Entire Universe has been Expanding at the Speed of Light (Part2) / Comprehensive Study of Cosmological Gravitational Redshift

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Abstract:

The profound revelation that our entire universe is undergoing inflation at the precise velocity of light has ignited a need for reevaluation of our understanding concerning the fundamental characteristics of dark energy, dark matter, and the overarching topology of the cosmos. Building upon these groundbreaking insights established in Part 1 of our investigation, this Part 2 endeavors to meticulously quantify the phenomenon of Cosmological Gravitational Redshift. This quantitative assessment is undertaken to enhance and complement the initial findings in Part 1, thus contributing to a more comprehensive comprehension of the universe's intricate dynamics.

Introduction:

The present study serves as a continuation of our prior research (referred to as Part 1), titled 'Entire Universe has been Expanding at the Speed of Light / Comprehensive Study of the Hubble Constant throughout the Ages of the Universe' *(1)*. In Part 1, we demonstrated that the universe is undergoing expansion at the speed of light, grounded in an extensive examination of the Hubble Constant. Our analysis yielded calculated celestial redshift values that exhibited a notable congruence with observation data gleaned from the NASA/IPAC Extragalactic Database (NED) spanning the most recent 8 billion years.

However, in the initial 5 billion years following the Big Bang, the calculated redshift values with our model exhibited a more pronounced deviation from the NED observational dataset, particularly as the galactic objects' distance increased. This divergence was attributed to the dominant influence of the gravitational redshift effect during the universe's earlier compact state, as expounded in Part 1.

The principal objective of the present paper is to quantitatively assess the cosmological gravitational redshift. This endeavor aims to provide a complementary investigation to the findings presented in Part 1 of this research.

Main Text:

In Part 1 of our study, we established that the entire universe is currently expanding at the speed of light. This insight emerged from a comprehensive analysis of the Hubble Constant, a pivotal factor in understanding cosmic expansion.

The existing Hubble constant value of [70 ±3 km/s/mpc *(2)*] can be interpreted as the Speed of light [299,792.458 km/s *(3)*] divided by the current Age of the Universe [13.8 Billion years *(4)*], taking into account the conversion factor of 1 mpc = 3.26 million light years.

Extending our investigation, we seek to extrapolate this phenomenon back to the inception of the universe, suggesting that the universe has consistently expanded at the speed of light since the moment of the Big Bang. Our analysis produced calculated celestial redshift values that closely aligned with observational data obtained from the NASA/IPAC Extragalactic Database (NED) spanning the last 8 billion years.

However, during the initial 5 billion years following the Big Bang, the calculated redshift values revealed a more pronounced divergence from the NED observational dataset, particularly as the distance of galactic objects from earth increased. This disparity was attributed to the prevalent influence of the gravitational redshift effect during the universe's earlier compact state, as elaborated upon in Part 1.

The primary aim of this paper is to quantitatively evaluate the cosmological gravitational redshift within the initial 5 billion years following the cosmic origin. This pursuit serves as a complementary exploration to the conclusions elucidated in Part 1 of our research.

Methodology:

The gravitational redshift, known as the Einstein Shift, elucidates the alteration in the wavelength of light due to the gravitational influence of massive objects. This effect is mathematically defined as:

Gravitational Redshift $z = \Delta\lambda / \lambda = GM / c^2R$

Where: λ is the initial wavelength of light
$\Delta\lambda / \lambda$ is the fractional change of wavelength of light
G is the universal gravitational constant
M is the mass of the gravitational source
c is the speed of light in vacuum
R is the distance between the center of gravity of M and the observer

In the context of our study, we posit that the gravitational redshift induced by the cumulative Mass-Energy content (M_u) of the universe upon a galactic object is inversely related to the distance of said object from the point of origin, the Big Bang singularity. This relationship can be succinctly expressed as:

Gravitational Redshift $z = \Delta\lambda / \lambda = k / R$

(Here, k represents a constant, defined as $G M_u / c^2$, signifying the strength of the universe's gravitational field.)

Acknowledging that gravitational effects are most pronounced in proximity to massive gravitational sources, our methodology hinges on the analysis of distant galactic objects (i.e. when the universe was very young) to attain a more accurate measurement of the constant k and with less noise.

The reciprocals of the distances of these galactic objects from the Big Bang singularity are employed as proxies for the relative intensities of cosmological gravitational redshift experienced by these objects as they extend toward infinity. These relative intensities of gravitational redshift concerning Earth are meticulously documented in Column J of Table S1.

To derive an average value for k, our analysis centers on galactic objects located within one billion light-years from the momentous event of the Big Bang, as gravitational effects are most pronounced. This rigorous analysis yields an approximate value of k, specifically 1.6733. Consequently, the cosmological gravitational redshift of a galactic object is estimated to be 1.6733 times the relative gravitational redshift intensity as measured on Earth (as documented in Column J of Table S1), giving the theorized Gravitational Redshift value (Column N).

The estimated gravitational redshift value is then added to the theoretically projected redshift (i.e. from part 1 of our study), ultimately leading to the determination of the total theorized cosmological redshift value, as elucidated in Column O of Table S1.

To evaluate the validity of our methodology and findings, we proceed to compare the total theorized cosmological redshift values (Column O) with observational data obtained from the NASA/IPAC Extragalactic Database (NED), presented in Column C of Table S1. This comparative analysis will provide insights into the agreement or discrepancies between our theoretical predictions and empirical observations.

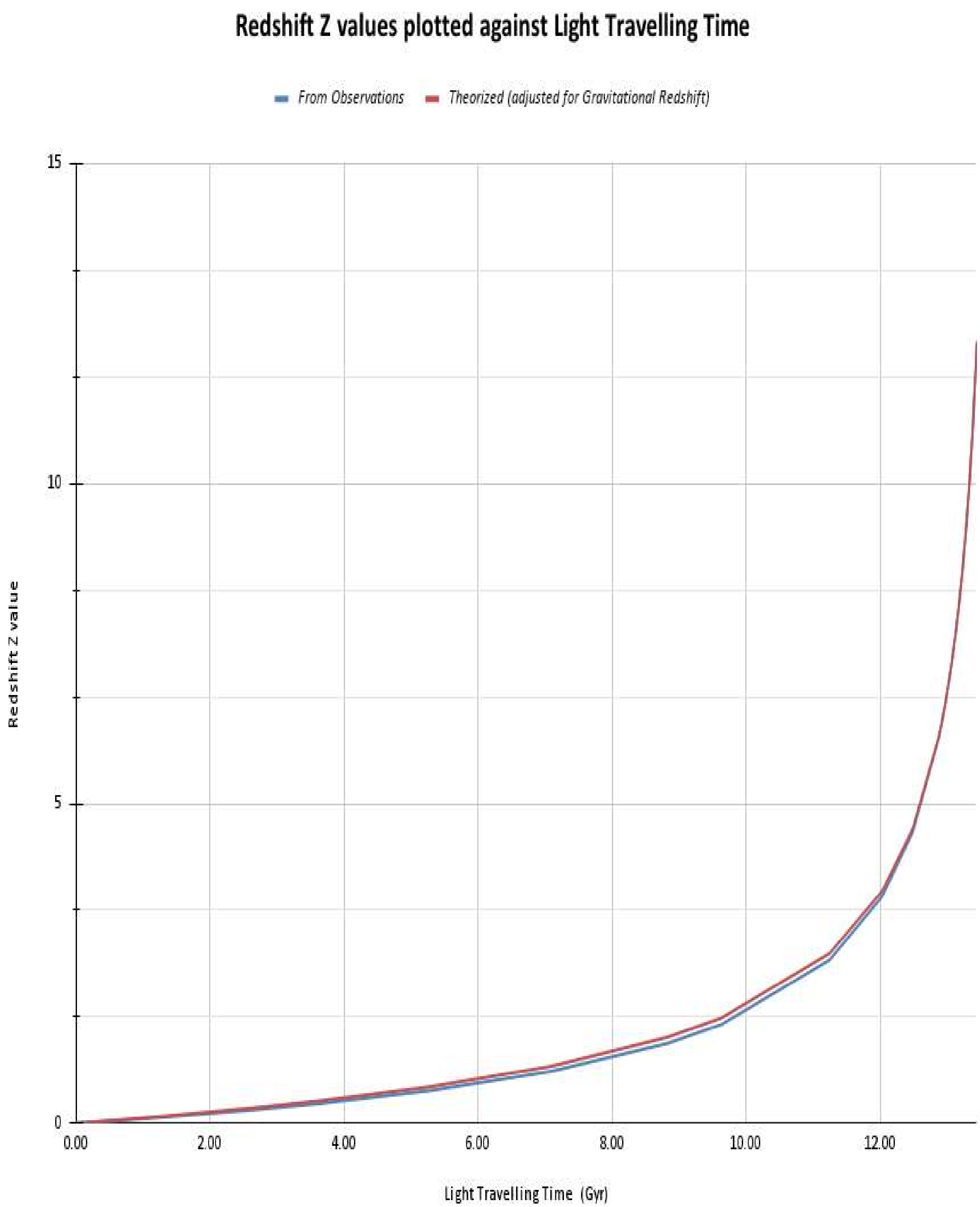
Table S1:

Theorized Total Cosmological Redshift Z of a celestial body, calculated using apparent relative velocity to the observer, and adjusted for cosmological gravitational redshift effect. (Assumption: the entire universe has been expanding at a constant speed of light).

	Theorized Redshift Z, adjusted for Cosmological Gravitational Redshift												
	Col C	Col D	Col E	Col F	Col G	Col H	Col J	Col M	Col N	Col O	Col Q	Col R	Col S
Celestial Body	Redshift Z	Theorized Redshift Z (Relativistic)	Light Travelling time (Gyr)	Time Elapsed since Big Bang (Gyr)	Distance from Big Bang (B. Ly)	ΔZ to be Expained	Relative Strength of Cosmological Gravitational Redshift	Estimate value for (G * M / C2)	Theorized Cosmological Gravitational Redshift	Total Theorized Redshift (Relativistic + Cosmological Gravitational Redshift	Redshift Prediction Discrepancy (ΔZ)	Projection Discrpency1 (%)	Projection Discrpency2 Only Consider the Effect of Cosmological Gravitational Redshift for the first 5 Gyr after Big Bang (%)
	From NED data	Universe expanding at Speed of Light Model	From NED data	13.8 - Col E	=Col F	C# - D#	(1 / G5) - (1 / G6)	H# / J#	167.33% *J#	D# + N#	O# - C#	Q# / C#	0-5 Gyr: (D#+N#-C#) /C# > 5 Gyr: (D#-C#) /C#
EARTH Today	0.00	0.000	0.00	13.8000	13.8000	0.0000	0.0000	0.00%	0.0000	0.0000	0.00	0	0
NGC 7820	0.0102	0.0090	0.1280	13.6720	13.6720	0.0012	0.0007	169.66%	0.0011	0.0101	0.00	-0.16%	-11.34%
ESO 293- G 027	0.0106	0.0100	0.1400	13.6600	13.6600	0.0006	0.0007	77.69%	0.0012	0.0112	0.00	6.29%	-5.46%
2MASS J00000158-3930463	0.0107	0.0100	0.1420	13.6580	13.6580	0.0007	0.0008	99.15%	0.0013	0.0113	0.00	4.78%	-6.95%
2MASX J00075083+3259427	0.0510	0.0520	0.6940	13.1060	13.1060	-0.0010	0.0038	-26.06%	0.0064	0.0584	0.01	14.55%	1.96%
MRSS 349-067222	0.0510	0.0520	0.6970	13.1030	13.1030	-0.0010	0.0039	-25.71%	0.0064	0.0584	0.01	14.59%	1.94%
WISEA J000032.52-355357.8	0.0510	0.0520	0.6980	13.1020	13.1020	-0.0010	0.0039	-24.87%	0.0065	0.0585	0.01	14.54%	1.88%
NSC J000127+054957	0.1003	0.1020	1.3310	12.4690	12.4690	-0.0017	0.0077	-21.98%	0.0129	0.1149	0.01	14.60%	1.69%
WISEA J000041.79-273626.7	0.1010	0.1030	1.3430	12.4570	12.4570	-0.0020	0.0078	-25.81%	0.0131	0.1161	0.02	14.94%	2.00%
LCRS B235850.3-451904	0.1010	0.1030	1.3450	12.4550	12.4550	-0.0020	0.0078	-26.11%	0.0131	0.1161	0.02	14.99%	2.02%
WISEA J001007.77-040717.5	0.2112	0.2120	2.6160	11.1840	11.1840	-0.0008	0.0169	-4.87%	0.0284	0.2404	0.03	13.82%	0.39%
WISEA J000216.41-255341.5	0.2112	0.2120	2.6180	11.1820	11.1820	-0.0008	0.0170	-4.72%	0.0284	0.2404	0.03	13.82%	0.38%
WHL J021241.3-183219	0.2112	0.2120	2.6200	11.1800	11.1800	-0.0008	0.0170	-4.71%	0.0284	0.2404	0.03	13.83%	0.38%
WHL J000352.5+284308	0.3111	0.3080	3.6170	10.1830	10.1830	0.0031	0.0257	12.04%	0.0431	0.3511	0.04	12.85%	-1.00%
WISEA J001401.48+033532.2	0.3112	0.3080	3.6180	10.1820	10.1820	0.0032	0.0257	12.36%	0.0431	0.3511	0.04	12.82%	-1.02%
RM J011131.8+083542.6	0.3112	0.3080	3.6180	10.1820	10.1820	0.0032	0.0257	12.30%	0.0431	0.3511	0.04	12.83%	-1.02%
WISEA J000137.20+053741.0	0.5111	0.4940	5.2630	8.5370	8.5370	0.0171	0.0447	38.36%	0.0748	0.5688	0.06	11.27%	-3.35%
SDSS J001332.04-074601.1	0.5112	0.4940	5.2640	8.5360	8.5360	0.0172	0.0447	38.48%	0.0748	0.5688	0.06	11.26%	-3.36%
WHL J004025.9+384341	0.5112	0.4950	5.2650	8.5350	8.5350	0.0162	0.0447	36.24%	0.0748	0.5698	0.06	11.46%	-3.17%
WISEA J001154.26+010252.8	0.8111	0.7620	7.0740	6.7260	6.7260	0.0491	0.0762	64.47%	0.1275	0.8895	0.08	9.66%	-6.06%
2XLSSd J021641.0-061418	0.8112	0.7620	7.0760	6.7240	6.7240	0.0492	0.0763	64.52%	0.1276	0.8896	0.08	9.66%	-6.07%
DEEP2 42035712	0.8112	0.7620	7.0760	6.7240	6.7240	0.0492	0.0763	64.51%	0.1276	0.8896	0.08	9.67%	-6.06%
XMS J010324.6-065537	1.2510	1.1320	8.8240	4.9760	4.9760	0.1190	0.1285	92.61%	0.2150	1.3470	0.10	7.68%	7.68%
SDSS J000526.55+215237.4	1.2519	1.1330	8.8260	4.9740	4.9740	0.1189	0.1286	92.48%	0.2152	1.3482	0.10	7.69%	7.69%
2XMM J021810.8-045356	1.2520	1.1330	8.8280	4.9720	4.9720	0.1190	0.1287	92.49%	0.2153	1.3483	0.10	7.69%	7.69%
4C -02.01	1.5410	1.3650	9.6140	4.1860	4.1860	0.1760	0.1664	105.75%	0.2785	1.6435	0.10	6.65%	6.65%
SDSS J000028.14+355216.3	1.5455	1.3690	9.6250	4.1750	4.1750	0.1765	0.1671	105.63%	0.2795	1.6485	0.10	6.67%	6.67%
[YWF2017] J000.05315-00.30131	1.5500	1.3720	9.6350	4.1650	4.1650	0.1780	0.1676	106.18%	0.2805	1.6525	0.10	6.61%	6.61%
WISEA J000001.76-072909.3	2.5418	2.1160	11.2230	2.5770	2.5770	0.4258	0.3156	134.92%	0.5281	2.6441	0.10	4.02%	4.02%
WISEA J000022.00+071715.0	2.5446	2.1180	11.2260	2.5740	2.5740	0.4266	0.3160	135.00%	0.5288	2.6468	0.10	4.02%	4.02%
WISEA J000109.93-271543.6	2.5786	2.1420	11.2620	2.5380	2.5380	0.4366	0.3215	135.78%	0.5380	2.6800	0.10	3.93%	3.93%
PSS J0003+2730 ABS01	3.5100	2.7860	12.0000	1.8000	1.8000	0.7240	0.4831	149.87%	0.8083	3.5943	0.08	2.40%	2.40%
SDSS J000002.27-085640.9	3.5150	2.7890	12.0030	1.7970	1.7970	0.7260	0.4840	149.99%	0.8099	3.5989	0.08	2.39%	2.39%
LURGS J000104.2-354123	3.6000	2.8460	12.0520	1.7480	1.7480	0.7540	0.4996	150.92%	0.8360	3.6820	0.08	2.28%	2.28%
SDSS J001153.26+143444.9	4.5350	3.4510	12.4740	1.3260	1.3260	1.0840	0.6817	159.02%	1.1406	4.5916	0.06	1.25%	1.25%
WISEA J000314.99-000018.2	4.5500	3.4600	12.4790	1.3210	1.3210	1.0900	0.6845	159.23%	1.1454	4.6054	0.06	1.22%	1.22%
SDSS J000452.11+152320.4	4.5850	3.4830	12.4920	1.3080	1.3080	1.1020	0.6921	159.23%	1.1580	4.6410	0.06	1.22%	1.22%
WISEA J001411.00+010046.3	4.5850	3.4830	12.4920	1.3080	1.3080	1.1020	0.6921	159.23%	1.1580	4.6410	0.06	1.22%	1.22%
SDSS J000014.85+140159.3	4.5950	3.4890	12.4950	1.3050	1.3050	1.1060	0.6938	159.41%	1.1609	4.6499	0.05	1.20%	1.20%
ABELL 2744: [MAC2016] PAR001163	6.0350	4.3670	12.8740	0.9260	0.9260	1.6680	1.0074	165.57%	1.6857	6.0527	0.02	0.29%	0.29%
WISEA J000436.64+305758.6	6.0666	4.3850	12.8800	0.9200	0.9200	1.6816	1.0145	165.75%	1.6975	6.0825	0.02	0.26%	0.26%
PSO J002.3786+32.8702	6.1000	4.4060	12.8870	0.9130	0.9130	1.6940	1.0228	165.62%	1.7115	6.1175	0.02	0.29%	0.29%
SDSS J000037.57+243145.6	6.3942	4.5790	12.9410	0.8590	0.8590	1.8152	1.0917	166.28%	1.8267	6.4057	0.01	0.18%	0.18%
SDSS J000241.23+082348.7	6.5919	4.6930	12.9740	0.8260	0.8260	1.8989	1.1382	166.83%	1.9045	6.5975	0.01	0.09%	0.09%
WISEA J000105.09+293224.5	7.0112	4.9350	13.0380	0.7620	0.7620	2.0762	1.2399	167.46%	2.0746	7.0096	0.00	-0.02%	-0.02%
SDSS J001138.38+120344.4	7.0069	4.9350	13.0380	0.7620	0.7620	2.0719	1.2399	167.11%	2.0746	7.0096	0.00	0.04%	0.04%
ABELL 2744_z7_000671	7.4600	5.1900	13.0980	0.7020	0.7020	2.2700	1.3520	167.89%	2.2623	7.4523	-0.01	-0.10%	-0.10%
HRG14 J001355.12-302158.8	7.7600	5.3590	13.1340	0.6660	0.6660	2.4010	1.4290	168.02%	2.3912	7.7502	-0.01	-0.13%	-0.13%
ABELL 2744: [ARK2014] 2070	7.8700	5.4190	13.1460	0.6540	0.6540	2.4510	1.4566	168.27%	2.4373	7.8563	-0.01	-0.17%	-0.17%
HRG14 J033222.39-274835.6	8.1000	5.5480	13.1710	0.6290	0.6290	2.5520	1.5174	168.19%	2.5390	8.0870	-0.01	-0.16%	-0.16%
[MMD2016] A209-09-1	8.4000	5.7140	13.2010	0.5990	0.5990	2.6860	1.5970	168.19%	2.6722	8.3862	-0.01	-0.16%	-0.16%
[GGF2013] 35434	8.6000	5.8250	13.2200	0.5800	0.5800	2.7750	1.6517	168.01%	2.7637	8.5887	-0.01	-0.13%	-0.13%
[RMT2022] 0037-3337_0563	8.7600	5.9110	13.2340	0.5660	0.5660	2.8490	1.6943	168.15%	2.8351	8.7461	-0.01	-0.16%	-0.16%
ABELL 2744:[IKO2015] HFF1P-YJ3	8.8900	5.9810	13.2450	0.5550	0.5550	2.9090	1.7293	168.21%	2.8937	8.8747	-0.02	-0.17%	-0.17%
[PCB2012] 3020	9.1096	6.0990	13.2630	0.5370	0.5370	3.0106	1.7897	168.21%	2.9947	9.0937	-0.02	-0.17%	-0.17%
UDF12 41067304	9.5000	6.3100	13.2930	0.5070	0.5070	3.1900	1.8999	167.90%	3.1791	9.4891	-0.01	-0.11%	-0.11%
[GGF2013] 19776	9.5400	6.3320	13.2960	0.5040	0.5040	3.2080	1.9117	167.81%	3.1987	9.5307	-0.01	-0.10%	-0.10%
ABELL 2744:[LBD2014] 19.2	9.8300	6.4850	13.3160	0.4840	0.4840	3.3450	1.9937	167.78%	3.3359	9.8209	-0.01	-0.09%	-0.09%
[JDL2018] 85005338	10.0000	6.5730	13.3270	0.4730	0.4730	3.4270	2.0417	167.85%	3.4163	9.9893	-0.01	-0.11%	-0.11%
S-CANDELS J021734.25-051536.2	10.0300	6.5890	13.3290	0.4710	0.4710	3.4410	2.0507	167.80%	3.4313	10.0203	-0.01	-0.10%	-0.10%
MACSJ0416-2403:[IZL2015] 8958	10.1120	6.6310	13.3340	0.4660	0.4660	3.4810	2.0735	167.88%	3.4695	10.1005	-0.01	-0.11%	-0.11%
[RMT2022] 1437+5043_0259	10.5600	6.8660	13.3610	0.4390	0.4390	3.6940	2.2054	167.49%	3.6903	10.5563	0.00	-0.04%	-0.04%
ABELL 2744:[ZZB2014] JD1C	11.1090	7.1540	13.3910	0.4090	0.4090	3.9550	2.3725	166.70%	3.9699	11.1239	0.01	0.13%	0.13%
MACS J0647.7+7015:[CCS2013]JD1	11.2000	7.1940	13.3950	0.4050	0.4050	4.0060	2.3967	167.15%	4.0103	11.2043	0.00	0.04%	0.04%
[RMT2022] 1142+2647_1280	12.1600	7.6860	13.4390	0.3610	0.3610	4.4740	2.6976	165.85%	4.5138	12.1998	0.04	0.33%	0.33%
[RMT2022] 1237+2544_0806	12.1600	7.6860	13.4390	0.3610	0.3610	4.4740	2.6976	165.85%	4.5138	12.1998	0.04	0.33%	0.33%
								167.33%		ΔZ Avg =	0.03	4.699%	0.392%
										ΔZ Min =	-0.02	-0.174%	-11.339%
										ΔZ Max =	0.10	14.993%	7.691%

Figure S2:

Theoretical Total Cosmological Redshift Z (adjusted for cosmological gravitational redshift effect) values are plotted alongside the NED (NASA/IPAC Extragalactic Database) observations across various epochs of the universe.



Interpretations:

- Table S1 provides the computation of ΔZ, representing the disparities between the theorized total cosmological redshift and observational data, elucidating the predictive accuracy of our model.
- Figure S2 presents a graphical comparison between theoretical total cosmological redshift Z values (adjusted for cosmological gravitational redshift effects) and observations from the NED (NASA/IPAC Extragalactic Database) across various epochs of the universe. The graph reveals a remarkable alignment between the theorized values and the observational data.
- In our study encompassing 65 celestial objects, spanning distances from 0.128 to 13.439 billion light-years from Earth, we find the following ΔZ (prediction discrepancy) statistics: ΔZ Average = 0.03, ΔZ Minimum = -0.02, and ΔZ Maximum = 0.1.
- Our model demonstrates an average prediction discrepancy of 0.03, well within an average ±5% margin of error for predicting the Z value of a given celestial body.
- Acknowledging that the cosmological gravitational redshift influence on a celestial body diminishes as the celestial body is further away from the universe's center of gravity. When we exclude the gravitational redshift effect for light emissions that originated more than 5 billion years after the Big Bang, our model demonstrates a remarkable level of accuracy, with an average prediction error of 0.39% for the Z value.
- The close alignment between the theorized values and observed data provides strong support for the assertions made in Part 1 of our study.

References and Notes

(1) Stephen E. Shum, Entire Universe has been Expanding at the Speed of Light / Comprehensive Study of the Hubble Constant throughout the Ages of the Universe (2023).

https://vixra.org/abs/2307.0145

(2) NASA / LAMBDA Archive Team, Hubble Constant (2023). https://lambda.gsfc.nasa.gov/education/graphic_history/hubb_const.html

(3) Encyclopaedia Britannica, Speed of Light (2023). https://www.britannica.com/science/speed-of-light

(4) NASA Science, Universe Older Than Previously Thought (2023). https://science.nasa.gov/science-news/science-at-nasa/2013/21mar_cmb

Data and materials availability:

Table S1 is produced with Excel spreadsheet. It can be made available to any researcher for purposes of reproducing or extending the analysis.

Observation data in Table S1 are drawn from the NASA/IPAC Extragalactic Database (NED) at https://ned.ipac.caltech.edu/.

Supplementary Materials

Table S3:

Chart in figure 2 above is produced with the below data. Observation data are drawn from the NASA/IPAC Extragalactic Database (NED) at https://ned.ipac.caltech.edu/. Theorized Z numbers are computed using Table S1 spreadsheet.

Celestial Object	Observed Redshift Z (from NED)	Theorized Total Cosmological Redshift Z (adjusted for Cosmological Gravitational Redshift effect)	Light Travelling time (Gyr) from Object
NGC 7820	0.01	0.01	0.13
ESO 293- G 027	0.01	0.01	0.14
2MASS J00000158-3930463	0.01	0.01	0.14
2MASX J00075083+3259427	0.05	0.06	0.69
MRSS 349-067222	0.05	0.06	0.70
WISEA J000032.52-355357.8	0.05	0.06	0.70
NSC J000127+054957	0.10	0.11	1.33
WISEA J000041.79-273626.7	0.10	0.12	1.34
LCRS B235850.3-451904	0.10	0.12	1.35
WISEA J001007.77-040717.5	0.21	0.24	2.62
WISEA J000216.41-255341.5	0.21	0.24	2.62
WHL J021241.3-183219	0.21	0.24	2.62
WHL J000352.5+284308	0.31	0.35	3.62
WISEA J001401.48+033532.2	0.31	0.35	3.62
RM J011131.8+083542.6	0.31	0.35	3.62
WISEA J000137.20+053741.0	0.51	0.57	5.26
SDSS J001332.04-074601.1	0.51	0.57	5.26
WHL J004025.9+384341	0.51	0.57	5.27
WISEA J001154.26+010252.8	0.81	0.89	7.07
2XLSSd J021641.0-061418	0.81	0.89	7.08
DEEP2 42035712	0.81	0.89	7.08
XMS J010324.6-065537	1.25	1.35	8.82
SDSS J000526.55+215237.4	1.25	1.35	8.83
2XMM J021810.8-045356	1.25	1.35	8.83
4C -02.01	1.54	1.64	9.61
SDSS J000028.14+355216.3	1.55	1.65	9.63
[YWF2017] J000.05315-00.30131	1.55	1.65	9.64
WISEA J000001.76-072909.3	2.54	2.64	11.22
WISEA J000022.00+071715.0	2.54	2.65	11.23
WISEA J000109.93-271543.6	2.58	2.68	11.26
PSS J0003+2730 ABS01	3.51	3.59	12.00
SDSS J000002.27-085640.9	3.52	3.60	12.00
LURGS J000104.2-354123	3.60	3.68	12.05
SDSS J001153.26+143444.9	4.54	4.59	12.47

WISEA J000314.99-000018.2	4.55	4.61	12.48
SDSS J000452.11+152320.4	4.59	4.64	12.49
WISEA J001411.00+010046.3	4.59	4.64	12.49
SDSS J000014.85+140159.3	4.60	4.65	12.50
ABELL 2744:[MAC2016] PAR001163	6.04	6.05	12.87
WISEA J000436.64+305758.6	6.07	6.08	12.88
PSO J002.3786+32.8702	6.10	6.12	12.89
SDSS J000037.57+243145.6	6.39	6.41	12.94
SDSS J000241.23+082348.7	6.59	6.60	12.97
WISEA J000105.09+293224.5	7.01	7.01	13.04
SDSS J001138.38+120344.4	7.01	7.01	13.04
ABELL 2744_z7_000671	7.46	7.45	13.10
HRG14 J001355.12-302158.8	7.76	7.75	13.13
ABELL 2744:[ARK2014] 2070	7.87	7.86	13.15
HRG14 J033222.39-274835.6	8.10	8.09	13.17
[MMD2016] A209-09-1	8.40	8.39	13.20
[GGF2013] 35434	8.60	8.59	13.22
[RMT2022] 0037-3337_0563	8.76	8.75	13.23
ABELL 2744:[IKO2015] HFF1P-YJ3	8.89	8.87	13.25
[PCB2012] 3020	9.11	9.09	13.26
UDF12 41067304	9.50	9.49	13.29
[GGF2013] 19776	9.54	9.53	13.30
ABELL 2744:[LBD2014] 19.2	9.83	9.82	13.32
[JDL2018] 85005338	10.00	9.99	13.33
S-CANDELS J021734.25-051536.2	10.03	10.02	13.33
MACS J0416-2403:[IZL2015] 8958	10.11	10.10	13.33
[RMT2022] 1437+5043_0259	10.56	10.56	13.36
ABELL 2744:[ZZB2014] JD1C	11.11	11.12	13.39
MACS J0647.7+7015:[CCS2013]JD1	11.20	11.20	13.40
[RMT2022] 1142+2647_1280	12.16	12.20	13.44
[RMT2022] 1237+2544_0806	12.16	12.20	13.44