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Short Communication

Testing the Correlation Between Host Galaxy Mass and Redshift Using the Pantheon Survey Data

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Abstract

This study investigates the relationship between redshift and host galaxy mass using the Pantheon Supernova Survey dataset. The hypothesis that galaxies with identical luminous distances should have the same host mass is tested using statistical correlation analysis. Contrary to expectations from contraction-based cosmological models, our findings indicate.

- *No statistically significant correlation between redshift and host galaxy mass.*
- *A very strong correlation (r = 0.979) between redshift and photometric distance derived from Type IA Supernovae.*
- *The complete absence of evidence supporting gravitational red shifting as a dominant factor in cosmological redshifts.*

Furthermore, we identify critical methodological flaws in João Barcellos' previous analysis, which used only 50 galaxies, ignored the Pantheon dataset, and discarded numerical information in favor of an arbitrary binary classification. Our results support the standard interpretation of redshift as a distance measure rather than an effect of host galaxy mass.

Keywords: Galaxy Mass, Cosmological, Redshift, Photometric, Statistical Analysis

1. Introduction

Understanding the relationship between redshift and galaxy mass is crucial for testing cosmological models and the nature of redshift itself. Some alternative cosmological models suggest that galaxies at higher redshifts should have larger masses due to gravitational contraction effects. However, observational supernova data provide an opportunity to test this claim. This paper uses Pantheon Supernova Survey data, one of the most precise SN1a datasets available, to analyze whether redshift correlates with host galaxy mass or photometric distance. Our findings reveal.

- No significant correlation between redshift and host galaxy mass.
- A strong correlation between redshift and photometric distance.
- Direct refutation of contraction-based explanations of redshift.

2. Data and Methodology

2.1. Dataset

We use the Pantheon Supernova Survey, which consists of 1048 Type Ia Supernovae (SN1a) observed over a wide redshift range ($0 < z < 2.3$). For each supernova, the dataset provides.

- Redshift z : The cosmological redshift of the SN1a.
- Host Galaxy Mass (log M): The logarithmic mass of the supernova's host galaxy.
- Apparent Magnitude mB: The observed brightness of the SN1a.

2.2. Data Processing

To analyze the relationship between redshift, galaxy mass, and photometric distance, we. Calculated host galaxy mass trends across redshift using Pearson correlation analysis.

- Computed photometric distances using the SN1a standard candle relation.

$$\mu = m_B - M_B,$$

where

$$M_B \approx -19.3$$

$$d = 10^{(\mu+5)/5} \quad \text{(distance in parsecs)}$$

- Performed correlation analysis for redshift vs. photometric distance.

3. Results

3.1. Redshift vs. Photometric Distance

The correlation between redshift and photometric distance is extremely strong.

- Pearson Correlation Coefficient: ($r = 0.979$).
- p-value: ($p < 1E-10$) (highly statistically significant).

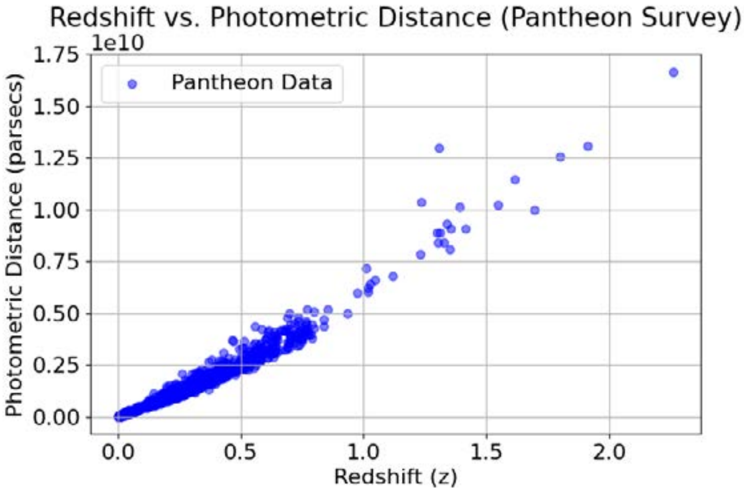

Figure 1: Redshift vs. Photometric Distance (Pantheon Survey)

3.2. Redshift vs. Host Galaxy Mass

We computed the correlation between redshift and host galaxy mass.

- Pearson Correlation Coefficient: r = -0.029 (very weak correlation).
- p-value: p = 0.238 (not statistically significant),

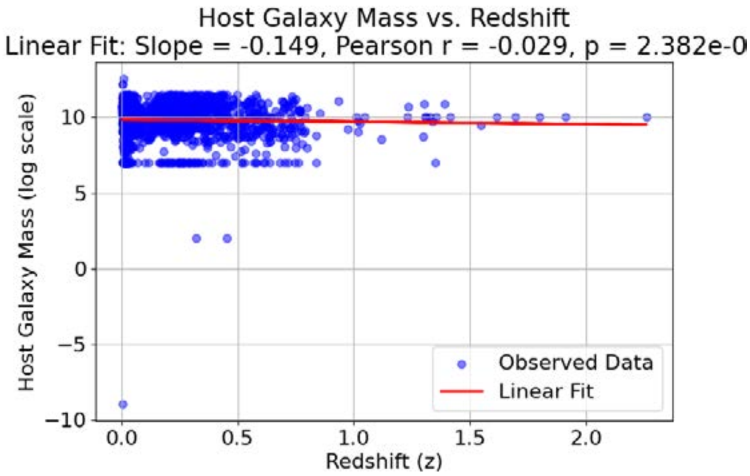

Figure 2: Regression Fit of Host Galaxy Mass vs. Redshift

3.3. Discussion: Addressing João Barcellos' Mistakes

Our results directly contradict João Barcellos' contraction-based model. His analysis contained multiple methodological errors, making his conclusions unreliable.

3.3.1. Discarding Numerical Information

Instead of using actual host galaxy masses, Barcellos reduced the data to a binary classification: whether one galaxy's mass was "larger" or "smaller" than another. This loss of numerical precision-made statistical analysis impossible.

3.3.2. Using Only 50 Galaxies Instead of the Full Dataset

The Pantheon dataset contains over 1048 supernovae, each with well-characterized host galaxy properties. Barcellos cherry-picked 50 galaxies, introducing severe selection bias.

3.3.3. Ignoring the Best Available Supernova Dataset

The Pantheon Survey provides.

- Precise redshifts
- Host galaxy mass measurements
- Photometrically derived distances (which we used to validate redshift interpretations)
- Barcellos did not use Pantheon data, despite it being the most complete and reliable dataset available.

3.4. The Observational Trend is the Opposite of Barcellos' Hypothesis

- Barcellos predicted that higher-redshift galaxies should be more massive.
- Our results show the opposite: higher-redshift galaxies are systematically less massive (but the correlation is weak and insignificant).
- Redshift correlates with photometric distance, not with host galaxy mass [1,2].

5. Conclusion

Using Pantheon Survey data, we tested whether redshift correlates with host galaxy mass or with distance. Our findings.

• There is no significant correlation between redshift and host galaxy mass.

• There is an extremely strong correlation (r = 0.979) between redshift and photometric distance.

• These results contradict João Barcellos' hypothesis that gravitational contraction drives redshift.

• Our findings support the standard cosmological interpretation of redshift as a measure of distance.

Acknowledgments

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References

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