A New Expansion Model of Our Universe

Charles B. Leffert

Email: Leffert.charles9@gmail.com

Abstract
In this introduction to the new SC-expansion model of our universe, the new physical concepts will be quickly reviewed to explain the source of gravity and a failure of the big bang consensus cosmology to account for a fundamental photon feature in an expanding universe.. This photon delay effect is not accounted for using present relativistic concepts of co-moving distance and standard candles. It is shown that following the photons by integration of the photon delay equation produces a larger luminosity distance and greater apparent magnitude sufficient to fit the supernovae SNIa data with no need of dark energy. It is shown that without this photon delay effect, the cosmic microwave radiation would not produce a clear first-pass pattern, but a smeared background of multi-orbit passes.

Key words: cosmology: theory; cosmology: cosmological parameters; time: general relativity

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1. Introduction

Our spatially three-dimensional (3-D) universe is expanding at the rate of 325 $Mpc^3\ yr^{-1}$ because 3-D space is being produced at that rate by a process called "Spatial Condensation (SC)"[1]. This is a prediction of a new cosmological expansion model. It is a non-relativistic, closed model in that it has no free parameters; just the fixed present parameters of size, R_0, time, t_0, Hubble constant, H_0, and the present densities and scale factors of the three contents of our universe. But, of course that is not enough to build the model.

Besides the size of the spatial building blocks, one also needs the physics of the relations between the various concepts.

The physical constants G, c, $\hbar$, must tell us the size, and in particular, should Planck's natural units: Planck length, l_p = 1.61×10^{-33} cm, Planck time, $t_p = 0.539\times10^{-43}$ s, Planck mass, $m_p = 2.18\times10^{-5}$ g. Such extremely small values of l_p and t_p are clues for a large universe.

To use such clues, it is logical to try to work with dimensionless numbers, like radius of our 3-D universe $N_R = R/l_p$ and present age $N_t = t/t_p$, etc.; but note that these will be enormous numbers and some software can not handle such large numbers.

As one might expect of a correct model for the expansion of our universe, that many old fundamental problems should disappear. It could be true for the present consensus, ΛCDM , big bang (BB) model with its many fundamental problems and very different geometry and concepts [2].

The general relativity (GR) discontents are rapidly growing [3, 4, 5].

Two fundamental problems are solved in this paper. Section 3 changes the historic Newton gravity; from a "pull" to a "push". Section 4, shows a fundamental photon delay feature in an expanding universe, missing in present physics.

Section 2 begins with a quick review of new physical concepts in preparation for the source of gravity.

More predictions of the new model will be presented in the section on photon delay, the supporting details of some predictions to be presented in future papers.

For presentation of a new model in opposition to the present consensus model, the presenter is obliged to carry a running contrast to explain how the new concepts should replace the old.

2. Quick Overview of New SC-Model

Space exists. Indeed, a number of different spaces exist. A source for our 3-D space must be found [6], and that source is in a pre-existing "epi-universe". However the first spatial cell spontaneously produced was not a cell of 3-D space but a 4-D hypercube of space of edge-length l_p and volume l_p^4 [Only volume is important, cubic shape is for convenience of calculation].

That 4-D cell was a catalytic site for further production of 4-D cells and an exponential production of such "free" 4-D cells was underway.

This hypothesized production of 4-D cells is called "Spatial Condensation (SC)'.

The SC-process reduces epi-pressure, and the inrushing epi-particles drive the "free" 4-D spatial particles into the form of a 4-D ball (geometric 3-sphere) of. radius R_0' ~ 72 cm, and t_0'~ 10^{-33} s. Then only the exposed 4-D cells on the bare surface of the 4-D ball support continued spatial condensation at a much smaller rate of one new 4-D cell on each exposed 4-D cell per Planck second. Our spatially 3-D universe is the surface of the expanding 4-D ball.

What has just been hypothesized is the bombardment of the surface of the 4-D ball, and any massive object in its 3-D surface, with even much smaller N-D (N > 4) spatial particles of the epi-universe. The 4-D ball is like an incompressible liquid in that any massive object M, like our Earth, dimples the surface and any smaller massive object m, with its smaller dimple, at distance r is driven, "push", towards the center of M

The expansion redshift, z, is related to the scale factor, R/R_0, as $z = (R_0/R) - 1$. Thus as the radius $R \rightarrow \infty$, $z \rightarrow -1$, which says that the entire future of our universe is between z = 0 and z = -1.

GR cosmologists do not extend their curves for their equations past z = 0 because unphysical behavior is predicted [2, Fig. 6]; thus the *future* is a major GR-problem.

In contrast, view the beautiful SC-parameter curves of Fig. 1.

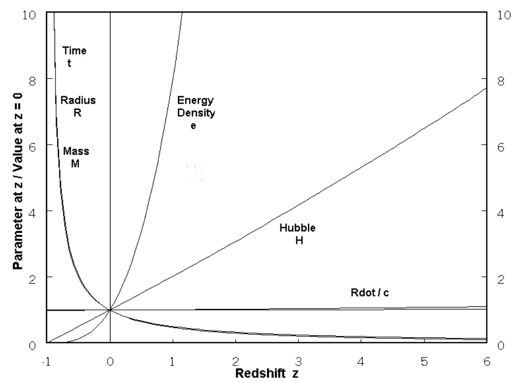

Fig. 1 SC-parameters are well behaved into the future, $(-1 \le z \le 0)$. Parameter values at z were divided by their value at z=0.

In later papers when the parameter equations are derived, dimensionless parameters, tH, and, q, go to unity in the future, so the SC-model can tolerate no acceleration of the decelerating expansion. Although called a constant, R_0 also varies with the expansion.

3. Source of Gravity

Newton's force on m towards M is $F_3 = -GMm/r^2$ or in terms of acceleration of m, $a_3 = F_3/m = -GM/r^2$. At distance r from the center of mass of M, let the normal to the 3-D curvature of the dimple due to M be at angle θ to the radius of the 4-D ball so that the epi-source of acceleration $a_4 = F_4/m$ and our measured acceleration is $a_3 = a_4\sin(\theta)$. The conversion of Newton's equation to $a_4\sin(\theta)$ is simple.

Consider that M is the equivalent mass of a non-rotating black hole and set $\sin(\theta) = 1$ at the event horizon, which is at the Schwarzschild radius r_s of the black hole.

With a little algebra and using dimensionless numbers; let $N_M = M/m_p$, $N_r = r/l_p$ and $G = c^2 l_p/m_p$. For $r_s = 2Gm/c^2$, $N_{rs} = 2N_M$ for a black hole.

$$a_3 = a_4 \sin(\theta) = -(c^2/l_p)(N_M/N_r^2) = -\xi\,(N_M/N_r^2) \qquad (1)$$

where $\xi = c^2/l_p = 5.569 \times 10^{53}$ cm s^{-2}

At $N_r = N_{rs}$, $\sin(\theta) = 1$, and $N_{rs} = 2N_M$,

$$a_4 = -(c^2/l_p)(N_M/N_{rs}^2) = -(c^2/l_p)(1/4N_M) \quad (2)$$

Dividing Eq.(1) by Eq.(2), gives,

$$\mathrm{Sin}(\theta) = +\,4(N_M/N_r)^2 = \chi\, M^2/r^2. \qquad (3)$$

and $\chi = 4(l_p/m_p)^2 = 2.204 \times 10^{-56}$ cm^{2}g^{-2}.

Thus $a_3 = a_4\sin(\theta)$ produces exactly the same values as Newton's equation but in terms of the SC-source of gravity. As a check, multiply the last expressions for a_4 and $\sin(\theta)$ to get $a_3 = -GM/r^2$.

For our feet on the surface of the Earth, the curvature of its 3-D dimple in the 4-D ball is $\theta \approx \sin(\theta) = 1.93 \times 10^{-18}$ rad., which together with the epi-impact acceleration of $a_4 = 5.08 \times 10^{-20}$ cm s^{-2} produces the measured acceleration $a_3 = a_4\sin(\theta) = 980$ cm s^{-2} as we know.

The source of gravity is no longer a weak force but now ranks *strong,* along with the other three strong forces

4. Photon Delay Effect

With the telescope pointing fixed, its detector can be measuring photons from many distant sources. On the scale of the universe, photons from more-distant sources join photons from lesser-distant sources and that common trajectory defines the emission distance ED as a function of the redshift z.

The speed of light is c in all local regions of 3-D space. But from any fixed point in space (origin), all other local regions of space at distance r, are moving away in the Hubble flow at velocity Hr. Thus a packet of photons at r, moves toward the origin at the difference in velocity of Hr – c.

However, on that trajectory, there is a special point defined by redshift $z_m = 1.7$ where for $z < z_m$ the photons are moving at a net velocity v_c toward the telescope and the photons at $z > z_m$ are moving at a net velocity v_c away from the telescope. That trajectory is defined by the photon delay equation (4), the integral of which [6] gives the emission distance ED,

$$v_c = dr/dt = Hr - c. \qquad (4)$$

At $z = z_m$, $v_c = 0$ and all photons are momentarily at rest relative to the telescope.

As the universe ages, the Hubble parameter becomes smaller and the photons gradually gain net velocity and enter the telescope, r = 0, at net velocity $v_c = -c$.

For $z > z_m$, the photons are not moving backwards on the ED trajectory: the expansion just increases the ED-slope and that increases the length of the trajectory.

The important point is that even near z_m the expansion is taking a heavy toll on the energy density of packets of photons which increases the luminosity distance d_L [7], This increases the apparent magnitude m.

An integrating factor was used to integrate Eq. (4), but with the often used approximation of neglect of radiation, and ED(z) was obtained [7]. Also the reception distance RD = (1 + z)ED. ED curves for the various sizes of the SC-universe are shown in Fig. 2 where factor F = new R_0'/R_0.

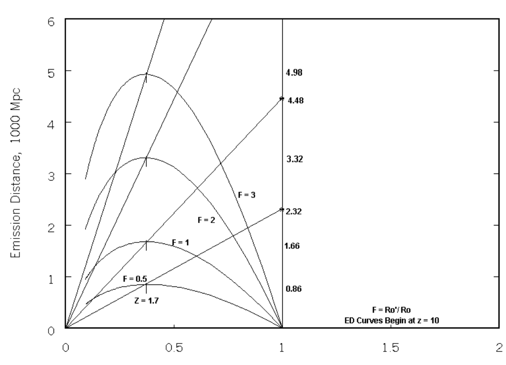

Fig. 2 In a SC-3-sphere universe, photon delay with increasing scale factor R/R_0, increases emission distance until z = 1.7. Reception distance RD = (1+z) ED.

At unity on the abscissa of Fig. 2, R_0' values very as R_0' = F x 4388 Mpc.

All ED-curves have $z_m = 1.7$. For SNIa exploding stars at z = 1.7, the convex curves are the world lines of the photons and the straight lines are the world lines of the star remains to RD = (1 + 1.7) ED.

The good fit, center curve, of predictions of the new model to the "Gold and Silver" SNIa data of Riess, et al. [8] is shown in Fig. 3 with no added lambda or dark energy [7].

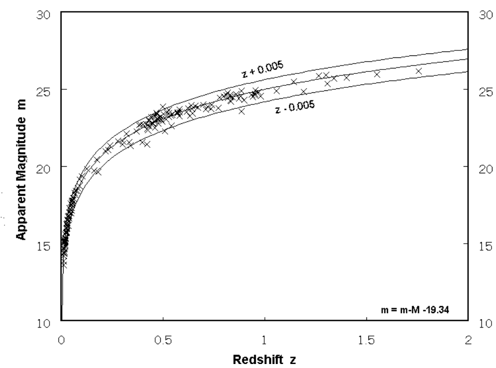

Fig. 3 Published 185 "gold and silver" SNIa data and SC-curve. No added lambda or dark energy were needed to fit the data.

The attempts of the two GR-groups to fit the early SNIa data, predicted deficient apparent magnitudes, m_{eff}, because of deficient luminosity distances, d_L. Their GR-solution introduced the unphysical lambda or dark energy concepts and accelerated expansion. The SC-photon delay effect with increased SC-d_L accounted for that GR-deficiency.

The COBE satellite produced a clear pattern of the slight difference in the present temperature (T=2.726 K) of the CMB and a near perfect curve of its black body spectrum. This could only happen if the CMB was a measure of the radiation on its first-orbit from a definite patch of that early plasma (T~3000 K) when re-combination of electrons with their ions released the radiation. Equation (4) is responsible for that first-pass radiation release at z ~ 1000.

The radius of our universe was only R_0' = 4.388 Mpc at $R/R_0 = 10^{-3}$ but the Hubble parameter was enormous, H_0' = 8.252 x10^{5}', (km/s)/Mpc. Thus the Hubble flow v_H = Hr was also great, much larger than |-c| of Eq. (4). The F = 1 curve of Fig. 2 starts at z = 10; but for the CMB it would start nearer the beginning,, at z = 1000.

In the BB-relativistic concepts of co-moving coordinates and geodesics, the minus sign of negative c does not appear in integrations for the emission distance that accounts for the expansion. The co-moving coordinate concept implies that the elapsed time of a photon moving a distance |ED| is independent of its direction of travel, to or from ED, contrary to Eq. (4).

To show that including the Hubble flow in Eq. (4) is essential, three computer integrations over time were made with different functions of c/a with final scale factor a = R/R_0 = 1; but with surprisingly different results.

The first integration, corresponding to curve F = 1 of Fig. 2, used the function: f = (Hr – c)/a of Eq. (4) as the integrand and is shown by SC-ED curve in Fig. 4.

The F = 1 curve did not include radiation, but still agrees well with the SC-ED curve in Fig. 4 which did include radiation.

The second integration used the function of the comoving distance [9] as the integrand, c/a(t'), and gave the GR χ curve, for increasing distance with time, and about five times the distance of the SC – ED.

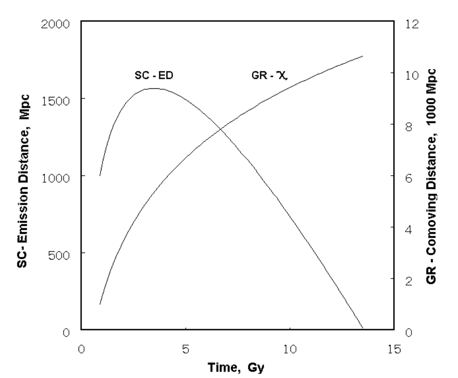

Fig. 4 Numerical integration of the function f' = (Hr – c)/a gave SC-ED curve, with a = R/R_0. Integration over the comoving distance function f' = c/a(t'), gave GR - χ . Both curves start at ED = 1000 Mpc.

The third computer integration was made without the "Hr" Hubble term of Eq. (4), f' = (-c)/a, with a = R/R_0. The unphysical result, with the Hubble term removed is shown in Fig. 5. Starting at z = 10, R_0' = 4.388 Mpc, t = 0.94, ED = 1000 Mpc, it ended at R_0 = 4388 Mpc, z = 0, and ED =0. However, if it had been started back when the CMB photons were emitted, z = 1000, the center of Fig. 5 would be black with many hundreds more orbits of the universe.

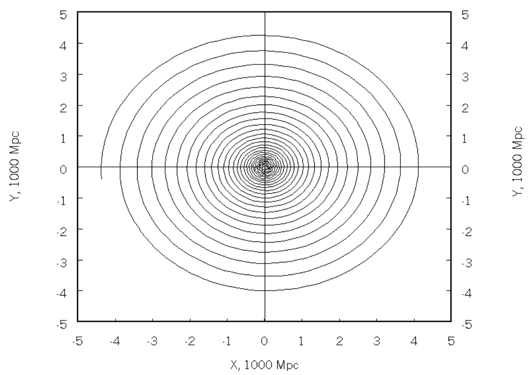

Fig. 5 With Hubble term removed of Eq (4), f = -c/a, there is no constraint and the –c photons are freed to spiral out to the present.

Figure 5 shows the orbit of only one packet of photons from one small patch of the early plasma. All the other patches of plasma would be emitting such orbits, and the overlay on the photon detector of many-pass combinations of different orbits from different origin patches of the CMB, would have smeared the measured CMB pattern toward a more uniform glow. The Hubble flow constraint must be accounted for in the trajectory of photons.

The main conclusion of this first paper is that the GR- flat universe $(\Omega = 1)$ model can not account correctly for the expansion of our universe.

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