The Case for a Gentler *Bang* of Cosmic Creation

Dietmar Rothe*

Abstract

Aspects of the Big Bang cosmology are discussed, and inconsistencies with certain observational evidence and with established physics are pointed out. A new cosmological theory of a gradually evolving universe, populated by galaxies with electrically charged nuclei, is shown to be consistent with observational evidence, without invoking new, unproven laws and effects.

Introduction

In the second half of the twentieth century, scientific debates about the structure of the universe revolved around two opposing cosmological concepts: George Gamow's[1,2] Big Bang theory versus Fred Hoyle's[3] Steady State theory. Neither theory can adequately explain all observational facts. Whereas a Quasi-Steady State theory has great philosophical appeal, most observational data seemed to favor the Big Bang theory of creation. Interpretation of new observational data obtained via the orbiting Hubble space telescope, however, suggests that our universe may be older than 15 x 10^9 (15 billion) years, and that the expansion of the universe is accelerating[4], rather than decelerating. Both observations are incompatible with a *flat* universe evolving according to the Big Bang theory.

In this paper, we discuss the pros and cons of the presently prevailing cosmology and then present a new theory of gradual and continuing creation, a theory that has no need for an extremely violent beginning and that does not require new speculative laws outside of the realm of established physics, yet can easily account for most of the problematic observational evidence. It is offered with similar sentiments as those expressed by Hannes Alfvén[5]: "Instead of searching for new laws of physics, we should be trying to find out how to use the ones we already know."

Whereas our theory is at odds with the Big Bang idea, it does not subscribe to the Steady State concept either, as it differs from both in its philosophical implications. Continual change is evident throughout the universe, which keeps evolving toward ever higher organization and complexity, in apparent disregard of the second law of thermodynamics. We believe that the universe is much older than 15 billion years but not infinite in time. And we see the evolutionary processes in the cosmos as an act of ongoing creation.

History and weaknesses of the Big Bang theory

The idea of an expanding universe arose from observations made by Edwin Hubble[6] at the Mt. Wilson observatory around 1930. He discerned many so-called *nebulae* as full-fledged galaxies located at enormous distances outside of our own galactic system, and he found their optical emission lines shifted toward lower frequency (red shift). Interpreting this as a Doppler shift phenomenon, distant galaxies appeared to be fleeing from us at high velocities. Hubble found their velocities of recession varying in direct proportion to their distance. His observations matched the characteristics of one of Alexander Friedmann's[7] theoretical models, previously derived to describe the evolution of a dynamically expanding universe. In this model, the universe came into being by a single act of creation from a primordial nucleus of extreme energy density, exploding and expanding to become our universe. The details of his theory were later refined by Georges Lemaître[8], Willem de Sitter[9], George Gamow[1,2] and other cosmologists. Cosmic expansion is now considered a fact and the *Big Bang* creation theory the only viable cosmology.

According to this theory, the Big Bang occurred between 12 and 18 billion years ago by a gigantic explosion of a superhot, superdense mass of near-infinite energy density. As it expanded, the fireball cooled, particles and atoms formed, gas clouds condensed into stars and galaxies. Galaxies still rush outward, carried by the momentum imparted by the Big Bang. The universal expansion is slowed only by the gravitational pull between galaxies. Most cosmologists believe we live in a universe of critical density; i.e. it contains just enough mass for the expansion to come to a standstill after an infinite amount of time. In relativity theory, this corresponds to a *flat* universe of zero curvature in space-time. The condition is modeled by setting the constant S equal to unity in the cosmological equations of Friedmann and de Sitter. Another parameter in these equations is the *cosmological constant* 7. It is usually taken to be zero, meaning no long-range repulsive forces act on the fleeing galaxies.

Number counts of distant galaxies indicate that the universe may indeed be *flat*. But there is a problem. If we take all stars, gaseous nebulae, dust clouds and intergalactic gases that can be observed and inferred, the amount of matter in the universe accounts for only a few percent of the matter needed to give the universe its critical density. For decades, astronomers have scanned the heavens unsuccessfully in search of the missing *dark matter*. Even if they added supermassive black holes, large populations of *brown* dwarf stars, planetary bodies, neutrinos and other stuff, they still fell far short of the expected critical mass density. As enumerated below, the widely accepted Big Bang cosmology has additional problems.

According to this theory, our universe first became transparent when it was 300,000 years old and the fireball had cooled to a modest 3,700 ^oK. Once the temperature dropped below this level, the electrons and protons in the optically dense plasma combined to form neutral hydrogen atoms. That point in time signified the end of the radiation era, heralding the beginning of the stellar era. Previously, most of the energy in the universe was in the form of radiation. Thereafter the cosmos became dominated by the presence of matter. Since then the universe is assumed to have expanded by a scale factor of 1360. The left-over fireball radiation should also have expanded and cooled to approximately 3 ^oK. This downgraded radiation would lie in the microwave frequency band and would appear to be coming to us isotropically from all directions.

In 1989, the Cosmic Background Explorer (COBE) satellite was launched to investigate the microwave background. Measurements confirmed the existence of a uniform radiation background corresponding to a temperature of 2.7 ^oK. The confirmation of this microwave background is now considered the strongest observational evidence in support of the Big Bang cosmology. COBE data, however, conflicts with expectations in two ways. First, the microwave background is too uniform. It varies only by a thousandth of a percent[10] and cannot explain how the presently observed lumpiness in the distribution of galaxies came into existence. Second, the COBE temperature data displays an unequivocal dipole anisotropy[11], believed to be due to the Earth's motion relative to a *comoving* reference space that follows the general expansion of the universe. This nonconforming motion of the Earth amounts to 370 km/s. Compare this with a speed of 29.8 km/s for Earth in its orbit around the sun, and a speed of 250 km/s for the solar system circumnavigating the galactic center. This type of measurement, however, is strictly forbidden by the basic tenets of Einstein's Special Theory of Relativity. The measurement of the motion of the Earth relative to a cosmic background can in effect be considered a modern-day Michelson-Morley experiment, but this time with a positive result, and with the background radiation defining a preferred frame of reference.

Everywhere the Hubble space telescope looks[12] are millions of distant galaxies with large red shifts in their spectra, implying that they are moving toward the edge of the universe with high velocities. As we look far out into the cosmos, we also look far back into the past. For example, we see many galaxies now because they emitted light at a time when the universe was only a billion years old (according to theory) and one sixth its present size. If the age of the universe is now 15 billion years, it has taken light from these objects 14 billion years to reach us. They appear to be a distance of 14 billion light years (ly) away from us. But this is not where they are now. Using the relativistic equations of the Big Bang model for a Friedmann-de Sitter universe of critical density (S = 1), we can calculate[13] the present speed of recession of a galaxy and its present distance from us. According to these equations, a universe with critical density expands at a rate proportional to the 2/3 power of time from the Big Bang. A galaxy which appears to be 14 billion ly from us is now actually 27 billion ly away and is receding from us at 1.19 times the speed of light. When it emitted the light we see, it was 4.4 billion ly away and was speeding away from us at nearly three times the speed of light.

But wait, does Special Relativity not prohibit relative speeds in excess of the speed of light, c? The spectral Doppler shift of light from the galaxy indeed indicates an apparent speed of recession of less than c, consistent with Einstein’s claim that nothing can be *observed* to move faster than c; but its actual speed away from us, as seen from a cosmic frame of reference is larger than c. Relativistic cosmologists have saved the day for now by declaring that velocities due to the cosmic expansion are different from normal velocities. They no longer refer to the galactic red shifts as *Doppler shifts* but as *cosmological red shifts* resulting from the expansion of space itself. The idea of space expanding and stretching electromagnetic waves gives space all the attributes of a luminiferous aether, however; and to be consistent, we should then logically conclude that the speed of light changes with the aging of the universe, as space expands and becomes more tenuous.

When the 300,000 year old primeval fireball became transparent, its size was less than one thousandth of our present universe. So why do we not see the red shifted microwave remnants of the fireball *in there* somewhere instead of all around us *out there* at a calculated distance of 44 billion light-years? The reason given is that we have always been well inside this fireball. But then, if the young universe was so much smaller, light from any point in it should have passed by us aeons ago. Yet we are apparently able to *see* back into the early universe by looking out at the edge of the cosmos. This is only possible, if the early universe was already almost infinite in extent and was expanding at many times the speed of light. The presently popular *Inflationary Model* of the Big Bang even proposes that the universe inflated *instantaneously* from the size of an atom to several billion light-years across in the first picosecond. Expansion velocities and accelerations had to be near-infinite. These extremes are hard to accept and should make us question the Big Bang hypothesis. Some of the troubling aspects of this hypothesis are listed hereunder:

1. We know of no physical laws or observational data for describing the extreme energy densities alleged to exist in the early stages of the Big Bang. Such energy/matter states are pure conjecture.
2. The Big Bang theory gives no satisfactory explanation for the apparent absence of antimatter in the universe.
3. For light to be still reaching us from early epochs of creation, distant galaxies had to be receding from us at many times the speed of light. As explained above, this idea causes problems with Einsteinian relativity.
4. The interpretation of Hubble's red shift as a cosmological stretching of space ripples is also hard to reconcile with Special Relativity, as it treats the vacuum space as a medium that is the carrier of light and that can be distorted (i.e. a luminiferous aether).
5. The observed non-symmetry in the microwave background temperature implies the existence of a preferred reference frame, the existence of which is denied by Special Relativity.
6. The COBE satellite data shows an extremely smooth microwave background with radiation energies varying by less than 10^{-5}. This is incompatible with the clustering of galaxies observed today. As is well known,[14] galaxy formation requires a relative non-uniformity in

density of more than 10^{-3}. Similarly large values are required to explain large-scale clustering of galaxies.

7. Based on our knowledge of thermodynamic and nuclear processes in stellar interiors, certain stars in our galactic neighborhood appear to be older than the 12 to 18 billion year old universe.

8. There is strong evidence[15] for the existence of supermassive black holes (SBHs) with 10^9 and greater solar masses at the centers of many galaxies. Estimated star capture rates are too low to explain the formation of such SBHs within the age of the Big Bang universe.

9. We see galaxies near the edge of the observable universe as they were 14 billion years ago. Yet many of these galaxies appear to be fully evolved with normal stars ranging in age from 1 to 10 billion years, making these galaxies older than 24×10^9 years.

10. Heavy elements with mass numbers above 11 can only be made in the hot interior of stars and in shockwaves associated with supernova explosions. This is at odds with emission spectra of galaxies and quasars at the edge of the observable universe. *Proto-galaxies* and quasars formed when the universe was alleged to be less than a billion years old already show unmistakable evidence of heavy elements. Hence, a high percentage of stars must have lived out their lives and exploded as novae and supernovae already at this early cosmic age. Such an assertion is not compatible with our understanding of stellar evolution. Moreover, astronomers have never observed a so-called Population III star, containing no heavy elements, anywhere in the universe. Yet they should be plentiful, because all stars condensing out of the primordial fireball should have been Population III stars. If all hydrogen stars have completed their life span, the universe should be much older than assumed.

11. Number density counts of galaxies can be interpreted as having some consistency with a flat universe. Yet, the critical density required for a flat universe is ten to thirty times the actually observed mass density.

12. New evidence[4] has been reported, which shows the cosmic expansion is accelerating rather than decelerating.

This last point suggests a non-zero *cosmological constant*, indicative of a cosmological pressure or repulsive force field, which continues to propel the galaxies apart. Such a universe has no need for a Big Bang. It could easily be much older and could have had a more gradual and less violent beginning.

A cosmology of gradual creation

The cosmic model proposed here describes an evolutionary universe of continual creation. It has not necessarily existed forever. The galactic red shift is taken to indicate a recession of galaxies, driven by a repulsive force that acts between galaxies but not on the stars within galaxies. As the space between galaxies increases, new hydrogen is *created*[a] there, condensing into new stars and galaxies, so as to keep the population density of galaxies approximately constant as the universe ages. Whereas this process may be similar to the one proposed by Hoyle, we do not depend on intergalactic gas pressure to drive the galaxies apart.

We accept Hubble's interpretation of the red shift as a Doppler shift and assume galaxies recede from us with velocities that increase linearly and proportional to their distance. Hubble's proportionality constant is taken as H = 23 km/s per million light-years. We further assume the universe has existed for aeons of time in excess of 10^{11} years, perhaps much longer. No speculation is made as to how the universe came into being. A violent Big Bang is not needed. Rather, a continuous ongoing process of creation, consistent with observation, is inferred.

Stellar systems are continuously being born, evolving into brilliant galaxies. Galaxies go through a life cycle lasting 20 to 100 billion years until they blink out, leaving behind supermassive black holes (SBHs), containing typically 10^{11} solar masses. Within each galaxy the dynamics are such that stars continually condense from gases and dust in the galactic disc, shining for periods of 1 to 10 billion years until their nuclear fuel is exhausted. During their relatively short life spans, they slowly spiral toward the galactic center, where their material is eventually swallowed up by a monster SBH, to be recycled back into the universe by processes not understood at this time. Gravitational refraction and

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[a] as particles ejected out of the *zero-point energy* of the stressed vacuum space and/or as material ejected from supermassive black holes, the remnants of galaxies that have burned out.

reflection[b] of light around these SBHs, as well as violent plasma jet emissions from these SBHs, may account for the observed characteristics of quasars. According to our theory, quasars may be active SBHs at the centers of galaxies, and they may also be naked SBHs, i.e. burned-out cinders of extinct galaxies. We thus expect to find quasars at all distances in the cosmos, not just at the edge of the observable universe. This is consistent with spectral data[16] from quasars, which often show the same red shift as nearby galaxies.

To explain the apparent expansion of the cosmos, we assume that SBHs at the galactic centers have a slight electric, or perhaps magnetic monopole charge. The intergalactic fields from these charged galactic nuclei drive the galaxies apart. Stars within the galaxies are electrically neutral and are not affected by electric or magnetic fields. They remain gravitationally bound within their galaxy in the conventional manner.

Let us now look at the dynamics of this cosmological model. We will not use relativistic formulae, so as to avoid unnecessary complexity, and also because we have doubts about the validity of certain relativistic concepts when applied to the description of the cosmos as a whole. In the opinion of the author, a valid description of the cosmos requires an absolute point of view, one that is not limited by the speed of transmission of information. Let us assume a universe, with a uniform, quasi-steady population of n galaxies per unit volume. As the universe expands, new galaxies form to keep n constant with time. Assume further that the universe is spherically symmetric. If the universe is infinite, we pick an arbitrary center C to serve as reference point for a suitably large spherical volume of the cosmos. Consider now a typical galaxy of mass M and core charge q at a distance r from this reference point (see Fig. 1). The sample galaxy is gravitationally attracted to all other galaxies and is electrically or magnetically repelled from all other galaxies. For analyzing the motion of this galaxy, we divide the universe into two regions by drawing a spherical boundary around the reference point, with the sample galaxy lying on the periphery as shown in Fig. 1. We then label the

[b] All black holes have *halos*, which *reflect* the light from the entire universe multiple times into the eye of a distant observer. The author has studied and calculated the apparent intensities of supermassive black hole halos. These can under certain circumstances masquerade as sources of extremely powerful emission of radiation, specially when the black hole (alias quasar) is believed to be orders of magnitude further away than it actually is.

volume enclosed by the spherical boundary as Region I, everything outside as Region II. Because of symmetry and because gravitational and electric forces fall off inversely as the square of distance, we can make the following two simplifications:

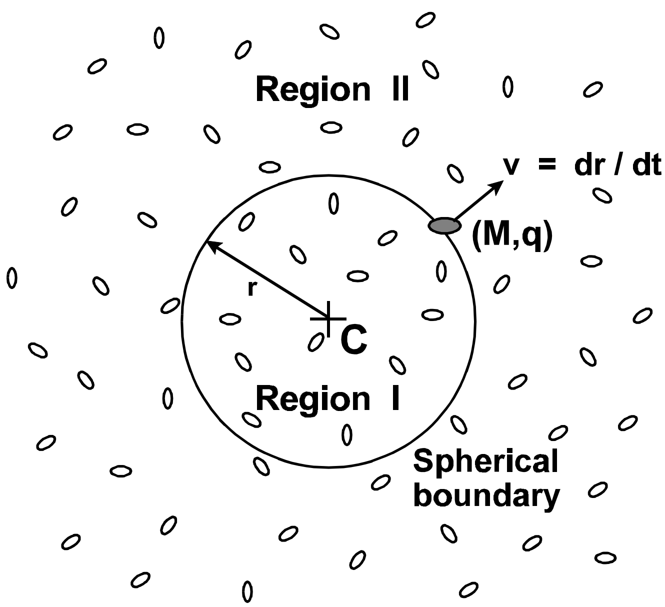

Figure 1.
Arbitrary division of universe into Regions I and II to facilitate analysis. A sample galaxy with mass M and core charge q lies a distance r from an arbitrary center C on the surface of the dividing spherical boundary.

1. The resultant gravitational attraction of the sample galaxy to all galaxies in Region I within the spherical boundary is the same as if all these galaxies were concentrated at the center of the sphere. Similarly, the resultant electric repulsion caused by all galaxies in Region I is the same as if all galactic charges were concentrated at the center. Assuming the electric repulsion dominates over the gravitational attraction, the sample galaxy is subjected to a net force and acceleration directed away from the reference center. At time t, the net repulsive force is assumed to have imparted a velocity $v = dr/dt$ to the sample galaxy.

2. The cumulative gravitational and electric forces on the sample galaxy due to all galaxies lying in Region II outside of the reference sphere cancel out to zero because of symmetry.

Hence the net electric force on the sample galaxy is:

$$F_E = \frac{q}{4\pi\epsilon_o r^2}\left[\frac{4}{3}\pi r^3 nq\right] = \frac{nq^2 r}{3\epsilon_o} \qquad \textbf{(1)}$$

where ϵ_o is the electric permittivity of space. The net gravitational force on the sample galaxy is:

$$F_G = -\frac{GM}{r^2}\left[\frac{4}{3}\pi r^3 nM\right] = -\frac{4\pi\, nGM^2 r}{3} \qquad \textbf{(2)}$$

where G is the gravitational constant. The total force per unit mass on the sample galaxy is then:

$$\frac{F}{M} = \frac{n}{3}\left[\frac{q^2}{\epsilon_o M} - 4\pi GM\right] r \qquad \textbf{(3)}$$

From Newton's second law of motion, we can write

$$\frac{F}{M} = \frac{dv}{dt} = v\,\frac{dv}{dr} = H^2 r \qquad \textbf{(4)}$$

where

$$H = \sqrt{\frac{n}{3}\left[\frac{q^2}{\epsilon_o M} - 4\pi GM\right]} \qquad \textbf{(5)}$$

Solving differential Equation (4) and applying the boundary condition, that v = 0 when we shrink the arbitrary reference sphere to zero, we find

$$v = Hr \qquad \textbf{(6)}$$

This is Hubble's Law, consistent with observation. The parameters contributing to Hubble's constant are given by Equation (5). Solving this equation for the galactic charge required to account for the observed cosmic expansion, we find:

$$q = \pm \sqrt{ M \epsilon_o \left[\frac{3H^2}{n} + 4\pi G M \right] } \tag{7}$$

Assuming 10^{11} galaxies exist within a radius of 15×10^9 light-years, we derive an average galactic number density of $n = 8.3 \times 10^{-69}$ galaxies per m^3. Then, taking the average mass of a galaxy as $M = 2.4 \times 10^{41}$ kg and Hubble's constant as $H = 2.4 \times 10^{-18}\ s^{-1}$, we obtain $q = \pm 7 \times 10^{31}$ coulombs per galaxy, which works out to one elementary charge (one extra proton or electron) for every 3.3×10^{17} atomic mass units in the galaxy. The minimum electric charge necessary to balance gravitation is one elementary charge for every 10^{18} nucleons. We only need such a slight deviation from neutrality because electric repulsion between protons is over 10^{36} times stronger than gravitational attraction between nucleons.

The question arises as to how the SBHs in the galactic nuclei could become electrically charged. First, it is possible that charge may not be conserved in the extremely compressed state of matter inside the black hole “singularity”. Second, charges may become irretrievably separated during the accretion process onto a rapidly spinning SBH in the presence of strong magnetic fields. We only need a very small imbalance in charge, and hence only a minute preference for particles of different charge and mass to be captured. Suppose it is slightly more probable for protons to enter the SBH horizon than for electrons. Then a net positive charge would accumulate inside the event horizon and a net negative charge outside. It has recently been argued by Price and Thorne[17] that a black hole's event horizon acts like an electrically conducting membrane with a resistivity of 377 ohms, the dynamic impedance of space, $Z_o = (:_o / ,_o)^{1/2}$, where $:_o$ is the magnetic permeability of “empty”space. Such a conductive event horizon may shield the internal charge from outside view, so that from the outside the SBH appears to be negatively charged. In the laboratory, we know how to shield electric or magnetic fields, but we do not know any way of shielding gravitational fields. Evidently, charge can be concealed but energy cannot.

Summary

Our cosmology avoids many of the inconsistencies that plague the Big Bang hypothesis. We do not need to search for large amounts of dark matter to make the universe flat, since there is no overriding requirement for it to be flat. We do not have to invent unproven mechanisms to explain the initial phases of creation, and we have no conflict with observational evidence. For other writings of the author, refer to http://www.avilabooks.com/writings.htm.

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* Dietmar E. Rothe Ph.D.
Scientific Consultant
Rothe Technical Research
1404 Rubenstein Avenue
Cardiff by the Sea, California 92007, USA
E-mail: rtr@sand.net