MedCrave
Step into the World of Research
Physics & Astronomy International Journal

Review Article
Open Access
CrossMark

Decreasing universe: the CMB and the age of the universe

Abstract

We will use the "Decreasing Universe" (D.U.) theory to estimate the age of the Universe based on the average wavelength of the Cosmic Microwave Background (CMB) radiation.

Keywords: Decreasing Universe, CMB, Universe Age, L-CDM

Volume 9 Issue 2 - 2025

João Carlos Holland de Barcellos
University of São Paulo, Brazil

Correspondence: João Carlos Holland de Barcellos, University of São Paulo, Brazil

Received: April 21,2025 | **Published:** May 26, 2025

Introduction

The current model for the origin and expansion of the universe, known as the 'L-CDM' model, proposes that the universe is about 13.8 billion years old and yet has an observable radius of approximately 46 billion light-years. This seems to contradict the Theory of Relativity, which establishes that no particle can travel faster than the speed of light. This excerpt illustrates the issue: "...*First of all, we should explain that the light-speed limit that relativity imposes on objects within the universe doesn't apply to the universe itself…*"[1]

If an object (star or galaxy) is moving away from us, I ask: which part of the theory of relativity says that we must "discount" the portion of the recession due to space itself expanding and which part is not? This doesn't exist in relativity theory and shows the first flaw in this traditional model.

Other evidence also seems to challenge the model: *"...a new study by professor Rajendra Gupta, of the Department of Physics at the University of Ottawa has put the age of the universe at almost double what has long been believed - 26.7 billion years old..."*[2]

The Klein-Gordon Equation:

"…In this paper, we demonstrate again by a completely different method, namely the solution of the Klein-Gordon equation for a bosonic particle undergoing a quantum expansion of space (Hubble-Lemaître law) that the age of the universe is indeed 76.4 Gy and we observe a shorter age by the effects of the special relativity generated by the relative speed of our galaxy with that of the CMB rest frame…."[3]

The oldest known star: "*...In 2000, scientists looked to date what they thought was the oldest star in the universe. They made observations via the European Space Agency's (ESA) Hipparcos satellite and estimated that HD140283 — or Methuselah as it's commonly known — was a staggering 16 billion years old....*"[4]

Despite these issues, the L-CDM model is still the most widely accepted theory and produces satisfactory results across a wide range of observations. We will borrow part of this model, specifically regarding the early universe, to (using D.U.) recalculate the age of the Universe.

The CMB and the L-CDM model

According to the current model, known as L-CDM (Lambda Cold Dark Matter), the Cosmic Microwave Background (CMB) is the remnant thermal radiation from the early universe, emitted when the cosmos was about 380,000 years old. It is evidence that there was a time in the history of the universe when the photons that arose were distributed almost uniformly throughout the cosmos. It is now observed as an almost uniform microwave bath, with a temperature of 2.725 K. Initially, the universe was an opaque plasma of electrons, protons, and photons. As the universe expanded and cooled to ~3000 K, electrons combined with protons to form neutral hydrogen (recombination). At that moment, photons stopped interacting with matter and began to travel freely. This moment is called radiation decoupling. The CMB photons originate from a thermal plasma in equilibrium, with a blackbody spectrum. The main photon-generating processes at this stage were:

Double Compton ($e^- + \gamma \leftrightarrow e^- + \gamma + \gamma$) (very hot plasma) generated approximately 90–95% of the photons.

Bremsstrahlung "free–free" ($e^- + p \leftrightarrow e^- + p + \gamma$) generated about 5–10% of the photons.

If these processes were performed today in a laboratory, the wavelengths of these newly generated photons could be calculated:

Double compton: in today's laboratory

The process is: $e^- + \longrightarrow e^- + \gamma_2 + \gamma_3$

In a hot plasma, this creates new low-energy photons. The average energy of these photons depends almost solely on the temperature of the electron plasma where the scattering occurs.

To simulate the universe just before decoupling (origin of the CMB), we would use $T \approx 3000$ K.

Average energy of the photon produced:

$\langle E \rangle \approx kT = 8.617 \times 10^{-5}\ \mathrm{eV \cdot K^{-1}} \times 3000\ \mathrm{K} \approx 0.26\ \mathrm{eV}$

Corresponding wavelength:

$\lambda a = hc/E = 4.8\mu m \Rightarrow$

$\boldsymbol{\lambda a \simeq 5\times10^{-6}\ m}$

Wavelength produced by "double Compton" in laboratory

b) **Bremsstrahlung ("free–free")** in a plasma at $T \approx 3000$ K

When free electrons decelerate in the field of ions, they emit a continuous spectrum of photons. Unlike the blackbody spectrum — which drops exponentially beyond $h\nu \sim kT$ — most of the photons have energies equal to or less than kT (=0.26 eV). Thus we have:

λb = hc/(kT) ⇒

λb ≃ 4.8×10^{-6} m

Wavelength produced by "Bremsstrahlung" in laboratory

If we take a weighted average of the wavelength of these two processes by the frequency of the photons produced, we get:

λm = 95% λa + 5% λb

Therefore, we can use the following average wavelength (if produced in a lab today), simulating the originally produced CMB photons:

λm ≃ 5×10^{-6} m

Average wavelength of lab-simulated CMB

The measured average wavelength of the real CMB is:

λcmb ≃1.44×10^{-3} m

Decreasing universe (D.U.) and the age of the universe

Using the Decreasing Universe model (D.U.)[5] and the average wavelength of the Cosmic Microwave Background, as well as the wavelength that would be produced in the laboratory today (derived above), we can estimate the age of the Universe under this new model. The idea is: by comparing photons produced in laboratories today — where atoms and everything else are already contracted after billions of years under the galactic gravitational field — with the original CMB photons, we can estimate the time it took to reach the current level of contraction.

Some considerations and hypotheses

a) In D.U., the universe **is not** expanding in an **accelerated manner**. Reversing time would not necessarily result in everything converging to a single point (as in the Big Bang).

b) However, D.U. does not deny that this might have occurred or that the Big Bang might (or might not) have happened.

c) In this theory, the Universe may still be expanding (but not accelerating), and the Big Bang may have occurred.

d) Let us assume, for argument's sake, that there was a time in the Universe when matter existed as plasma, which originated the current CMB.

e) We will also assume that this period roughly corresponds to the beginning of the Universe.

The original formula

In D.U., gravitational fields contract space and everything within it at a rate that depends on the intensity of the gravitational field.[5] Thus, in our model, the original wavelength of the CMB is not stretched by space expansion (as in the L-CDM model), but rather it is our own contraction that makes the wavelength appear larger — an illusion caused by our own spatial shrinkage.

In our Milky Way, and from our terrestrial position, using the contraction formula due to the gravitational field,[6] we can relate wavelengths λm and λcmb:

$$\ddot{e}_m = \ddot{e}_{cmb} / \exp(H_0 \Delta t) \quad \text{(E1)}$$

Ratio of wavelength produced today to its original

Where: λm = Wavelength produced here (already contracted ≃ 5×10^{-6} m)

λcmb = Original wavelength (little contraction ≃ 1.44×10^{-3} m)

H_0 = Hubble Constant (2.2×10^{-18} s^{-1})

Δt = t − t_0 (time interval for this contraction ≃ Age of the Universe)

Thus, isolating Δt:

$$\Delta t = \frac{1}{H_0} \ln\left(\frac{\ddot{e}_{cmb}}{\ddot{e}_m}\right) \quad \text{(E2)}$$

Time of the universe as a function of the CMB

Substituting values into the equation above we get: Δt = 82 billion years

Discussion

Our calculation used the contraction time under a gravitational field like ours. Of course, our galaxy took time to form and thus did not have this strong gravitational field from the beginning. Therefore, the age of the Universe *must be greater* than the one calculated here (T > 82 billion years). It is important to emphasize that relativity theory never separates, when calculating motion, the part of velocity due to 'space expansion' versus the 'real' motion of the object. So, in the L-CDM model, treating galaxies as moving faster than light due to expansion is a bad workaround to explain what otherwise cannot be explained in that model. The beginning of the Universe, in the D.U. model, does not necessarily start with a Big Bang or with everything concentrated in a point. Its origin is open, and 'Jocaxian Nothingness'[7] may be the key to this mystery.[8-10]

Conclusion

Using the 'Decreasing Universe' model and the CMB wavelength data, along with the hypothesis that the Universe began around the time it emitted photons from a plasma of ~3000K, we estimate that the Universe is ***at least 82 billion years old***.

References

1. How can the visible universe be 46 billion light-years in radius when the universe is only 13.8 billion years old? 2024.
2. Cherry Stewart-Czerkas, Sanjana Bhambhani, Anna Bressanin. The age of the Universe might be drastically wrong. 2023.
3. CMB Photon Predicts the Age of the Universe (76.4 Gy) and the Observed Age (13.8 Gy) with Special Relativity.
4. David Crookes. Methuselah (HD140283): The oldest star in the universe. 2022.
5. Barcellos JCH. Derivation of Hubble's Law and its relation to dark energy and dark matter. *Open Acc J Math Theor Phy.* 2019;2(2):29–32.
6. Decreasing Universe: The 'Dark Matter' Effect.
7. Barcellos JCH. The Jocaxian's nothingness. *Aeron Aero Open Access J.* 2024;8(4):205-207.
8. Barcellos JCH. Decreasing universe: the distance as a function of redshift. *Aeron Aero Open Access J.* 2025;9(1):57–60.
9. Bennett CL, Larson D, Weiland JL, et al. Nine-Year Wilkinson Microwave Anisotropy Probe (WMAP) Observations: Final Maps and Results.
10. O telescópio Webb observou quasares onde não deveriam estar. 2025.

Citation: Barcellos JCH. Decreasing universe: the CMB and the age of the universe. *Phys Astron Int J.* 2025;9(2):114‒115. DOI: 10.15406/paij.2025.09.00372