theory with observed results obtained on type Ia supernovae

Calculated values of MMAI (Eq. 6) and MM (Eq. 8) at redshifts of 0.4, 0.5, 0.6 and 0.83 are in agreement with observational data reported by Perlmutter et al. (1998). In fact, the location of the bulk of SNe Ia reported by the Supernova Cosmology Project (Perlmutter, et al. 1998) appears to be centered along the MMAI curve, with a few High-Z SNe Ia approaching the MM curve. These results appear to explain the "unusual" behavior of signals from high redshifted glowing objects in space, claimed to be due to an accelerated rate of expansion of matter without the help of dark energy, which is said to "pervade all of the empty space" of our universe.

The agreement between theory and experimental results extends to other SNe Ia with higher values of redshift. Recently new data on distant SNe Ia was reported by Riess, et al. (2006). These data were obtained with the Hubble telescope. The results provide many detailed measurements made on SNe Ia at redshifts extending all the way to z = 1.551 (SN2003ak). Revealing photographs of five of these SNe Ia and of their host galaxies were shown on the internet (Hupp/Brown et al. 2006). Over 12 SNe Ia had redshifts greater than 1.2. The maximum magnitude of SN2003ak was 25.8, or only 1.13% under the value given by MMAI. SN2002fx, with a redshift of 1.40, had a maximum magnitude of 25.5 or 1.22% lower than the value of MMAI at this redshift. These maximum magnitude values were taken from Asiago SN Catalogue (2005), but are obtainable from published data by Riess, et al. (2006). The locations of these two new SNe Ia are shown in Figure 1, appearing to be located along the MMAI curve. Data obtained by Riess, et al. (2006) appears to be an expansion of Perlmutter et al. (1998) data to higher values of redshift.

The most distant supernova observed thus far (SN 1997ff) exploded 10 Gyr ago, 10 Glyr away from Earth (Riess et al. 2001). It had a redshift of about 1.7, recently reported to be 1.755 (Riess et al. 2006). In a steady state universe, a redshift of 1.755 would place SN 1997ff at a distance of 14.15 Glyr (Eq. 2), indicating that this event actually took place 14.15 Gyr ago. The reported maximum magnitude for SN 1997ff was 26.77 (Barbon, et al. 1999). The calculated maximum magnitude for this SN Ia should be 24.23 (Eq. 5), as a result of spherical expansion only. The correction in the maximum magnitude of the SN due only to amplitude attenuation should be 2.20 (Eq. 4), resulting in the total magnitude value of 26.43 (Eq. 6). This calculated value of MMAI for this SN Ia is 1.01 percent under its observed magnitude of 26.77 (Bian, et al. 2005), after correction of its magnitude value for frequency reduction. Figure 1 shows that the location of the three maximum magnitudes of the most distant SNe Ia observed thus far happened to lie very close to their corresponding theoretical values as predicted by the MMAI curve. By applying relatively simple math to a logical concept, we obtained results, which are in an amazingly good agreement with observational data on distant SNe Ia.

Finally, 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 life span as a white dwarf is unknown, but it might have been many additional Gyr. Thus, by observing the SN 1997ff explosion, which occurred 10 Gyr ago, we have witnessed a spectacular death of a star that probably first began to glow some 20+ Gyr ago. Many more distant SNe Ia were observed at distances extending to 10 Glyr (Riess et al. 2006). Discovery of a few SNe Ia at the fringes of our presently observable universe, some 13 Glyr in space, would truly challenge the validity of the time limit imposed on the age of our universe by the theory of expansion of space. It would be ideal to observe some distant SNe Ia at redshift values approaching 12 (Wilson 2004) not just to prove their existence, but also to measure their maximum magnitude.

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 (Eq. 5) is equal to the MC (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 observed 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 when observed on Earth. This crossover point appears to occur slightly to the left, but near the very top of the observed cosmic background radiation (CBR) curve in Figure 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 CBR curve in Figure 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 wavelength of the bulk of radiation at the crossover point received on Earth would have to approach the 0.1 cm peak wavelength of the observed CBR frequency spectrum in Figure 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 Figure 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 (Eq. 2). 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 Figure 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 CBR curve, as observed on Earth, at a wavelength of 0.38 cm. At distances greater than 124 Glyr, this radiation will continue its never-ending journey through space as a fully formed wavefront, attenuating as a cube of its continuously decreasing frequency, now caused primarily by scattering of the signal. 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 before 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 eventually following the left side of the observed CBR curve in Figure 2. Its observed 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 Figure 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 longer wavelengths.

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. In this area of space, essentially all signals from individual radiation sources (but of the same frequency) are finally beginning to propagate through space as unified wave fronts. 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 than those from our Sun. 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 point in space. It determines the shape of the observed CBR curve in Figure 2 at the wavelength of 0.1 cm.

The observed CBR spectrum in Figure 2 is a composite of all RIs 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. 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. Its behavior is governed by the AM curve (Eq. 5). It is caused by the inability of spherically expanding signals from these sources to form coherent isotropic radiation fronts in a relatively short period of time. This behavior of signals determines the shape of the cosmic background radiation curve in Figure 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 produces radiation, which attenuates in space as the inverse cube of its wavelength and is controlled by MC (Eq. 7). In reference to Earth, the dividing line between these 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, scattering of signals reduces the observed magnitude of SNe Ia 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 would be 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, a 6.02 magnitude reduction in brightness would be 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. 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 observed brightness of this SN Ia would be 3.71 magnitudes lower, or only 3.3 percent of its value, given by IM. By correcting for 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 its value given by IM.

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 some galaxies stated to range in redshift from 7 to 12, and reported to be 0.8 to 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. They had a similar distribution pattern. 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 photographs, including those made by HDF.

Subsequent HUDF data released in September 2004 show that as we manage to look deeper into space, we find nothing very unusual but more of the smaller galaxies exhibiting very high redshift values. These photographs show a few tiny, compact red dots, widely separated in space. Approximately 100 of these somewhat distorted distant galaxies were observed in deeper space. Each distant galaxy was circled for ease of identification (Windhorst & Yan 2004). Some of these galaxies date back to approximately 0.4 to 0.8 Gyr, or nearly the beginning of time. It is reasonable to expect that we would find even more distant High-Z 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 2197 (8.35 magnitudes) due to signal and space charge interaction over and above its value from spherical expansion. It would be a 5.0 magnitude reduction in intensity (99%) from the one given by IM in Equation 3. This would make them appear significantly fainter than expected. Their actual size would be three times larger than what would be apparent in an expanding universe model at this value of redshift because of their greater distance.

As one considers the observation that galaxies in the expanding universe appear reduced in size the greater their distance from Earth, one can make this additional observation: If we were able to determine the value of redshift differential from the opposite sides of a distant galaxy when it is viewed on edge, one should be able to determine its rate of rotation. In an expanding universe, a reduction of the size of a distant galaxy beyond what would have been normally expected, would make the galaxy appear to rotate at a faster pace. Recent observations of distant galaxies made by van Dokkum et al. (2008) appear to confirm this observation. In a steady state universe, the galaxy would be actually farther away and larger than we think, and therefore it would be rotating at a lower speed.

The depicted area of distant space as shown in the HUDF photograph is equivalent to an area of space as seen through an eight-foot-long soda straw (Wilson 2004). Actually, it is a very tiny view of space 12.7 Glyr away as if seen through a stirrer-straw with the size of the HUDF field shown in the photograph being 3.6 Mlyr on the side (Windhurst 2008). At a redshift value of 12 in the steady state model of the universe, the HUDF photograph would measure 10.2 Mlyr across, 35.81 Glyr away.

Based on this information, the HUDF volume of space in a steady state universe is about 22 times larger than its equivalent of the expanding universe. Its average galactic density calculates to be about one galaxy per each 124 cubic Mlyr up to a distance of 35.81 Glyr in space. This value of galactic density is about equal to the one estimated by Powell (2002) for a two Glyr deep universe, with the dwarf galaxies included. The HUDF data indicates that we are probably surrounded by some 1.6 x 10 ^ 12 galaxies to a distance of 35.81 Glyr, encompassing a spherical space of about 72 Glyr in diameter. It appears that no matter where we look, we find more galaxies with a reasonably constant, large-scale galactic density, confirming that on the large scale the steady state universe is homogeneous and isotropic.

Finding just a few widely separated galaxies formed so very early from the beginning of time, or shortly after the very rapid expansion of space has presumably ended and with the universe still expanding, raises some interesting questions. We tried to demonstrate in our Andromeda example that it would take an appreciable amount of time to form stars and even more so for galaxies, in that sequential order. It takes time to form stars initially, and only then can they be assembled into galaxies, but in each case from an initially homogeneous and isotropic distribution of matter. If so, how could galaxies form at the fringes of our presently observable universe by the time the universe was only 0.4 to 0.8 Gyr old? However, the more troublesome questions arising from these observations are why only a few galaxies, separated laterally by such large distances from each other, were formed in this same period of time in such a vast space?

Actually, the separation between galaxies in deep space, where some of these 100 galaxies were located, is even greater than it appears, because the photograph of the deep space by Windhorst & Yan (2004) shows only a very small view of a three-dimensional space projected onto a two-dimensional plane. That is, in the HUDF photograph, the tiny viewing diameter of the Hubble telescope capured only a few widely separated galaxies of the deep space, inlcuding some 100 very distant galaxies. Their images were then projected onto a small area as shown in the photograph. In most cases, even the galaxies which appear to be next to each other as if they were in the process of merging, would be merely in the same line of sight but yet with a significant depth of separation between them. For this reason the separation between galaxies would have to be greater when the redshift differential between the galaxies is taken into account.

Most likely the redshifts of 100 individual galaxies in very deep space are not identical, but in the deep field of a steady state universe, even a minor difference in redshift between two galaxies that appear to be very close to each other in the photograph would produce a significant separation in depth between them. For example, a one tenth of one percent differential in redshift between two galaxies at a redshift value of 12 would correspond to a separation of about 12 Mlyr of depth. A one-half percent difference would correspond to a distance in space of 60 Mlyr. A 7 to 12 range of redshift would encompass a depth of space of about 6.8 Glyr. The bulk of the 10,000 galaxies in the HUDF field are probably located in this large area of space.

In an expanding universe it would have been more reasonable had we found many more than just 100 of the smaller galaxies in the deepest portion of the HUDF space formed very early from an initially homogeneous and isotropic plasma field. So then what happened to all of this homogenous and isotropic matter that was originally located in this huge area of space where these few galaxies were observed? Did all this matter merge in less than 0.4 to 0.8 Gyr into the few very widely separated galaxies visible today, or were there other galaxies too small to be observed with present-day equipment located in this area of space? If so, why the difference in the size of these galaxies supposedly formed from a uniform distribution of matter that was initally very small and basically invisible?

Clearly, the observed distribution of matter in space of a 0.4 to 0.8 Gyr old universe which has just gone through an incomprehensible period of inflation, soon after "the matter and radiation decoupled from each other" when the early universe was just 0.3 Myr old (Filippenko 1998), and shortly before, during or after the "reionization epoch" of the universe said to have ended 0.5 to one Gyr after the big bang (Villard et al. 2004) is contratry to what one would have expected to find at this moment in the early life of an expanding universe. But what lies beyond those few distant galaxies in space, which this picture of the young 0.4 to 0.8 Gyr universe was able to convey, becomes the crucial question. We will need to wait for future photographs of even deeper space to resolve this issue. However, it is beginning to look more and more as if we are a part of a very large galactic universe.

Conventional observations of deep space have shown that at very high redshifts, the unexpectedly rapid decay of galactic intensity with distance must be due only to amplitude attenuation and frequency reduction of signals, and also because these galaxies are actually farther away than prevoiusly thought. The galaxies in the far field of space soon become essentially unobservable by optical means. 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, of the number of galaxies that should have appeared in our view at these larger distances, the majority 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. But there are many more galaxies in deeper space as enhanced observational techniques using the Hubble telescope to obtain the HUDF photograph have demonstrated (Wilson 2004). Finally it is interesting to point out that in the current HUDF photograph of space, as captured by the Hubble telescope's camera, all pictures of different galaxies were taken as they appeared during the observation moment of each individual galaxy, but all of these images were recorded at different times extending over a time span of many Gyr.

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 located in the near field of 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 any signal's frequency was reduced exponentially with distance due to interaction of the signal with space charge, thereby reducing its amplitude intensity (AI) by continuously 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 in our view increases as a square of the distance from Earth. However, the total luminosity per unit volume of space at any distance remains 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 under observation, is also independent of distance and remains constant. This conclusion leads to 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.

To create a state of uniform radiation density in space, 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. For the time being, 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 energy 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 anywhere in space would then be uniquely defined by MC (Eq. 7) as a function of redshift.

Now, with scattering of signals solely responsible for signal attenuation in our homogeneous and isotropic space, we can analyze variation in RI from a continuous body of glowing matter in our universe. Since Equation 7 for MC is logarithmic with redshift, and wavelength, our "ideal" cosmic background radiation curve would then appear as a straight line in Figure 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 exactly in Figure 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), then the slope of our "ideal" derived radiation curve would have to be identical to the left side of the observed CBR curve at longer wavelengths, indicating an agreement between theory and experimental data. 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 (or wavelengths) 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 3×10^8 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) however, 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. But 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 and 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. See also the amazing full image of HUDF (2004). In this case, at a redshift of about 12, we would be looking at an area in space some 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 (NASA 2004). 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 per unit radius would increase, although they would be invisible from Earth. 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 (Eq. 2), 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 a limited amount of 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 at least 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 (for the same value of space charge density) 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), the observed RI from galaxies in the deeper universe would increase rapidly with distance. The variation of RI with wavelength appears to have a slope with a 24 order of magnitude change in value 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 radiation intensity 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 Figure 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 (first detectable at a wavelength of 0.01cm), reaching a maximum and then attenuating as a cube of its frequency. 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 (RIs) 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 have an identical shape as the observed CBR curve in Figure 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 essentially a plain propagating wave.

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 very large number of stars of different surface temperatures located in that area of space 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 long 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 from any one area of space (as measured on Earth at any one particular wavelength) would include a component of energy of any one particular wavelength originating in one particular area of space, given by Equation 2. That is, the observed radiation at any wavelength would always consist of a huge number of individual energy components of signals with originally-different frequencies from many adjoining areas of space in their vicinity, all of them frequency-reduced, 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 frequencies (as measured later on Earth at any one time at one single wavelength) would have originated in space at different times, often many Gyr from each other in time, similar to the time composite photograph of HUDF (Wilson 2004). The higher the value of the signal's original frequency, the farther in space would be its source of origin.

Radiation energy emitted at or near the wavelength of 0.0000138 cm (about 92 Glyr away) would 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 particular radiation intensity group 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 widely-separated 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 total radiation energy in signals with a wavelength of 0.000053 cm 73 Glyr away in space would be observable on Earth as coherent radiation 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 be detectable at first. The total amount of radiation energy with the wavelength of 0.000053cm, 73 Glyr away, would approximately be represented by the ideal CBR curve in Figure 2.

If we were to look into the energy content of background radiation on Earth at a slightly longer wavelength of 0.02 cm, we would find that these signals would have originated in a slightly deeper space. The distance to their original energy sources would again be given by Equation 2. We would also find that the amplitude of the observed radiation intensity at a slightly longer wavelength would be slightly larger than the value previously recorded at the wavelength of 0.01 cm, because a similar amount of radiation energy which originated in the same range of wavelengths of 0.000053 to 0.0000138 cm in deeper space would have traveled a longer period of time (83 and 102 Gyr, respectively) and would be able to produce a larger unified wavefront of observable coherent radiation 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 this observed background radiation from this group of signals 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 Figure 2, because radiation would now be originating approximately 113 to 132 Glyr in space. In this fashion, radiation originating at greater distances than 73 to 92 Glyr (depending on the wavelength) would behave increasingly like radiation from deeper space and would gradually produce more recombining of individual wavefronts, observable on Earth at longer wavelengths, slowly encompassing more and more of the total radiated energy of the same common frequencies in our view.

This background radiation, although originating farther away, would be observable on Earth (or anywhere else in space in any direction) with an ever-increasing magnitude with increasing wavelength, as it slowly approaches its limiting value, imposed by the "ideal" CBR curve. At this point in space, the effectiveness of the signal scattering process takes over control of radiation originally destined to be observed on Earth, from the continuously decreasing effectiveness of spherical expansion. For this reason, the background radiation must level off at this point before reaching its peak at some maximum allowed value. In this case it will happen somewhere near the observed wavelength of 0.1 cm (Fig. 2). On the basis of this discussion, the shape of the slope of our theoretically derived background radiation curve from the near field of space would have to look exactly the same as the right hand side of the observed CBR curve in Figure 2 (at shorter wavelengths) indicating a general agreement between experimental data and theory. Shortly after reaching its maximum value, the observed background radiation emanating from areas of space greater than 124 Glyr away would behave as plain propagating waves and would continue to attenuate in space by following the "ideal" CBR curve in Figure 2.

In our discussion, we have estimated that the bulk of radiation energy in stars was produced primarily by signals near the visible 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 surface temperatures 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 might have been slightly 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 Figure 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 Figure 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 Figure 2. Since the bulk of the cosmic radiation intensity is near the microwave range of frequencies, the CBR curve 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 and attenuation 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 Figure 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, and we do. In a way, this process is similar to re-radiation of stored energy from a black body.

By looking at the observed CBR curve in Figure 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 Figure 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 emitting 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. Its ideal CBR curve would follow the one shown in Figure 2 with an identical slope, but at a higher level of intensity.

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" spectrum (Peebles 1993), but of a significantly higher intensity. However, the two are not the same. Without signal attenuation and frequency reduction in our universe, 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.

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 (Wolfson 1998). 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 each signal, and the length of the interaction cycle between them are all individually very 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 out of "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, on a large scale 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. The "enormous" size of the universe is beyond our comprehension.

The explanation of redshift in space by the concept of expansion of matter or space 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 perturbation[1] and amplitude attenuation concepts for propagating EM waves in a homogeneous and isotropic steady state universe filled with a large number of 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.

[1] *WordNet* of Princeton University defines perturbation (in physics) as: "a secondary influence on a system that causes it to deviate slightly."

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