The James Webb Space Telescope (JWST) Anomalies Resolved

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Abstract

A model of the universe is offered that can derive the Hubble Constant independent of empirical measurement, using just a midline estimate of the age of the universe and simple arithmetic calculations. It can explain the JWST discoveries of apparent anomalous early galaxy formations without need of substantial revisions to established astrophysical theories, as the new findings have seemed to require. Concepts of "Dark energy", cosmic flatness, cosmic inflation, and an accelerating expansion of the universe are rendered unnecessary or at least partly misinterpreted.

Key Words

Cosmology, Astrophysics, James Webb Space Telescope, JWST

Introduction

16 The James Webb Space Telescope (JWST) has brought considerable astrophysical disarray with the discovery of
17 primordial galaxies, which by their apparent distances and ages seem to undermine the established model of the
18 universe. Several galaxies have appeared to be even older than the universe, and many seem to be well formed
19 much earlier than it was thought possible.

20 Astrophysicists have adapted to the new evidence with commendable flexibility, abandoning the established theory
21 of galaxy formation that predicted some two billion years of prerequisite development. But the previous consensus
22 was based on persuasive considerations, and an interpretation that would restore much of the conventional
23 understandings should be considered worthy of serious investigation.

24 I contend that the JWST anomalies can be resolved with a cosmological model that restores the newly discovered
25 galaxies within previously expected timeframes. The universe will be represented here as a four-dimensional
26 (hyper)sphere -- not a "hypersphere" (a mathematical model consisting of numerous spatial dimensions) -- but
27 rather, a three-dimensional spatial surface with the fourth dimension being an immaterial interior, the dimension of
28 time. The sphere is considered to expand at the speed of light in all directions, with time impelling the enlargement,
29 advancing a constant one year of radius with a corresponding *pi*-relation that expands the surface of the sphere with
30 acceleration. The model conforms to the concepts of spacetime of Einstein[1] and Hermann Minkowski[2], but with
31 the relativity of interactions playing out only on the surface of the (hyper)sphere. I have discussed the idea of time
32 in its dynamic relation to space in detail elsewhere[3], but will focus here only on the proposed cosmological utility
33 of the concept.

34 My hypothesis departs from the prevailing belief among many astrophysicists that the universe is flat, and anyway,
35 recent findings have already undermined that consensus, renewing preferences for various shapes other than
36 flatness, including the spherical.[4] An important aspect of the flat universe theory has been a belief that the energy
37 of outward expansion would have to be balanced by the energy of inward gravitational pull, but in the model I am
38 presenting, gravitation is lateral along the surface, and is independent of the radial expansion.

39 Several demonstrations of the utility of conceiving a four-dimensional universal (hyper)sphere will be explored, first
40 showing how it results in a rate of area enlargement in-line with the various estimates of the Hubble Constant,
41 calculated independent of empirical input or analysis -- just an assumed universal age of 13.75 billion years.
42 Second, it will be shown how the principal anomalies (the unexpected discovery of apparently extreme ages,
43 brightness, and maturity of distant galaxies) found by the JWST can be resolved according to the same spherical
44 model. Third, it will be argued that the model eliminates the need for various theoretical constructs like cosmic
45 inflation and dark energy, given that a *uniform* increase in the radius of a sphere, driven by time, is what produces an
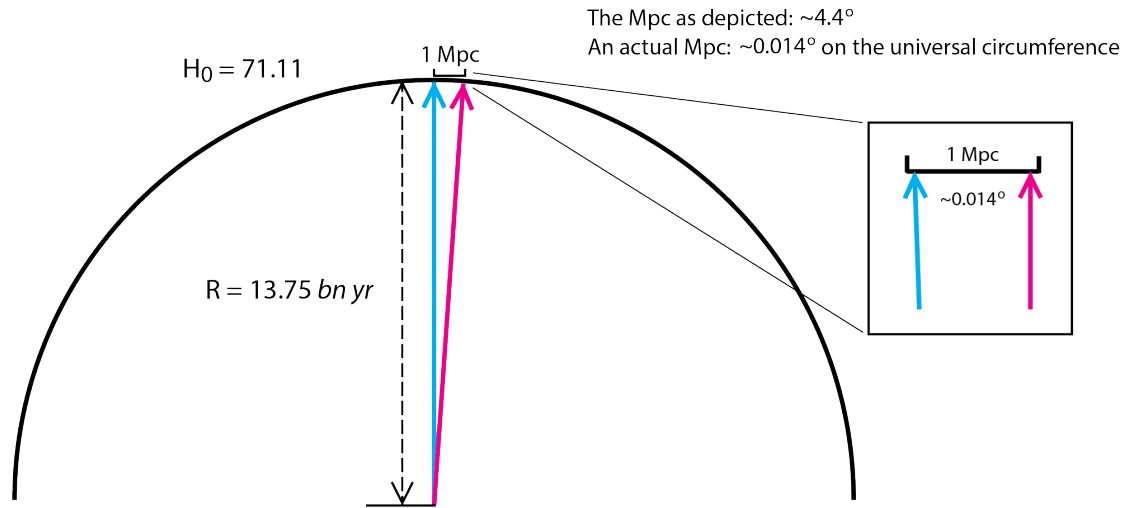46 *accelerating* expansion of its area.

47

1

49 **Figure 1** treats the universe as a "(hyper)sphere" with a current radius (**R**) = 13.75 *bn* yr (billion years), and a
50 Hubble Constant (H_0) of 71.11 km/sec/Mpc. Both numbers fall within the margins of commonly accepted estimates.

51 Space is treated as the surface of a four-dimensional (hyper)sphere with a radius expanding at the speed of light in
52 all directions. The Hubble Constant H_0 is derived from 1) a radius of 13.75 bn yr, 2) the *pi* ratio of surface to area,
53 and 3) the ratio of one Mpc to the surface at a given time.

54

Figure 1

The Mpc as depicted: ~4.4°
An actual Mpc: ~0.014° on the universal circumference

$H_0 = 71.11$

1 Mpc

$R = 13.75$ *bn yr*

1 Mpc

~0.014°

THE UNIVERSE
(its "northern" hemisphere)

The circumference of the (hyper)sphere: $c_1 = 2\pi R = 8.63937979737193 \times 10^{10}$ lyr (light-years)   (1)
Circumference +1 year: $c_2 = 2\pi(R+1) = 8.63937979800025 \times 10^{10}$ lyr   (2)
Increase of the circumference in the most recent year: $c_d = c_2 - c_1 = 6.2831878662$ lyr   (3)
Megaparsecs in the circumference at year c_2: $m = c_2 \div 1$ Mpc* $= 2.64884588779 \times 10^4$ Mpc   (4)
Derive the c_d per 1 Mpc: $c_m = c_d \div m = 2.37205192993598 \times 10^{-4}$ lyr   (5)
Convert c_m to km: $c_k = c_m \times 9.4607304725808 \times 10^{12}$ km $= 2.24413439752492 \times 10^{12}$ km   (6)
Divide by seconds per year: $H_0 = c_k \div 3.15576 \times 10^7 = 71.11$ km/sec/Mpc   (7)

(*See *note 5* for Mpc converted to light-years and km per light-year)

The assumption of the age of the universe and the derivation of the Hubble Constant are roughly in the middle of current empirical estimates. (If for example the age of the universe is held instead to be 13.5 *bn yr*, H_0 is 69.82; if it is 14.0 *bn yr*, H_0 is 72.40.) I maintain that the close correlation between the advancing cosmic radius on such a (hyper)sphere and the expansion of the arc on the surface per an Mpc (H_0) suggest at least a remarkable coincidence, worthy of investigation.
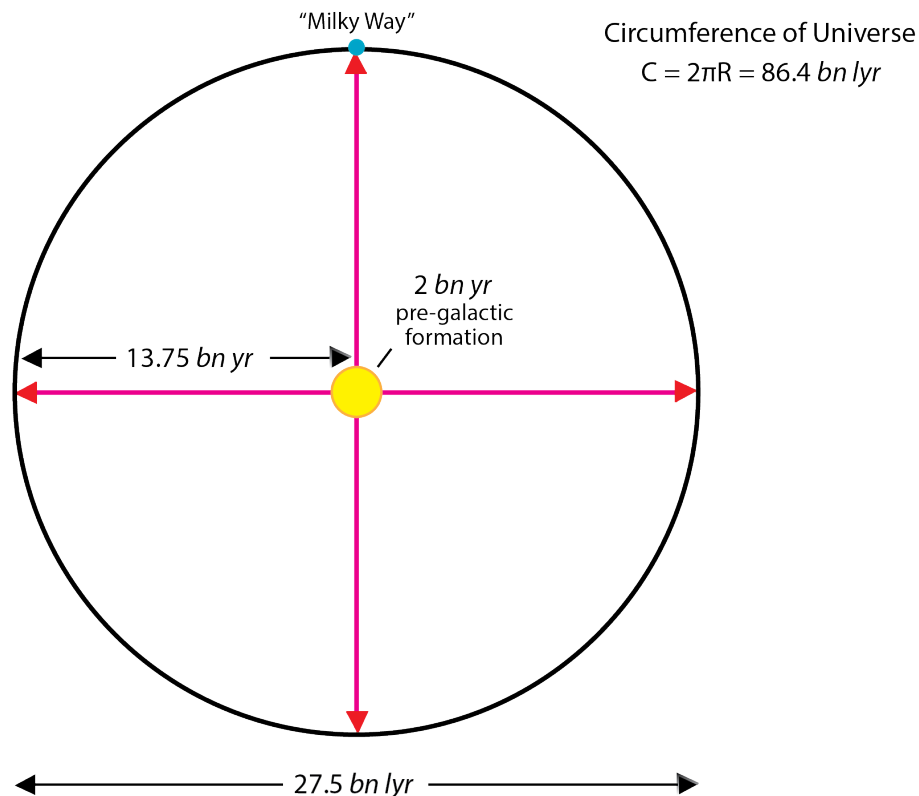
If it is objected that the model is inconsistent with evidence that the universe appears to be flat, an Mpc on such a (hyper)sphere would comprise only 0.014° (of 360°) on the circumference, and space would therefore be nominally flat for more than an Mpc in every direction.

Figure 2 provides an overall view of the (hyper)spherical model in two dimensions.

Figure 2

The small yellow sphere surrounding the center in **Fig.** 2 represents the age when galaxies have been thought to have first formed, at about 2 billion years. In this regard, I have adhered to a pre-JWST expectation.

A diameter of 27.5 *bn lyr* yields a circumference of 86.4 *bn lyr*, even less than a recent estimated universal diameter of 93 *bn lyr*[6] and even that magnitude is only of the "observable universe." But although a sphere is, of course, three dimensional, the (hyper)sphere is four-dimensional, with a four-dimensional *surface* (an admittedly hyper-intuitive concept), which indicates a universal spatial volume larger than conventional estimates.

It is commonly thought that the universe is expanding at an accelerating rate due to "Dark Energy." But given the calculation of the surface area of a three-dimensional sphere ($A = 4\pi r^2$), and disregarding the implications of a four-dimensional surface ($A = 4\pi r^3$?), at a radius of 13.75 *bn yr* the surface would be 2375.83 *bn lyr*^{2} (billion light-years); adding +0.25 *bn* to the radius, at 14.00 *bn*, the surface would be 2463.01 (an increase of 87.18); adding another 0.25 to the radius, at 14.25 *bn*, it would be 2551.76 (an increase of 88.75). Thus, as the radius of the universe increases at a constant *c*, its surface area increases with acceleration. Time, as a universal dynamic, thus determines a uniform expansion of the radius of the universe and an accelerating surface-area, with no need of a "cosmological constant", or a "dark energy."

Regarding the aspect of time in the (hyper)sphere model, recall that Einstein's and Hermann Minkowski's Special Relativity revealed time and space to be a continuum (as spacetime), with time as the dynamic aspect -- a physical *principle*, not an *energy*. Cosmologically, the dynamic of time can be interpreted as that which drives universal expansion in every direction on the surface, and at the speed of light, i.e., the *speed of time* (described in detail in *reference note 3*), without invoking the oddities involved with the idea of "dark energy" (which would become the bane of current cosmology): A supposed inexhaustible force that was first offered to provide a cosmological period of accelerated expansion to explain the uniformity of the cosmic microwave background, and more generally, to offer a relentless, actually un-force-like, un-energy-like effect against the resistance to such an energy by the mass of the universe.

2

101 **Figure 3** is a two-dimensional "look-down" view on a hemisphere of the model, which will be developed in what
102 follows to explain the apparent anomalies discovered by the JWST.

Figure 3

103
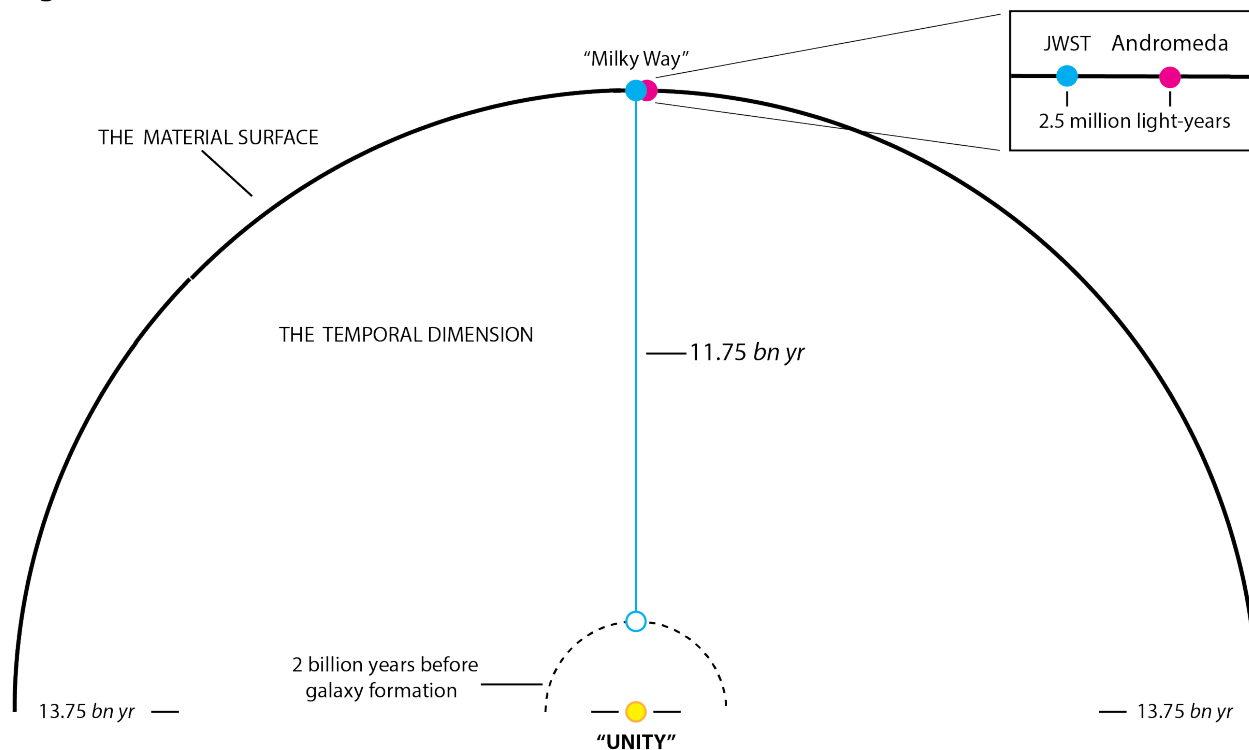
104 (I prefer the term "Unity" to "The Big Bang"; the latter seems tantamount to
105 referring to a god or "God" in an otherwise serious theology as "The Big Guy.")

106 The blue vector shows the Milky Way advancing in time along a radius of the universal (hyper)-sphere from its
107 formation at 2 billion years after "Unity" to its present age of 11.75 *bn yr*.

108 The magnification shown in the expansion box at upper-right illustrates the immensity of the scale being viewed: At
109 relatively short distances, spatial expansion and curvature are insignificant. The distance to the Andromeda galaxy,
110 a separation of about 2.5 million light-years, is only about 0.00003 degrees of separation on the surface of the
111 (hyper)sphere, which is therefore nominally flat.

112 **Figures 4** thru **6** use the cosmological (hyper)sphere model to explain the most troubling anomalies so far observed
113 by the JWST: the apparently excessive ages, sizes, brightness, and precocious development of newly found galaxies.

114 Distances here and in the following diagrams will be idealized, as any relatively minor local factors such as
115 gravitation can be ignored.

Figure 4
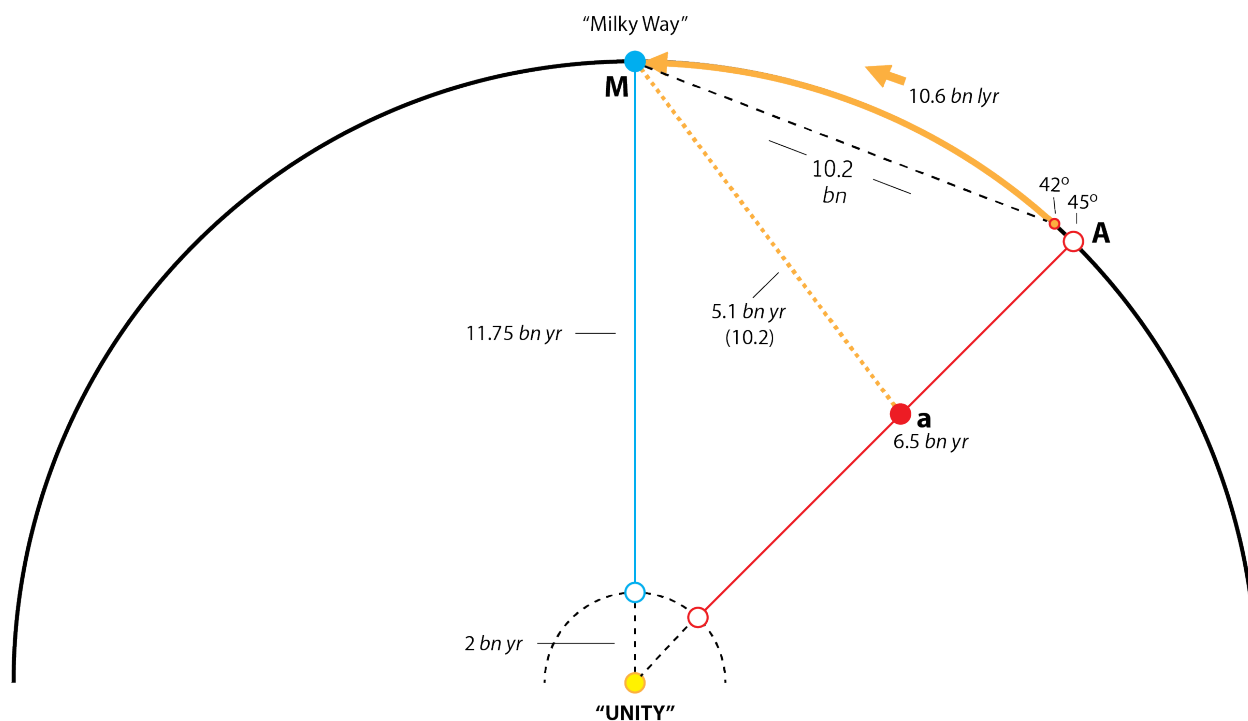
118   The progression through time of galaxy **A** is represented as a vector on a two-dimensional surface. Like our galaxy,
119   it is advancing with the radius of the (hyper)sphere at the speed of light (which is equated with the speed of time) at
120   a 45° angle from our galaxy. With minor fluctuations due mainly to gravity, galaxies maintain their orientation in
121   the expanding universe and continue to progress along a consistent trajectory at this scale.

122   The vector **aM** emanating from point **a** represents the radiation of light from **A** toward our galaxy from its age of 6.5
123   *bn yr*, arriving here at the present time. Point **a** is the unique position on **A**'s progression where the distance from its
124   origin to its location at the emission, summed with the length of travel of the light to our galaxy, equals
125   approximately 11.75 *bn yr*, the current age of both galaxies. As a ray of light having a length of 5.1 *bn yr*, vector
126   **aM**, is actually 10.2 *bn lyr* in length. This is because unlike galaxies, which advance in time along their radii on the
127   surface of the (hyper)sphere, light both advances with time and moves independently across space at light-speed, so
128   it arrives at **M** in approximately half the time that is indicated by the distance. (The distance light must travel
129   increases due to the expansion of space, but it is insignificant, less than 0.1 light-year per billion years.)

130   Three representations of the light ray are shown in **Fig. 4**: Vector **aM** displays it as flat, as from a perspective
131   looking down on the sphere as on a two-dimensional semi-circle. The arc **AM** represents the same ray of light in
132   profile, traveling along the surface of the sphere as-if by a 90° rotation of the diagram to place it on the horizon.
133   The chord of **AM** is the same length as **aM**, but it is set in profile at the horizon to display the contrast between the
134   "look-down" and the profile views. This is useful for a comparison of the apparent flat-vector travel of light **aM**
135   with that of the actual arc **AM**. The arc is about 4% longer than the chord for **A**, but as will be seen, the differences
136   between arc and chord increase with the distances between other galaxies and **M**. The speed of light is not exceeded
137   in any case, but combined with the expansion of space. And all such differences, between the lengths of flat vectors
138   and arcs, are essential to an understanding of the principal JWST anomaly:

139   **Galaxies appear more distant than expected because space is curved, and time is linear.**

140   **Figure 5** illustrates the contrast of a galaxy **B**, set at 90° distant from **M** along the circumference, twice as divergent
141   from **M** as **A**.

Figure 5
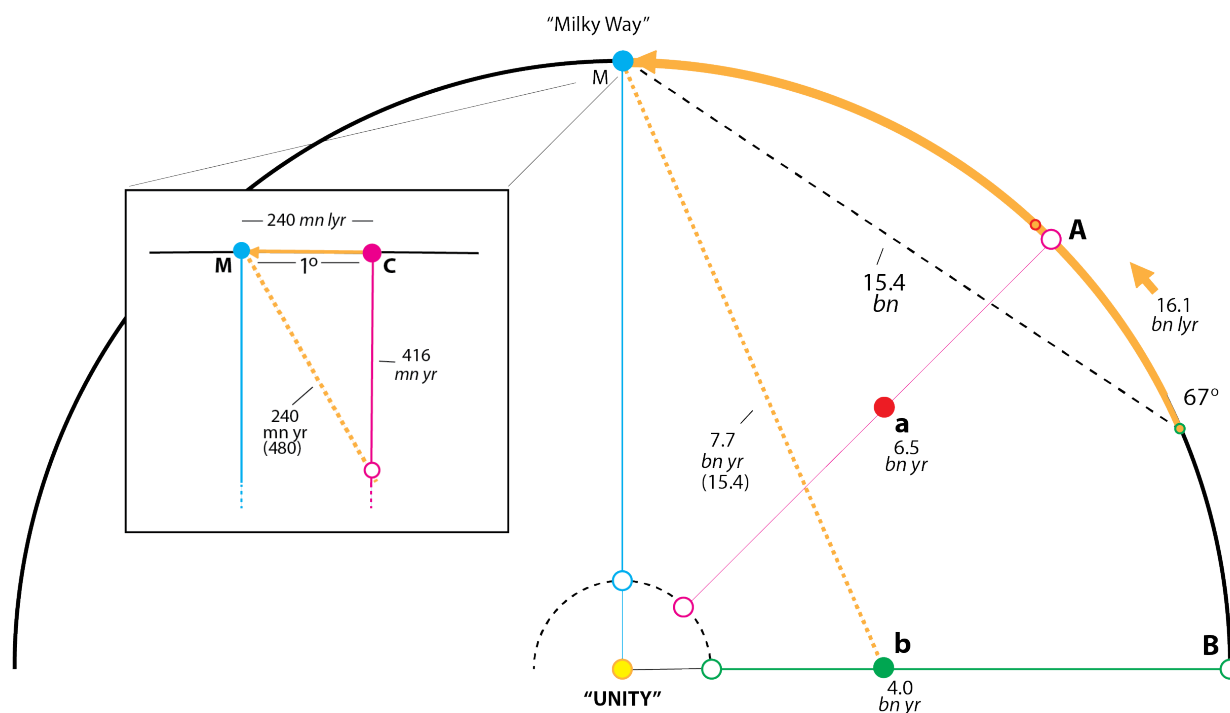
142

143 The radiation of light from **b** to **M** is emitted at **B**'s age of 4.0 *bn* yr. The light travels 7.7 *bn yr* to reach our galaxy,
144 which will be 15.4 *bn lyr* distant at reception along the vector **bM**. Galaxy **B** appears to us as it was approximately
145 7.75 *bn yr* ago. The actual arc of travel, from 67° along the surface toward **M**, extends 16.1 *bn lyr*, about 5% longer
146 than the corresponding chord. The highly divergent vector of **B** relative to **M** also contributes to an initial red-
147 shifting of **bM** due to the relative recession of its source at emission, but it is relatively insignificant, and can be
148 ignored here**.**

149 Before the installation of the JWST, the distances to observable galaxies showed negligible discrepancies between
150 their separations in time (of their radii on the (hyper)sphere) and space (along the surface). Only now, with the
151 power of the JWST, have some significant differences become apparent. The variance of Galaxy **A**, at 45° from **M**
152 on the circumference, might not be noticed to provoke controversy. But the vector of Galaxy **B** at 90° from **M**
153 produces a more significant variance between space and time similar to galaxies that have recently been observed by
154 the JWST. The light from **B** will seem as reaching us from more than 16 *bn lyr*. Having traversed an arc at 67°
155 from **M, B**'s radiance will be calculated by its highly shifted wavelength, which not even counting the 2 *bn yr* prior
156 to galaxy formation, will make it seem older than the universe. And its actual age at emission, 4.0 *bn yr*, will make
157 it appear abnormally large and bright at the apparent distance.

158 The expansion box at the upper left on **Fig. 5** illustrates by contrast a more local relationship than can be represented
159 on the scale of the hemisphere. Galaxy **C**, at a current distance of just 240 *mn l*yr (million light years) from M**,** is
160 progressing almost parallel with **M** on the virtually flat surface of the very small segment of the sphere. About 416
161 *mn* yr ago (million years) ($b^2 = c^2 - a^2$), galaxy **C** emitted light that has traveled 240 *mn lyr* and also progressed
162 along with the universal radius 240 *mn yr* to arrive here and now. The arc of travel on the surface and the
163 corresponding chord are indistinguishable at this scale.

164 **Figure 6** illustrates how even light from the most distant possible source in the universe could at least potentially
165 survive the journey to be detected here, if only with an occasional photon.
166

Figure 6
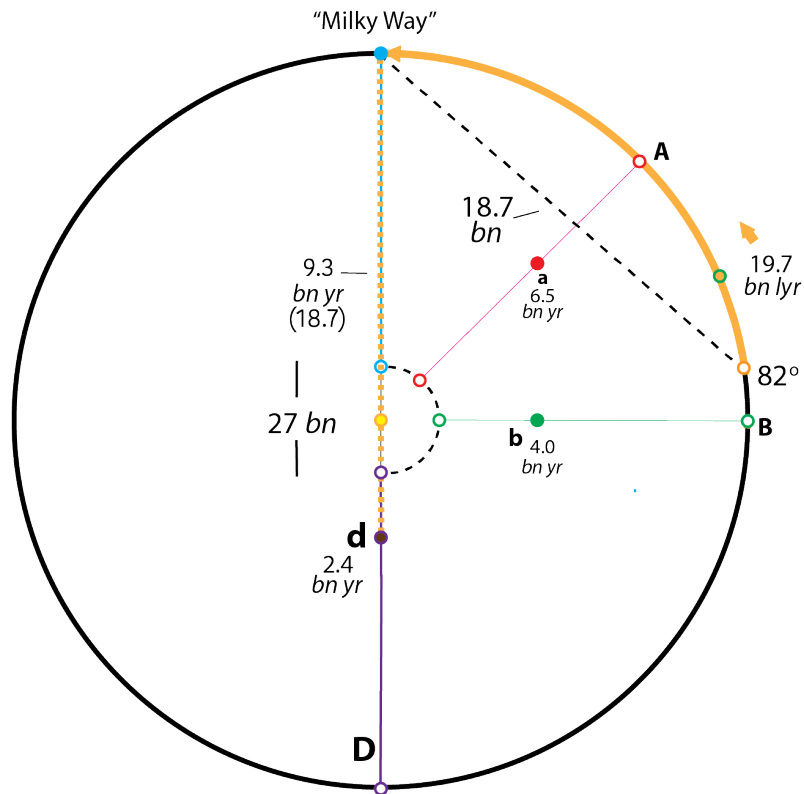
167
168
169   Galaxy **D** is advancing along the radius of time at 180° from ours. For light to be visible from that distance, if only
170 in principle, it would have to be emitted at point **d**, at **D**'s age of approximately 2.4 *bn yr*, and it would have to travel
171 without interception along the surface of the (hyper)sphere for 19.7 *bn lyr* in 9.3 *bn yr* of time -- a theoretically
172 possible but extremely unlikely and no doubt prohibitively faint occurrence due to the progressive dispersion of the
173 light.

174   To make clear what the two-dimensional representation may obscure, the light from point **d** may seem to traverse a
175 region backward in time, before galaxy formation. But all physical activity occurs on the surface of the universal
176 sphere, every direction on the surface is homologous, and events that occurred on the earlier surface (like that at the
177 2 *bn yr* radius after pre-galactic formation) no longer exist when the subsequent expansion of the surface develops.

178   The example of galaxy **D**, given the factors assumed by the model, has emitted light 2.4 *bn yr* after galaxy
179 formation, and its characteristics of size and brightness are as may be observed at our galaxy at the present time. Its
180 wavelength as observed is determined not by the 9.3 *bn yr* it has taken to arrive, but by the 19.7 *bn lyr* it has
181 traversed across the intervening expanding space. Its age might be estimated by present convention to be at least
182 19.7 + 2.4 *bn yr*. This is what accounts for the seeming perplexity of the phenomena brought to us by the JWST.

183

184 **3**

185   Several theoretical oddities discovered by the JWST and several cosmological problems are resolved with the
186 present model. The apparent accelerating expansion of the universe commonly attributed to "dark energy" and the
187 reintroduction of "the cosmological constant" have already been addressed, but it may need to be repeated: An
188 acceleration of the expansion of the surface of a sphere is the product of the linear, or *constant* increase of the radius.
189 (And we can ask: Whatever the shape of the universe, what sort of "energy", dark or otherwise, would maintain a
190 relentless, or even *increasing* pressure against an expanding surface or range?)

191 The dynamic of time, a ubiquitous and self-evident everyday principle, can be invoked (with less taxation on the
192 imagination) to describe a constantly extending radius which only secondarily determines an accelerating surface
193 (by $A = 4\pi r^2$ or $4\pi r^3$). Time is already inextricably linked to space as *spacetime* in Einstein's and Minkowski's
194 formulations, so invoking time as *the* fundamental cosmic dynamic, expressed in all the various interactions and
195 relative deviations on the surface of the (hyper)sphere, requires no additional principle such as "dark energy" or
196 "cosmic inflation."

197 The "Horizon Problem" or "Hubble Tension" has arisen due to evidence of a homogeneity of the universe that has
198 evidently been beyond possible causal integration, as is suggested by the cosmic microwave background. But the
199 various solutions that have been devised to try to understand the problem are likewise resolved with the present
200 model of a unified (hyper)sphere driven by a central principle: time.

201 The Cosmic Microwave Background radiation (CMB) that has evaded absorption by mass until now has been
202 circling the universe for about one-and-a-half billion years more than the earliest mass and "foreground" radiation of
203 the universe. Consequently, it has an estimated Hubble number of only 67.4 +- 0.4, significantly less than galactic-
204 era radiation. The current model can attribute CMB degradation as due to both its age and to so many near-misses
205 with gravitational influences.

206
207 Conclusion

208 The idea of a four-dimensional (hyper)sphere expanding with time might be criticized as fanciful or exotic. But
209 popular alternatives, such as the idea of an infinite flatness in three dimensions, and the *ad hoc* revisions of galactic
210 evolution, are hardly more scientifically compelling. And those various models don't serve to resolve the JWST
211 anomalies.

212 The present model of the universe has been shown to be consistent with calculations, notably the Hubble Constant,
213 and by some calculation of assumed age according to its characteristics, and its distance according to a combination
214 of wavelength as a component of travel time and space expansion. It serves to explain how there is nothing actually
215 anomalous about the distant galaxies being discovered by the JWST, which only seem to be more distant, brighter,
216 and more fully developed earlier than expected. The ideas of "cosmic inflation" a model invoked as an explanation
217 for the evident homogeneity of the universe, "dark energy", and the "cosmological constant" are in the present
218 hypothesis unneeded. The newly discovered phenomena are understood to be entirely due to the oddity of four-
219 dimensional spherical geometry, with no need for *ad hoc* inventions like premature galactic development or a pre-
220 "bang" population of residual galaxies from previous universes. It is an admittedly *odd* solution being offered here,
221 but it is not a resignation to odd anomalies. And it is all just because space is curved, and time is linear.

222
223   If Hubble'd derive his Constant
224   from the studied stars tomorrow
225   t'would be regarded confirm'shun
226   of this the proffered model.

227
228
229 Notes

230 **1**. A. Einstein, "On the Electrodynamics of Moving Bodies" ("Zur Elektrodynamik bewegter Körper" in Annalen
231 der Physik 17:891, 1905), translated in The Principle of Relativity, Methuen and Company, Ltd., London, 1923.

232 **2**. H. Minkowski, (1908) Space and Time. The 80th Assembly of German Natural Scientists and Physicians,
233 Cologne, 21 September 1908, 133-216. Space and Time (1920) by Hermann Minkowski, translated from German
234 by Meghnad Sahal. The German Original: Raum und Zeit (1909), Jahresberichte der Deutschen Mathematiker-
235 Vereinigung, 1-14, B.G. Teubner. A Lecture delivered before the Naturforscher Versammlung (Congress of Natural
236 Philosophers) at Cologne — (21st September, 1908). In The Principle of Relativity, Meghnad Sahal, (1920),
237 Calcutta: University Press, pp. 70-88

238 **3**. See "Time as the dynamic aspect of the continuum", J. Arnold,
239 https://eujournal.org/index.php/esj/article/view/5275. The article provides a relevant and helpful corollary: It is
240 determined that "the speed of light and the speed of time are equivalent. Given the equivalence of world-lines
241 [provided in an alternative spacetime diagram], given the perpendicular relationship between space and time

expressed by the Lorentz transformations, and given the world-line of light as lying along the x-axis [in the spacetime diagram], distance in time must be equal to distance in space: One second in time is the same distance, but in a perpendicular direction, as ~300,000 km in space."

4. "What Shape Is the Universe? A New Study Suggests We've Got It All Wrong", Natalie Wolchover, Quanta Magazine. "If all the matter and energy in the universe, including dark matter and dark energy, adds up to exactly the concentration at which the energy of the outward expansion balances the energy of the inward gravitational pull, space will extend flatly in all directions."

5. Mpc: $3.2615637769443 \times 10^6$ ly
Km per ly: $9.4607304725808 \times 10^{12}$
Seconds per year: 3.1557600×10^7

6. Bars, Itzhak; Terning, John (2018). *Extra Dimensions in Space and Time*. Springer. pp. 27–. ISBN 978-0-387-77637-8.