

On the Origin of Space

Part 2: A Many-Hyperspheres Model of the Universe

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Abstract

A 4D hypersphere model of the universe has been recently developed by another Author. In order to get a model fully matching observations, we are adding here the concept of superposed spaces, thereby extending the model to multiple hyperspheres. Each sphere then represents the space containing one galaxy. Space is then understood as a superposition of component spaces originating from the electromagnetic emission by matter contained within them. This approach is in line with Einstein's concept of a physical space, with the difference that space is no longer seen as an all-encompassing entity. Besides reconciling the well-known non-expansion of astrophysical gravitationally-bound systems, with recent observational data obtained by NASA from the outer parts of the Solar system showing an expansion of our own galaxy, the model physically explains why the universe is seen as flat, and accommodates other astrophysical data on supernovae at redshift ranges going beyond half the age of our galaxy that shows a deviation from Hubble's Law. Such data gives us the true age of our galaxy at $(17.9 \pm 3\%) \times 10^9$ years, confirming earlier unconnected data, and verifies that the Hubble effect is related to, and limited by the electromagnetic expansion of the space attributable to our galaxy. The physical relation to a finite quantum mechanical "zero point energy" of space is also provided.

Keywords: hypersphere model, 4DO, anomalous acceleration, hubble effect, redshift, supernovae surveys, galaxy age, quasars, universal expansion, decheseaux-olbers paradox

[†] Independent scholar, email: rgouin@mindspring.com

c/o Jose B. Almeida University of Minho Physics Department 4710-057 Braga, Portugal
bda@fisica.uminho.pt

Introduction

We are defining a space existing only through interactions within its contents, i.e. between ponderable matter and radiation; matter and radiation are seen as monadic spaces, as Gouin (2004a) physically described and as Almeida (2004a, b) mathematically developed within the 4-dimensional optics (4DO) theory. This space is thus not pre-existing, and especially not an arena where the dynamics is played, as present General Relativity describes. It only exists tied to interactions, and thus is continually maintained by the evolution of its contents. The Appendix gives a summary of the 4DO mathematical theory, and provides a formal backing of the physical theory presented here.

The universe cannot be described by a single essentially electromagnetic hypersphere as Almeida proposes because the speed of light is not infinite, limiting the extent of generated spaces. To take this into account, we need to model the universe as a set of expanding e-m spaces where each is generated through its internal e-m emissions, being then only one among many expanding spaces.

We will show that such a many-hyperspheres model indeed predicts the *observation* of a **flat universe** from within any one of its expanding hyperspherical spaces, understanding that spaces are then superposing at their common events (only there and then) between their contents, and this without need for a cosmological constant or “dark energy” to explain the observed flatness.

Almeida (2004b) has also shown that, within the 4D expanding hypersphere model, there is no need for unseen matter (“dark matter”) in order to explain the observed odd rotation of spiral galaxies.

We will first look at the nature of physical space as defined by the model, to develop further the line of Einstein’s view of space as a physical entity instead of the present mathematical form with no substance that his theory used. We shall thereby demonstrate that an electromagnetic nature for space leads to the observed effect known as the Hubble redshift, and this without an overall universe expansion, only through the expansion of component spaces.

A verification of the model adequacy is first provided by reconciling the *blueshift* effect seen recently by NASA in the outer parts of our Solar System, per Gouin (2004b), with the well-known observation of a lack of expansion in other galaxies, per Misner et al. (1973). Galaxies are predicted to be observed with their present size instead of their past size (as an all-encompassing expanding space must obtain), thereby giving a straightforward explanation about why *galaxies are seen as not expanding in a universe with an overall expansion*, as originally inferred from the Hubble effect.

Subsequently, we dwell on an added feature brought out by the model into this important effect. Per the model, **the effect is found to be limited to the extent of our galaxy’s space at the time the observations are made**. Here we are able to compare with recent known observations, and thereby give a second

observational verification of the model adequacy.

The third verification is via debunking the DeCheseaux-Olbers paradox, a paradox originally used by 20th century theorists to show (in a rather crude and immediate way) that the universe had to be finite (and so its “zero point energy”). This conclusion helped open the door 40 years ago to an all-encompassing expanding universe with a beginning common to all (the big bang), something found incorrect as a consequence of the physical model proposed here. Other experimental facts further support this proposed model.

Irreversible superposed electromagnetic spacetimes

a. The redshift concept

Following the original method by Hubble (1929),¹ the distance of astronomical objects is given by their observed “redshift.” The redshift of an object has been thought since Hubble to be the shift of the object spectrum to longer wavelengths because of the Doppler shift of the radiation it emitted *due to an assumed recessional velocity from Earth*. If the velocity V does not approach the speed of light c :

$$V = c z \tag{1}$$

with z being the redshift from wavelengths changes between the time they are emitted and the time they are observed:

$$z = (\lambda_{obs} - \lambda_{em}) / \lambda_{em} \tag{2}$$

The redshift of the object was observed by Hubble as proportional to its distance d :

$$V = c z = H d \tag{3}$$

where H is the Hubble constant, with the latest value (Gouin, 2004b) known to be 75 km/s-Mpc (at $\pm 0.5\%$ uncertainty), with Mpc = 3.26×10^6 light-years (megaparsec).

Example: $c = 3 \times 10^5$ km/s and $z = .3$, Eq. (3) gives $d = 1,200$ Mpc.

b. The many-hyperspheres space generation model

DEFINITION:

- A galaxy generates its own space through radiation produced by its matter, with a **density** vs. the spaces of other galaxies proportional to the radiation flux emitted up to a **saturation value**. This space superposes onto these background spaces, and can be modeled as a 3D sphere of the 4D hypersphere defined by Almeida (2004b), identifying that space as only one among many other spaces that superpose onto it. The superposi-

¹ See also Longair (1996) pp. 104 and 126 and Elmore and Heald (1969) p. 165.

tion of space frames exists only through *common events* between their contents, i.e. matter/radiation. For example, the observation (interaction) of one photon from one space by matter from another space effects the superposition, which then physically exists only at the location of the event in the superposing spaces.

PROPERTIES:

- Unlike the mathematical spacetime of Relativity (Wald, 1984), the physical spacetime of the present model only exists within timeslices across the superposing mathematical spacetimes experiencing the common events.
- The speed of light must be the same for all spaces when using their own measuring rods. (This is an extension of the principle that the speed of light is the ultimate speed per Gouin, 2004f.) Since their measuring rods expand with their expansion their time scale must be then proportional to their age. A young space has thus time passing quicker compared to an older space.
- The evolution of superposing timeslices in expanding spaces is fundamentally irreversible, matching the fact reality is an irreversible stream of changes in timeless superposing spaces as Gouin (2004c) identified via conscious experience, and this instead of an unphysical reversible time flow within an all-encompassing and insubstantial mathematical spacetime.

In the Almeida (2004a, b) model, space is all-encompassing; it is the space of the universe, while, in the many-spaces model above, we have a superposition of many space-matter systems evolving separately except for their common events. The superposition is represented by the added physical feature of a density for each space under consideration. The “saturation area” for that density corresponds to the core of the galaxy dominated by gravitational and electromagnetic interactions as Almeida describes. In that area the galaxy behaves as if it was the only gravitationally-bound object in the universe.

The key understanding that needs mathematical formulation beyond the presentation in the Appendix is the notion of tangent space. While our space (the space of our galaxy) is represented through the metric stated via Maxwell's equations in Almeida (2004a), *any galaxy we observe is seen in a tangent space, thus a flat space in the 4th dimension* (a NOW view). Therefore the metric for that “outside” space is observed only in the three dimensions of our space, not time. In other words, it is seen from our space only in 3 of its 4 dimensions.

This tangent space is only a *mathematical space* as Almeida (2004b) describes since it is an image of the expanding real space containing the observed galaxy. Then Almeida is justified in using a mathematical (geometric) form to describe the evolution of that observed space.

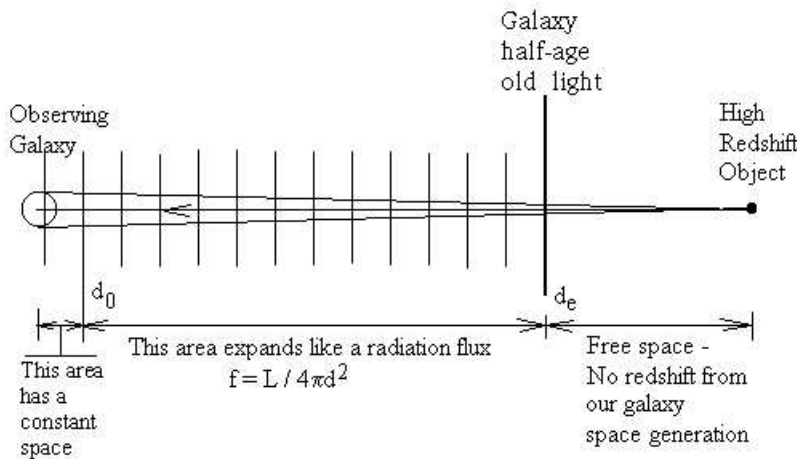
However, since not getting the time dimension in the observations, *that observed space must include a cosmological constant to accommodate its expansion in our time.* Indeed, we observe a succession of NOW images from the other space, with its sequence of images governed by OUR time. The observed tangent space is seen as infinite since it is a flat space, but it changes with the various times from the various observed spaces, as it is a superposition of many other spaces from galaxies that expand in their own time. So the conversion to our time of these foreign expansions transforms their independent expansions to a *universal expansion* in a mathematical view, not a physical view.

We are now going to place ourselves in the space of our galaxy and study the evolution of photons across the spaces experiencing common events with our space. This viewpoint will lead to a Hubble redshift having a physical meaning different from the original envisioned by Hubble.

c. Redshift from physically generated electromagnetic spaces

Let's assume (Fig. 1) a *high redshift* object on the right is observed from our galaxy on the left. A photon received from this object has gone first through a starting region, a region the radiation from our galaxy did not yet reach then because we are too far away knowing the age of our galaxy. Within the above model, this starting space is a combination of the background space and the space the high redshift object built through its own radiation.

Then the photon enters a region at d_e away from our galaxy, where *space is a combination of the background space (which includes now the object's original*



space) and the space of our galaxy. d_e has to be half the age of our galaxy in light-years since the photon will have to travel to our galaxy to be observed there. For the duration of the travel in that region the photon goes through a space which becomes more and more the space of our galaxy closer the photon is from us until it reaches

FIG. 1. Superposition of a galaxy space onto the background space of other galaxies.

the local saturation area where the space is entirely produced by the galaxy (Fig. 2). The flux of radiation at distance s from our galaxy with luminosity L is

$$f = L / 4\pi s^2 \tag{4}$$

Within the spatial model definition above, the corresponding *local spatial scale change* versus the background space is then proportional to $1/s^2$. For a distance (wavelength) λ crossed by the photon *at distance* d from and towards the source of space, our galaxy, the *spatial scale increase* measured by the increase of distance from the source is proportional to

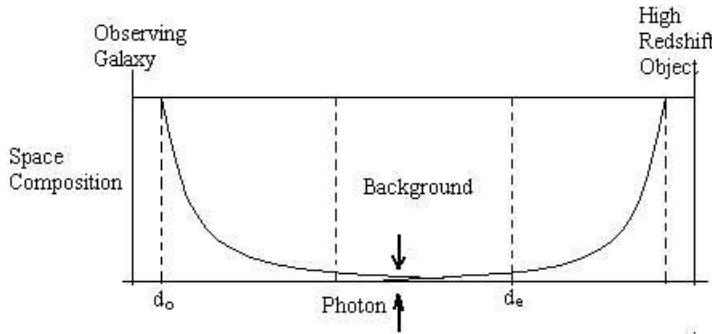


FIG. 2. Space composition along the photon travel.

$$\sum (1/s^2 - 1/(s+\lambda)^2) \sim \int_{d_o}^d 2ds/s^3 \quad (5)$$

where the sum is over the λ distance elements between the photon and the space saturation area near the galaxy center starting at d_o . Starting at distance d_e the photon experiences this scale

increase each period, so when it reaches the distance d the *accumulated* scale increase is proportional to

$$\int_d^{d_e} \left(\int_{d_o}^s 2ds/s^3 \right) ds = (d_e - d)/d_o^2 - (1/d - 1/d_e) \quad (6)$$

Since $d_o \ll d \ll d_e$

$$\Delta\lambda/\lambda \propto d_e \quad (7)$$

If the photon originated from an object at a distance less than d_e , the increase in spatial scale from the scale where the photon originated gives an increase in photon wavelength, i.e. a “redshift” proportional to the distance traveled.

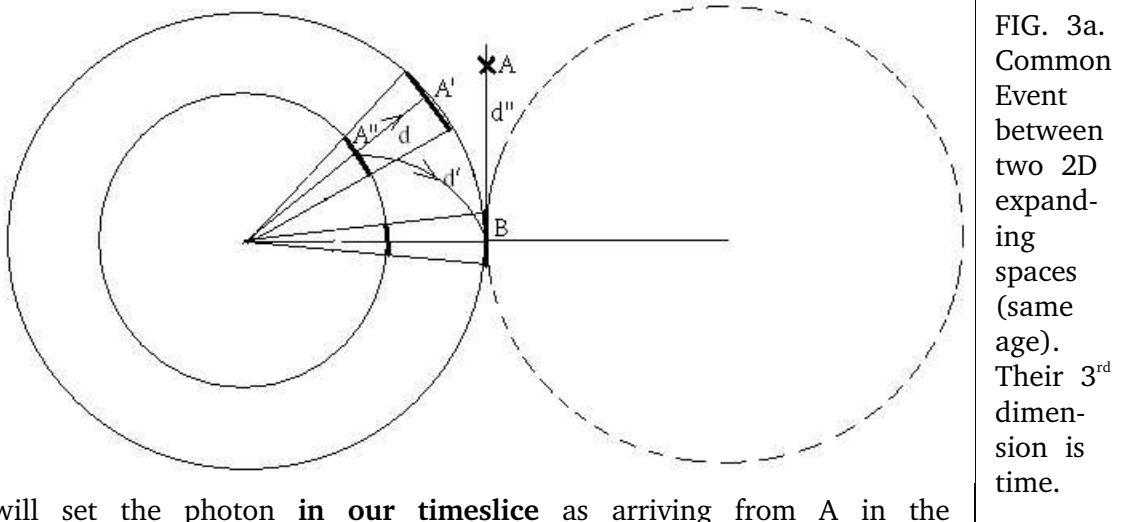
This change of scale is therefore equivalent to a receding speed V for our galaxy versus the originating astronomical object. The space generated by our galaxy has then the same effect via the photon travel towards it **as if** the originating object receded from our galaxy at a speed proportional to the distance the photon traveled in the spreading region of our galaxy’s own space. Eqs. (1) and (2) are thus followed (but arrived at here from the viewpoint of the photon facing an increasing e-m flux).

The above approach is however more representative of the physical process because we will be able to explain through it other observed phenomena that have no explanation in the Hubble view. For example, it has been observed that, when the photon originates from a distance $d > d_e$, the spatial scale no longer follows the Hubble Eq. (3). We shall cover this subject later.

Observational consequences of the model

As the single all-encompassing hypersphere model predicts, an expansion of our galaxy space has been verified to exist through an analysis of anomalous NASA spacecraft accelerations where the Hubble constant was involved (Gouin, 2004b). It is however well-known that galaxies are observed as not expanding - see for example Misner et al. (1973), p. 719.² The resolution of this apparent conflict in observations can be obtained through the many 4D hyperspheres model introduced earlier.

In that model, matter/radiation across two spaces can have common events only on **common timeslices** per the model definition. Let's consider the observation of a galaxy with the same age as ours. (Fig. 3a) In its originating space, the photon follows route d' to reach us, i.e. it follows a geodesic of the expanding sphere. The corresponding route in our space is seen as d'' *using our present measuring rods in the tangent space defined by the observed photon* (it is observed NOW), with $d' = d''$ since the galaxies are of the same age, i.e. **have the same measuring rods on the common timeslice**. Our spacetime frame at B



will set the photon **in our timeslice** as arriving from A in the superposition between our space and the tangent space. Note that this tangent space is created *by the photon frame* at B only. That space then has no extent, as it is the space of the IMAGE seen by the observer. Since the space of the observed object expands along d during the travel of its photons to our galaxy, the image we receive from it **in our space** is expanded at location A, which is an image **in our timeslice** of the location A' of the galaxy in its own timeslice versus the location A'' *at the time of the emission in the originating space*. (This is another way of understanding the calculation made earlier, which was following a photon in its travel - the space expansion in essence is “diluting” the en-

² The book reports that gravitationally bound objects, like “pennies glued on a balloon,” do not expand.

ergy of the photon as seen from our space.) As an observer from another expanding space, we see then the galaxy in its present size in our own space (but in a FLAT UNIVERSE), and with its redshift related to its present true distance (arc A'B length in the space measuring rod) with our present measuring rods.

The single hypersphere model representing the universe cannot account for this effect since the observed galaxy and our galaxy expand *within the same space* in that model, and so our measuring rods have expanded also *in all directions* during the light travel, requiring the observed object to be seen *in its original much smaller size*, a conclusion which is against observations. (If we were in the other galaxy space, we would be then observing A" in Fig. 3a, which is much smaller.) In other words, there is no origin of expansion in the all-encompassing space model, so we cannot identify a direction for this origin. Anything "out there" emitting light and with an appreciable size, should be seen as smaller if it expands in time. We are in effect looking at its past size.

The analysis above is valid if the age of the observed galaxies is comparable to the age of our galaxy. With such "normal" galaxies, their redshift comes from an almost even superposition of our space and their space, so the observed redshift gives their approximate distance, having comparable measuring rods. **If on the other hand the galaxies are not of the same age, the redshift observed will NOT relate to the true distance, which is the arc A'B length in Fig. 3a, when using our present measuring rods.**

This understanding leads us then to identify objects such as quasars that appear to us very small. We see them in their present size as we have concluded

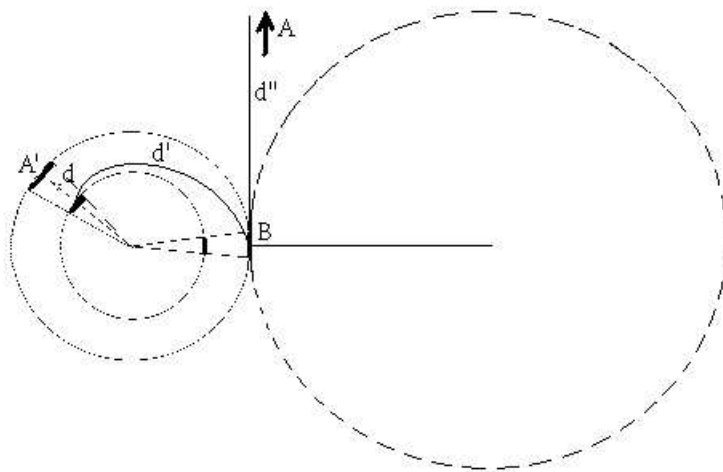


FIG. 3b. Quasar observation

above, so they must be very young galaxies, and their space has not expanded much by the time we see them. (Fig. 3b) We find however a high redshift for them per Arp (1998). This must be because (1) measuring rods for quasar spaces are much smaller than ours according to their relatively small space expansion, (2) **at constant**

speed of light among all spaces, their time must pass much faster, and (3) we see the redshift generated by their own space, not ours. They must be then much closer than their redshift indicates, (Arc A'B in Fig. 3b) as Arp (1998) en-

visioned, when using our own measuring rods: $d'' \gg d'$, $A'B \ll AB$. To find an approximation of their distance **with our measuring rods** we must then multiply their redshift by the ratio of their observed size to the size of our galaxy.

Conversely, very old galaxies compared to ours may be much farther away than their redshift indicates: $d'' \ll d'$, $A'B \gg AB$. (Fig. 3c)

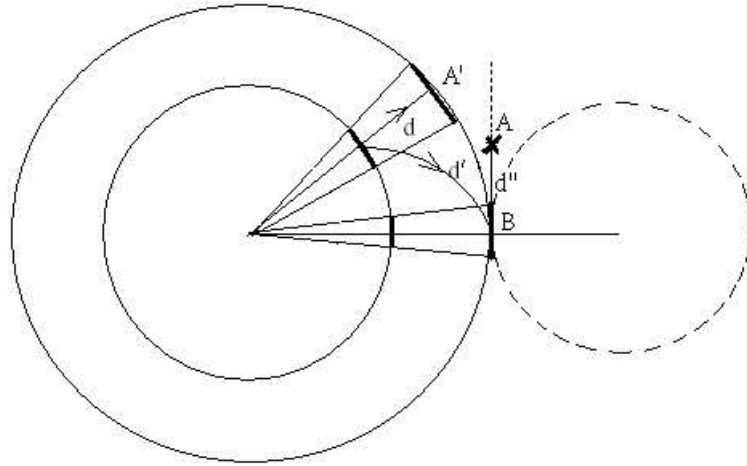


FIG. 3c. Old Galaxy Observation

High redshift observations

a. The observations

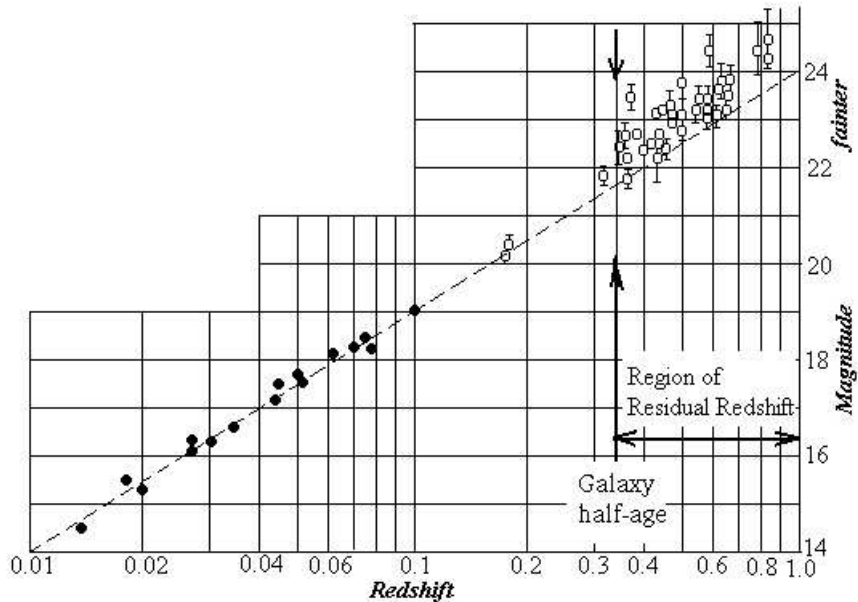
A set of standard candles (objects of known luminosity) spread throughout the visible universe has been used

to determine the redshift of “high redshift” objects (defined as $z > .3$). The distance is determined by comparing the known luminosity to the flux observed at Earth. Objects whose light was emitted at different times in the past can be evaluated by studying standard candles with different fluxes.

Observations of about fifty supernovae at redshift $z = 0.16$ to 0.83 have been obtained with a comparable number of closer supernovae ($z < 0.1$, Fig. 4

– The latest data from Reiss et al., 2004, adds 16 points

FIG. 4
Supernovae observed magnitude vs. redshift. The magnitude-redshift linear relation is shown as a dotted line extrapolated from low redshifts to high redshifts. Log-log graph layout per Bahcall *et al.* (1999), with data as reported by Perlmutter *et al.* (1998) and Reiss *et al.* (1998).



up to $z = 1.55$ showing the same trend above the Hubble line.). The results show that the distant supernovae (for $z > .3$) are fainter than if they were following the Hubble relation. Figure 4 plots a dashed straight line going upward for the luminosities corresponding to the Hubble relation. The observed brightness is in logarithmic units of magnitude versus redshift, which is also on a logarithmic scale.

b. The meaning of the observations

The data on the observed supernovae all fall above the Hubble relation straight line. In order to find *the reason for this change from the observed low redshift linear behavior*, we need to find what are the distances corresponding to the redshifts, as such are given in light-years, and thus correspond to a time in the past when the change happened. We shall then identify this change as corresponding to times *at that location* before our galaxy was seen as producing a *steady electromagnetic flux*. From the graph, *where the observed supernovae brightness starts deviating from the Hubble relation*, we get $z = .34 \pm 3\%$ or $(4.47 \pm 3\%) \times 10^9$ years per Eq. (3). We must use first a factor of 2 since that point is at half the round trip of light, and then multiply this also by a scale factor of 2 since at half its age the galaxy space was half its present size. From Fig. 4 interpreted in our model, we will then have

CONCLUSION #1:

- The supernovae observational data identify the electromagnetic age of our galaxy as $(17.9 \pm 3\%) \times 10^9$ years.

Our galaxy's age has been found to be $(19 \pm 3) \times 10^9$ years per Reid (1998), taking the oldest objects of the galaxy, i.e. globular clusters. So we obtain an excellent confirmation of our model here. (The Reid data is only $\pm 15\%$ accurate compared to our $\pm 3\%$ so we get a much more accurate age with our model.)

The graph shows also that supernovae whose light reaches us from before half our galaxy's existence are *not set on a curve as the post-galaxy start supernovae are (the Hubble straight line)*. These farther ones are instead **spread out vertically in brightness magnitude for a given observed redshift**. This feature can be explained through the fact obtained from our model that, at that time in the past, and at that location, our galaxy's space did not reach the area being traversed by the light. Eq. (6) would govern, and thus less redshift would be obtained for the same distances traveled by the light coming from the object if it followed Hubble's relation.

The observed spreads are **not** due to observational errors as a substantial number of error bars end way off the Hubble straight line, and no single reasonably drawn curve can fit all the experimental points (the referenced articles

draw such curves, but none of the published curves pass through all the error bars by far). As it has been pointed out in the referenced articles, the intrinsic value of the supernovae surveys came from the accurate readings of magnitude they allow, unlike other astronomical objects. Hubble and most subsequent observers could not make such precise measurements.

We shall also note that the grouping of supernovae at greater than .34 redshift does not appear to be an artifice of observational selection. Two separate surveys were made by different teams starting one at .16 and the other at .18 redshift, and both found the supernovae starting deviating from the Hubble line at around .34 redshift.

Separately, earlier analyses done within the universal expansion model (which then finds the need for a cosmological constant a.k.a. “dark energy”) do not account for the spreading of brightness magnitude at equal redshift as observed. If Hubble had observed such spreads he would not have come up with his relation, especially seeing the absence of spread at lower redshift.

We must then conclude that the observed variability at the same distance can only be produced by the objects located in-between the observed objects and our galaxy. For example, if object 1 in Fig. 5 was close to the path of the photon it would act as a “relay” whereby its space would have reached the high

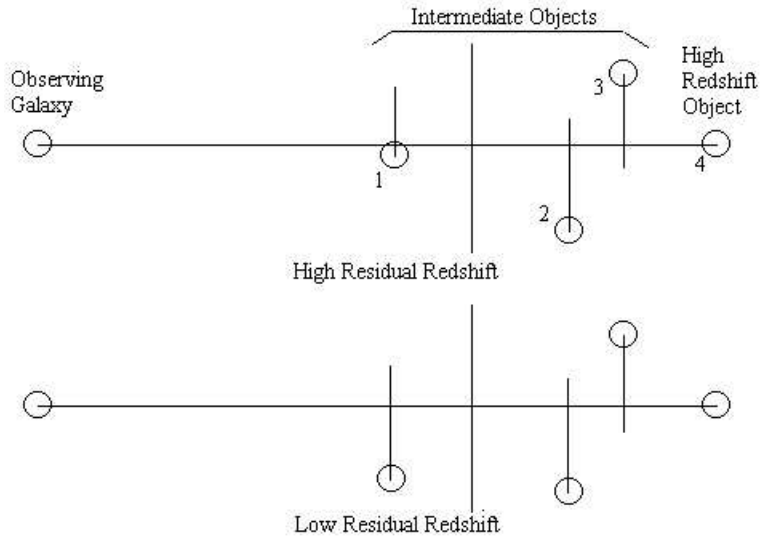


FIG. 5. Variability of residual redshifts.

redshift object and thus this object would be observed by us to be on the Hubble straight line.

CONCLUSION #2:

- High redshift supernovae are observed with a **residual redshift** coming from **intermediate** spaces from other galaxies existing in the area traversed by the light **before the space of our galaxy existed there**.

c. Other conclusions under the multiple hyperspheres space generation model

As we have just described, going further in the past before half the age of our galaxy, the observed residual redshifts come from local spaces traversed by

the light on the way from the supernovae. Such spaces are variable depending on the observed object, resulting in the spread of brightness magnitudes observed at a given redshift. What counts then is the fact the objects are “standard candles,” so in order to get their true distance their observed redshift needs to be *corrected* by assuming the Hubble relation still exists *to make up for the absence of our galaxy’s space*. We keep then the time scale as if our galaxy reached these points. Such an adjustment is only for somewhat making up for the absence of a yardstick. This adjustment is then done by projecting their brightness magnitude horizontally onto the Hubble straight line in Fig. 4.

The objects are then seen to be all at a greater distance than they are assumed to be when seeing the Hubble redshift as coming from a universal expansion. Fig. 4 shows that some of the supernovae need to have a redshift greater than 1. Since $z = 1$ corresponds to 4,000 Mpc or 26 billion years (with the scale factor of 2 coming from our galaxy’s half space expansion), they must be older than 26 billion years ($z = 1.3$ gives close to 34 billion years).

CONCLUSION #3:

- The high redshift supernovae are all farther away from us than found through an interpretation of the data using the universal expansion model.

CONCLUSION #4:

- The visible universe is much larger than found through the universal expansion model.

Astronomical objects such as gamma ray bursts have been found with redshifts up to at least 5 (Hjorth, 1999) corresponding to an age for these objects of *140 billion years* or more assuming they come through galaxies of our age. Of course they may be part of very young systems, as for quasars, and then their redshift needs adjustment. However, knowing certain high redshifts, the visible universe has to be *a lot* larger.³ Gamma ray bursts, like supernovae, are point-like objects in time, so they cannot generate a spacetime of their own. They just happen in the space superposition at their location and time.

A finite “zero point energy” in an infinite universe

Since the 18th century the so-called “naive” model of the flat absolute infinite universe (Weinberg, 1972, Chap. 16.1) raised the DeCheseaux-Olbers paradox because in that model the night sky should be bright instead of dark. Here is why following that line of thought. If absorption of light is neglected, the apparent luminosity of a galaxy of absolute luminosity L at a distance r from a given

³ That reference discusses the high redshift of quasars also, but we have seen earlier that quasars on the other hand may be much closer objects as their redshifts follow different measuring rods.

point in space will be $L/4\pi r^2$. If the density of such galaxies is a constant N , then the number of galaxies at distances between r and $r + dr$ is $4\pi N r^2 dr$ while the number of galaxies *visible from that point in space* is $4\pi N r dr$ due to the accumulation of galaxies absorbing the light from galaxies farther away in proportion to r . With r_0 being the average distance between galaxies corresponding to N , thus $N \propto 1/r_0^3$, the total radiant energy density due to all galaxies at that point in space is then

$$\rho_s = \int_{r_0}^{\infty} \left(\frac{L}{4\pi r^2} \right) 4\pi N r dr = LN \int_{r_0}^{\infty} \frac{dr}{r} \quad (8)$$

The integral *diverges* logarithmically, thereby giving an infinite energy density and thus the paradox.

Now, in the space generation model as we describe here, photons observed by us see their energy “diluted” according to their travel distance. We assume here that they follow Hubble’s relation; this is a conservative assumption because we saw that objects may have fainter luminosity than Hubble predicts at high redshifts. Then the energy E from galaxies at a distance D is such that

$$E \propto h\nu = hc/\lambda \quad \text{with} \quad \Delta\lambda/\lambda = HD/c . \quad (9)$$

From Eq. (8) the initial energy will be $dE_0 = LN/D dD$, and

$$dE = \frac{dE_0}{1 + \frac{H}{c} D} \sim \frac{c}{H} \frac{dE_0}{D} = \frac{c}{H} LN/D^2 dD \quad (10)$$

when $HD/c \gg 1$, giving a *background* radiant energy density

$$\rho_b = LN \int_D^{\infty} \frac{c}{H} \frac{dD}{D^2} = LN \frac{c}{HD} \quad (11)$$

which is *finite*. The divergence (and thus the paradox) has been eliminated. But why is the background dark? The *foreground* radiant energy coming from galaxies closer than D is

$$\rho_f = LN \int_{r_0}^D \frac{dr}{r(1 + \frac{H}{c} r)} \sim LN \text{Log} \frac{c}{Hr_0} \quad (12)$$

Since $c/HD \ll 1$ while $c/Hr_0 \gg 1$, $\rho_f/\rho_b \gg 1$ and the total radiant energy $\rho_s \sim \rho_f$, accounting for the observed dark background sky surrounding points of light at closer distance.

The finite result in Eq. (11) is also telling us that the energy density of space at any point can be finite even though the universe may be infinite, and can be related then to the “zero point energy” obtained through quantum mechanics.

The physical meaning of the Hubble constant

The Hubble constant over the speed of light H/c is the proportionality constant for Eq. (7). Within the monadic spaces concept described in Gouin (2004a), from our earlier analysis, it represents *the integrated number of monadic connections per unit of travel length that the photon fails to have with the space it ends up being observed in during its travel due to the non-zero number of other spaces in-between*. It is then a constant representing monadic space connection capabilities like the gravitational constant, but tied to radiation instead of matter (nuclei of atoms or ions).

The Planck scale (Penrose, 1994, p. 338) corresponds to the *matter spatial monadic* connections since the gravitational constant is involved in the definition of that scale. Using the value for H given earlier, $H/c = 8.0 \times 10^{-30}/\text{cm}$, the combination of all physical spaces at a given location would have the inverse or about 10^{29} *radiation* monadic connections per cm. We shall call the scale corresponding to this concentration the Hubble scale. It is 10^4 larger than the Planck scale. *The ratio between the Hubble and Planck constants then represents the relative ability of nuclei of atoms/ions to “warp” space vs. radiation*. A “flat” space (i.e. no gravitation) then has a concentration of spatial connections at the Hubble scale while a black hole has this concentration at the Planck scale. Areas where gravitation exists then correspond to spatial connections concentrations in-between these two scales.

Preponderance of matter over anti-matter

In our part of the universe matter is present, not anti-matter, and we observe one kind of neutrino chirality, not the other kind. With a universe of many space-matter systems evolving and expanding independently, it is highly probable that there is an equality of these types of contents, but since spaces interact only via their common events, annihilations have to occur well before we can observe the opposite kind of contents. It is then very possible that some or many far away galaxies are anti-matter types, with no way for us to tell since photons are their own anti-photons. The cosmology presented here could explain objects we are seeing at the present time without explanation in an all-encompassing space, from the fact we may be observing the product of local reactions between opposite contents somewhere and some time in the past of other expanding spaces.

Planck scale: The absence of blurring in far-away astronomical images

Are there such things as Planck scale phenomena in the proposed cosmology? The mathematical spacetime of GR is replaced by timeless physical spaces with only an existence in the present of physical events between their contents. We have seen in Gouin (2004c) that a “classical reality” provides a stream of tran-

sient realities selections among matter-space systems. Fluctuations in the definition of space must then exist in the classical definition of space and time within a given space system at extremely small scales. However, in the case of two spaces connecting through common events, ***there must be a single reality encompassing such events***; there cannot be any uncertainty on WHEN the events happen across the two spaces since these spaces are timeless (only streams of change occur). The interference fringes from a set of photons coming from another space won't never disappear due to fluctuations in their wavelength, as such fluctuations come from many realities interacting with the classical reality within each space.

This is what is observed in the Hubble Space Telescope Deep Field surveys (Ragazzoni et al., 2003), an observational fact, which then ***goes against a single all-encompassing space approach***. Photons coming from the same far away source (such as 5 billion years in the past) are indeed still producing interference fringes without blurs, and such blurs should be seen due to Planck scale fluctuations if the source and the observer were part of the same space.

Conclusion

An entirely different picture of the universe can be developed using the many-hyperspheres model of superposed spaces, with direct confirmation from independent and well-known observational facts of astronomy, including a flat universe without appeal to unseen matter and energy.

A direct physical reason for observing a flat universe is indeed justified, while for present cosmology this is an observational fact explained only through a very delicate sum of different energy contents, a balance ***very unlikely to obtain without an a priori fundamental basis, and such a basis is not provided by an all-encompassing space theory***. Additions of dark matter and energy, without experimental support after many years of search, allow this unlikely balance ***otherwise vital to the overall universal beginning and expansion model in order to fit the observed complete flatness***. (This flatness - within 2% per the latest WMAP data - cannot even be fully accounted for by these additions.)

Through the proposed approach, space also obtains a ***physical structure*** in a line long sought by Einstein, instead of being a mathematical form with no substance within his theory (as he was fully aware of at the time of publication – see Overbye, 2000). The unphysical “hole” problem he left in his theory as a result has been removed, as now space is no longer indetermined in a vacuum, i.e. this vacuum is no longer empty, as it is now a superposition of an infinite number of electromagnetic spaces with a resulting finite e-m energy density.

Indeed, the DeCheseaux-Olbers paradox is debunked, leading to a finite energy density of space related to the zero-point energy of quantum theory, while the universe can be composed of an infinite number of superposing spaces.

On the other hand, the indeterminism of ***space as a quantum entity*** (like

its contents) manifests itself in the fact observers create tangent spaces through their observation of other spaces, i.e. through the wave function collapse of the photons they observe. These tangent spaces are in effect observer-dependent as any quantum mechanical observation must be.

Also, time and space scales are now relative to the age of the spaces making up the universe, and so *cosmological distances have become relative to which space the observer is in, thereby extending the principle of Relativity*. The age and size of the observable universe components are seen much older and extended than previously thought, with now an inherent uncertainty about such data.

The initial Almeida model can be used to formalize the extended model, with a superposition of spacetime frames at common events using the density of the spaces participating in the superposition. The space generation saturation areas identified in that model apply directly to the many-hyperspheres model.

This extended model identifies Hubble's relation as limited to the observing space, and through supernovae surveys data, gives the age of our galaxy as $(17.9 \pm 3\%) \times 10^9$ years, in line with the observed age of the oldest objects found in our galaxy, which is then confirmed to be older than the universe under the universal expansion model.

The meaning of the Hubble scale vs. the Planck scale in the ontology of monadic spaces has been given, while the absence of anti-matter, the chirality of our neighborhood and the absence of Planck scale fluctuations in astronomical observations have found a justification.

We have not addressed the existing material composition "proofs" of a universal beginning (Rees, 2000), but *an ongoing self-renewal process* can be instead envisioned for the universe, as Gouin (2004d) discusses. Here it is believed that the various quantities of matter involved in such an analysis can be correlated to the processes that go on in the various types of active galactic nuclei. As to the cosmic microwave background within the presented model, it can only be the stochastic confluence of jets emitted by the various sinks of space present in the universe (Gouin, 2004e).

Acknowledgement: I thank Jose Almeida for the invention of his beautiful 4DO model and for very fruitful discussions on its many aspects. This new model has permitted to finalize at last a work on the meaning of space generation which was started back in 1998 and has remained posted on the Internet since 1999.

APPENDIX: The cosmological meaning of 4DO

In a **MATHEMATICAL** space defined only by gravitational interactions, following the 4DO notations of Almeida (2004b), taking the normalizing factors

$$\text{Length: } \sqrt{\frac{G\hbar}{c^3}} , \quad \text{Time: } \sqrt{\frac{G\hbar}{c^5}} , \quad \text{Mass: } \sqrt{\frac{\hbar c}{G}}$$

with Planck constant (divided by 2π) \hbar , gravitational constant G and speed of light c , with x_0 as radius and x_k as 3D coordinates on its 3D surface, an expanding 4D hypersphere is obtained via the skew frame vectors g_μ :

$$g_0 = \sigma_0 + \frac{x^k \sigma_k}{x^0} , \quad g_j = \sigma_j \quad (\text{A1})$$

where σ_μ is an orthonormed frame. The metric tensor of the space is defined by the inner product of these skew frame vectors:

$$g_{\mu\nu} = g_\mu \cdot g_\nu \quad (\text{A2})$$

With time defined as a geodesic arc length in this 4DO space

$$c^2 dt^2 = g_{\mu\nu} dx^\mu dx^\nu , \quad (\text{A3})$$

(as everything “goes at the speed of light” in both monadic spaces and 4DO concepts) the 4-velocity is then a vector of constant norm whose angle with the 0 axis (the proper time axis) takes any value between 0 and $\pi/2$:

$$v = g_\mu \dot{x}^\mu , \quad (\text{A4})$$

where “dot” over a variable means time derivative. The spatial velocity can have magnitudes between 0 and the speed of light.

Electromagnetic interactions develop the PHYSICAL space modeled by the following skew frame (Almeida, 2004a):

$$g_0 = \sigma_0 + \frac{qA^\mu \sigma_\mu}{m} , \quad g_j = \sigma_j \quad (\text{A5})$$

where $A = A^\mu \sigma_\mu$ represents the vector potential, with the space metric coming from Eq. (A2):

$$g_{00} = \left(1 + \frac{qA^0}{m} \right)^2 , \quad g_{0j} = g_{j0} = \frac{qA^j}{m} , \quad g_{jk} = \delta_{jk} \quad (\text{A6})$$

The vector potential makes the hypersphere expand at the speed of light. Comparing with Eq. (A1), Eq. (A5) gives the frame representing the hypersphere generated by the e-m interactions. The velocity is then

$$v = \frac{qA}{m} \dot{x}^0 + \sigma_\mu \dot{x}^\mu \quad (\text{A7})$$

Almeida (2004a) shows that photons **in the absence of matter** will describe great circles following Maxwell’s equations within such a hypersphere.

The curvature (“medium indices” in 4DO) of an *e-m space containing matter* must be then a *combination of matter and e-m flux curvatures* based on the relative *density of matter vs. the e-m flux*. The shape must reflect the fact matter goes at a speed less than light, so any area with matter must be less expanded. An expanding hypersphere containing a single galaxy as source of the space may be represented on a sheet of paper by replacing 4DO with a visualizable “3DO”, time-frozen in a spacelike slice (Fig. A1).

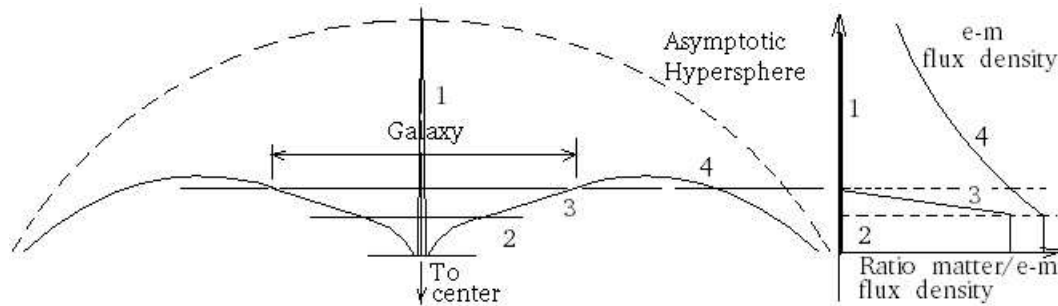


FIG. A1 - A 4DO hyperspherical spacelike slice for a spiral galaxy

Region 4 is outside the galaxy and its e-m flux decreases in $1/r^2$. The curvature of the space there being similar to a gravitational curvature, *Einstein's rings* may be observed, **but such rings do not come from gravitation**.

Region 3 in the galaxy (assumed to be a spiral) has a ratio of matter/e-m flux density smoothly decreasing, and where, the motion of matter is driven solely by the galaxy expanding at the same rate as the hypersphere, giving $\dot{r} / r = H$, with H being the Hubble constant, per Almeida (2004a). Elliptic galaxies do not have such a region per Romanowsky *et al.* (2003).

Region 2 is the central area where there is a constant ratio matter/e-m flux, and thus the space curvature follows General Relativity.

Finally, Region 1, being void of matter as a remnant of the white hole that started the space, must be a long narrow cone with its apex reaching the asymptotic hypersphere part of intergalactic space. Such a central void has been observed in the Andromeda galaxy, per Ciardullo and Rubin (1988), who imagined a “galaxy wind” there. Being a local sharp edge of the space, this galactic nucleus must be the stage of large scale quantum phenomena involving matter and space. Gouin (2004d) looks at a key consequence of this feature.

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