Quantifying the Universe's Mass-Energy Content via Cosmological Gravitational Redshift Analysis

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Abstract:

The profound discovery that the entire universe is expanding at the speed of light has prompted a reexamination of our comprehension of fundamental aspects related to dark energy, dark matter, and the overall structure of the cosmos. In the second segment of our investigation, we successfully measured the impact of Cosmological Gravitational Redshift. Expanding upon our understanding of Gravitational Redshift in the cosmos, this third phase of the study aims to assess the total Mass-Energy Content of our local universe, estimated at about 2.13 × 10^52 kg, in terms of Mass Equivalence.

Introduction:

The current investigation is a follow-up to our previous research (referred to as Part 2), denoted as "The Entire Universe's Expansion at the Speed of Light (Part 2) / A Comprehensive Examination of Cosmological Gravitational Redshift" *(2)*. In that particular study, we conducted a quantitative analysis of the effects of cosmic gravitational redshift. Our examination resulted in derived values for celestial redshift that displayed a significant alignment with observational data obtained from the NASA/IPAC Extragalactic Database *(3)*.

This current paper aims to extrapolate the total Mass-Energy Content of our local universe based on the findings regarding the cosmos' gravitational redshift from Part 2. The comprehensive Mass-Energy Content of our local universe is approximated at 2.13 × 10^52 kg, presented in terms of Mass Equivalence.

Main Text:

In the initial phase of our investigation *(1)*, we discovered that the entirety of the universe has been expanding at the speed of light. This understanding was derived from an in-depth analysis of the Hubble Constant, a crucial factor in comprehending the cosmic expansion.

Within the initial 5 billion years following the Big Bang, our model computed redshift values exhibited a more pronounced divergence from the observational data available in the NED dataset *(3)*, particularly as the distance between galactic entities and Earth increased. This deviation was linked to the predominant influence of the gravitational redshift effect during the universe's earlier, more condensed phase. Subsequently, in Part 2 of our study *(2)*, we conducted a quantitative assessment of the cosmos' gravitational redshift, deriving calculated celestial redshift values that closely corresponded with observational data collected from the NASA/IPAC Extragalactic Database *(3)*.

The primary aim of this current paper is to compute the total Mass-Energy Content of our local universe, drawing upon our previous research findings related to cosmological gravitational redshift.

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 $z = \Delta\lambda / \lambda = G\ M / c^2 R$

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 Part 2 of our study, the findings support that the cosmological gravitational redshift is inversely related to the distance of said object from the Big Bang singularity. This relationship can be succinctly expressed as: Cosmological Gravitational Redshift $z = \Delta\lambda / \lambda = k / R$.

Our analysis in Part 2 yields an approximate value of constant k =1.6733 B. Ly (also ref Table S1 below).

By equating $z = \Delta\lambda / \lambda = G M_u / c^2 R = k / R$, we can solve for M_u (note: M_u denotes the total Mass-Energy content of our local universe, G and c are known constants, k =1.6733 B.Ly).

$$G M_u / c^2 R = k / R$$
$$\Leftrightarrow \quad G M_u / c^2 = k$$
$$\Leftrightarrow \quad M_u = k\, c^2 / G$$

Substituting: $G = 6.6743 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2}$ *(4)*
$c = 299{,}792{,}458\ m^1\ s^{-1}$ *(5)*
k = 1.6733 Billion Light years = $1.58306403 \times 10^{+25}$ m *(2)*

$$M_u = k\, c^2 / G$$
$$= (1.58306403 \times 10^{+25}\ m) \times (299{,}792{,}458\ m^1\ s^{-1})^2 / (6.6743 \times 10^{-11}\ m^3\ kg^{-1}\ s^{-2})$$

$$= 2.13173965 \times 10^{+52}\ kg$$

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%
MACS J0416-2403:[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%

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) Stephen E. Shum, Entire Universe has been Expanding at the Speed of Light (Part2) / Comprehensive Study of Cosmological Gravitational Redshift (2023).

http://viXra.org/abs/2310.0100

(3) NASA/IPAC Extragalactic Database (NED) (2023).

https://ned.ipac.caltech.edu/

(4) Britannica, Gravitational constant (2023).
https://www.britannica.com/science/gravitational-constant

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

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/.