New Aspects of the Temporal Evolution of the Universe

Author

Martin Schauer
Postfach 1119
D-84495 Altötting
Germany
There are no other authors.
The author does not have any affiliations.

Abstract

In 1929, Edwin Hubble measured the redshift and brightness (magnitude) of distant stars and plotted the redshift against the derived distance in what is now known as the Hubble diagram. This plot revealed a linear relationship, leading to the conclusion that the universe is expanding as a function of distance. However, to fully comprehend the temporal evolution of the universe, redshift must be plotted against time. When this is done consistently, it becomes evident that redshift has been continuously decreasing over time, suggesting that the expansion of the universe is also progressively slowing down. This observation challenges the necessity of postulating dark energy, and it is therefore recommended that the standard physical model be thoroughly reevaluated.

1 Introduction

In 1929, Edwin Hubble [1] measured the redshift and brightness (magnitude) of distant stars and plotted redshift against the calculated distance in the now-famous Hubble diagram. This diagram revealed a straight-line relationship, leading to the conclusion that the universe is expanding as a function of distance. However, to understand the temporal evolution of the universe, redshift must be plotted against time.

2 Preliminary Considerations

To create a redshift–time diagram, a star of known brightness (magnitude) is needed—a “standard candle”, [2] such as one of the Cepheids (for intermediate distances), or a type 1a supernova (for greater distances). This will serve as a reference against which the measured magnitude of distant stars can be compared, allowing distance or time to be calculated. The measured redshift of this distant star is plotted on the y-axis and the derived time is plotted on the x-axis (Figure 1).

Redshift—time diagram

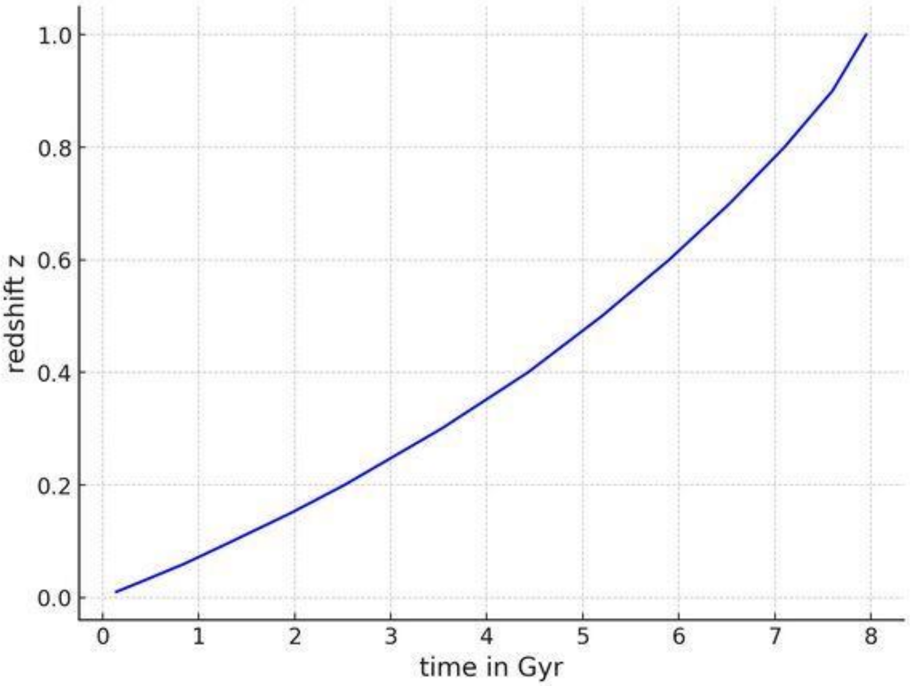

Figure 1: Redshift–time diagram up to a redshift of 1.0, created by ChatGPT 4.0 / OpenAI using cosmological redshift tables [3].

The time measured here not only represents a temporal distance but also offers a glimpse into the past. Time moves from the distant past to the near past to the present and into the future. In this diagram, time moves from right to left (Figure 1), resulting in a positive slope, indicating that the redshift of distant stars decreases with time. This may seem counterintuitive.

For clarity, the time it takes for light from distant stars to reach us is plotted on the x-axis with a negative sign (lookback time) (Figures 2–3). Time now flows from left to right, with a positive slope indicating an increasing redshift of distant stars over time and a negative slope indicating a decreasing redshift. The results remain identical (Figures 1–2) but the interpretation is much clearer.

3 Surprising Results

Figures 2–3 show a redshift–time diagram of distant stars based on real data from a cosmological redshift table [3]. From left to right, these figures consistently show a steadily decreasing redshift of distant stars over time. This implies that the expansion rate of the universe is continuously decreasing.

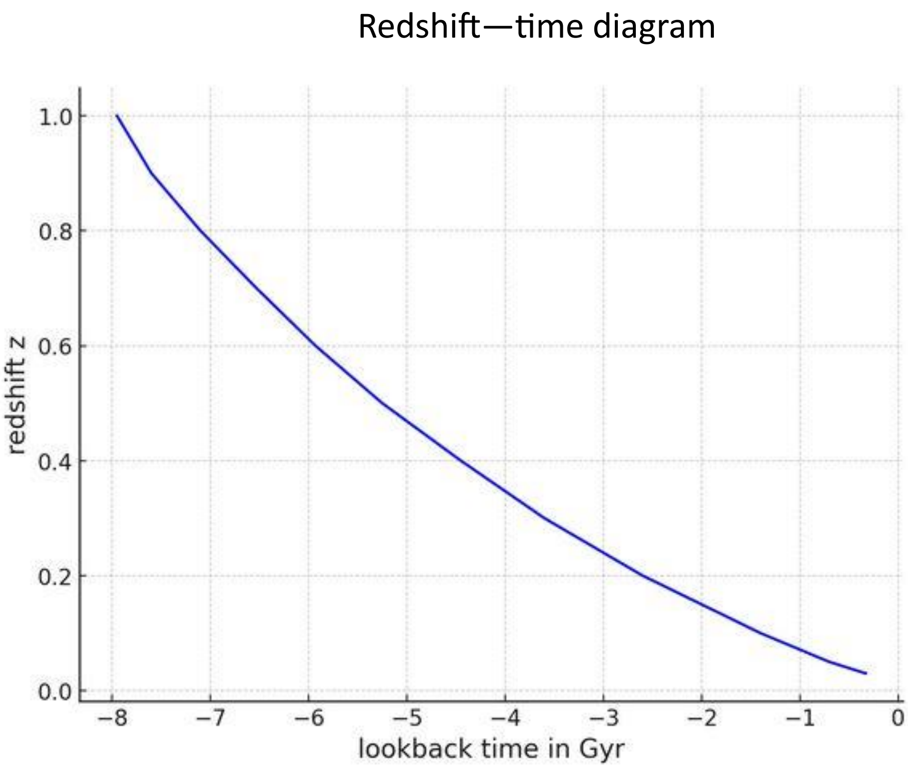

Figure 2: Redshift–time diagram up to a redshift of 1.0, generated by ChatGPT 4.0 / OpenAI using cosmological redshift tables [3], with the same data as in Figure 1.

Redshift-time diagram

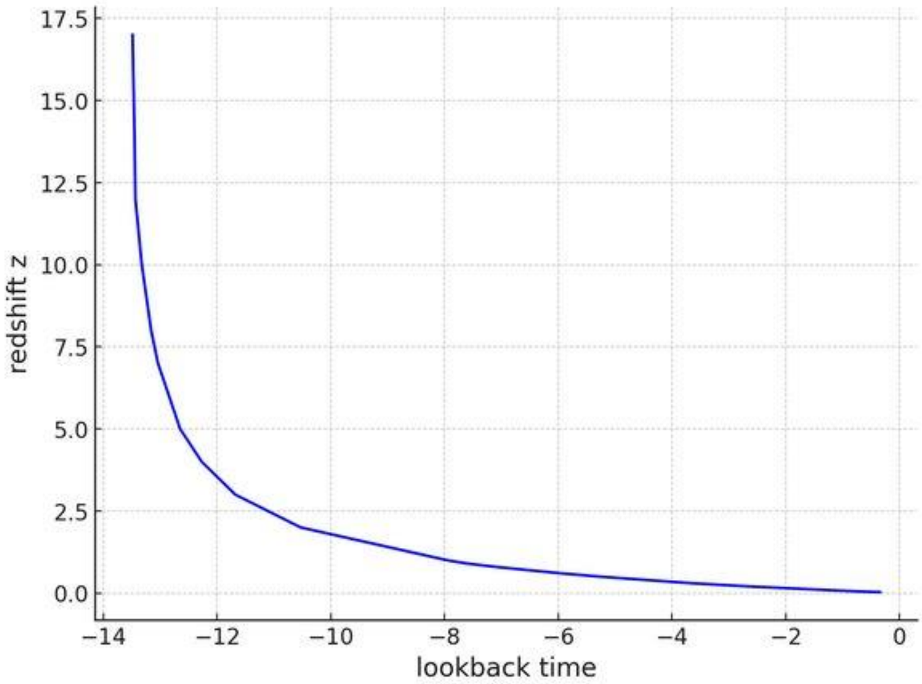

Figure 3: Redshift–time diagram up to a redshift of 17 [3], created in the same way as Figures 1 and 2 [3].]

4 Discussion

The Supernova Cosmology Project [4], the High-Z Supernova Search Team [5], and contemporary research [6-9] have all come to the conclusion that the universe has been expanding at an accelerated rate over the past billion years. So, what accounts for the discrepancy between these findings? The Supernova Cosmology Project [4] and the High-Z Supernova Search Team [5] have measured the redshift and brightness of distant stars with redshifts mainly between 0.3 and 1.0. The redshift of these distant stars (type 1a supernovae) was smaller relative to their brightness and thus to their distance and lookback time than would be expected given the current expansion rate [2, 4,5]. Perlmutter [2] explains the conclusions drawn from the data [4, 5] as follows: "Less redshift = Slower expansion in past = Expansion is accelerating = Less mass."

Less redshift means less redshift than expected at the current expansion rate, [2] but less redshift than expected is not necessarily less redshift than may occur later (see Figures 1–3).

In fact, the measured redshift [4, 5] of distant stars has steadily decreased over time (Figures 1-3).
This indicates that the expansion of the universe has been constantly slowing down. This makes the concept of dark energy unnecessary. It is consequently recommended that the standard physical model be thoroughly reexamined.

5 Summary and Outlook

The redshift–time diagram reveals a significant surprise. When the redshift of distant stars is plotted consistently against time, it becomes clear that the redshift has been continuously decreasing. This suggests that the expansion of the universe has been steadily slowing down over time, rather than accelerating.
As a result, the necessity of the concept of dark energy is called into question, and it is recommended that the standard physical model be thoroughly reviewed.

References

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Figures

Figures 1–3 were created on 13.9. 2024 by ChatGPT 4.0 /OpenAI using data from the Paper-and-pencil cosmological calculator of S. V. Pilipenko / arXiv: 1303.5961v2 [astro-ph.CO] 3 Mar **2021**.