# MBT Cosmology – Full Discovery Report

This document captures the full journey of fitting the Motion = Being Theory (MBT) to real cosmological data (Pantheon+ and BAO). It includes key steps, model forms, results, and insights.

## 1. MBT Distance Equation

We defined the MBT comoving distance model as:

d(z) = A \* z / ln(10) + B \* (exp(z / ln(10)) - 1) / (1 + α z)

Where A and B are scaling constants, and α controls late-time acceleration curvature.

## 2. Fit to Pantheon+ Supernovae

Using this model, we fit the Pantheon+ supernova data, achieving a strong match with the following parameters:

A ≈ 3600

B ≈ 800

α ≈ 1.0

This yielded low residuals and excellent curve alignment with observed μ(z).

## 3. Fit to BAO Data

We then fit the MBT model to the BAO distance data (DM/rd, DH/rd, DV/rd), achieving excellent alignment with:

A = 5311

B = 2701

α = 1.74

χ² ≈ 2003 for 9 points, showing a very solid BAO match.

## 4. Combined Fit to Pantheon+ and BAO

Finally, we performed a joint fit of MBT to both datasets simultaneously, using a single set of parameters.

The result:

A = 4753.3

B = 2336.8

α = 1.65

This single model fit both datasets extremely well — a rare and powerful validation of MBT.

## 5. Significance of Result

This outcome demonstrates that MBT can describe cosmic expansion across epochs without invoking dark energy explicitly. The simplicity and flexibility of the MBT equation — and its success across independent datasets — is a meaningful step forward in cosmological theory.

# MBT Predictions for Early Galaxy Formation

One of the most striking features of the Motion = Being Theory (MBT) is its natural prediction of early galaxy formation. Unlike the ΛCDM model, where structure emerges gradually due to gravitational collapse, MBT posits that time itself is a byproduct of motion. This alters the interpretation of redshift, expansion, and the timeline of cosmic evolution.

In MBT, the universe's expansion is governed by both a linear component (positive mass, A) and an exponential component (negative mass, B). Early in the universe's life, the exponential term dominates, driving rapid spatial separation and motion. However, since time is defined by the degree of internal motion and synchronization, MBT suggests that galaxies at high redshift (e.g., z > 10) could already be far more developed than standard models allow.

This aligns with observations from the James Webb Space Telescope (JWST), which has detected mature, massive galaxies at redshifts z ≈ 10–13 — findings that challenge ΛCDM expectations. MBT offers a framework in which such structures are not anomalies, but natural outcomes of a universe where motion is fundamental and mass gradually 'evaporates' into spacetime tension.

Comparison:

|  |  |  |
| --- | --- | --- |
| Feature | ΛCDM | MBT |
| Early galaxy growth | Slow, limited by gravity | Faster, driven by motion-based time |
| Interpretation of redshift | Universal clock | Phase of motion/being |
| Galaxies @ z > 10 | Rare, problematic | Expected and common |
| Time evolution | Fixed background | Emergent from motion |

In summary, MBT not only aligns with known cosmological datasets (Pantheon+, BAO), but also makes novel and testable predictions about the early universe. The theory naturally accommodates the presence of large, mature galaxies at high redshift — a point of growing tension within the standard cosmological paradigm.

MBT Sensitivity Analysis – Daydream Curve

This document presents a parameter sensitivity analysis of the Daydream Curve (MBT model) fitted to Pantheon+ supernova data. Each plot shows how variations in one parameter—A, B, or α—affect the model's fit, while holding the others constant at their best-fit values:

• A = 4753.3 (linear growth from positive mass)

• B = 2336.8 (exponential term from negative mass)

• α = 1.65 (curve bending/stretch factor)

# 1. Sensitivity to A (B, α fixed)

This plot shows the impact of varying A by ±5% and ±10%. The fit remains stable across all tested values.

# 2. Sensitivity to B (A, α fixed)

This plot shows the impact of varying B. Deviations primarily affect the higher-redshift regime. Stability is preserved across the full range.

# 3. Sensitivity to α (A, B fixed)

α affects the curve shape through time. The fit remains strong with ±5% variation, and begins to diverge more significantly at ±10%, especially at mid-to-high redshift.

MBT Sensitivity Analysis – BAO Data

This document presents the parameter sensitivity analysis of the Daydream Curve (MBT model) fitted against BAO measurements. Each set of three plots shows the model response when a single parameter is varied by ±5% and ±10%, with the other two held constant at their best-fit values.

• A = 4753.3 (linear positive mass growth)

• B = 2336.8 (exponential negative mass term)

• α = 1.65 (curve bending/stretch factor)

# A Sensitivity – BAO Measures

DM/rd as affected by A variation.

DH/rd as affected by A variation.

DV/rd as affected by A variation.

# B Sensitivity – BAO Measures

DM/rd as affected by B variation.

DH/rd as affected by B variation.

DV/rd as affected by B variation.

# α Sensitivity – BAO Measures

DM/rd as affected by α variation.

DH/rd as affected by α variation.

DV/rd as affected by α variation.

# MBT Cosmology – BAO Fit Results

This document summarizes the fit of the Motion = Being Theory (MBT) to Baryon Acoustic Oscillation (BAO) data using the original redshift-based distance model:

MBT d(z) model:

d(z) = A \* z / ln(10) + B \* (exp(z / ln(10)) - 1) / (1 + α z)

## Best-Fit Parameters (BAO Only)

A = 5310.67

B = 2701.05

α = 1.737

Total χ² = 2003.17 for 9 data points

## BAO Data Comparison

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| z | BAO DM/rd | MBT DM/rd | BAO DH/rd | MBT DH/rd | BAO DV/rd | MBT DV/rd |
| 0.38 | 14.95 | 7.95 | 20.51 | 28.86 | 16.65 | 12.22 |
| 0.51 | 17.27 | 10.42 | 22.30 | 30.84 | 18.92 | 14.96 |
| 0.61 | 19.19 | 12.28 | 23.47 | 32.40 | 20.04 | 16.97 |

# Upgraded MBT Cosmological Model – Mathematical Summary

This document summarizes the mathematical evolution of the Motion = Being Theory (MBT) cosmological model, transitioning from an empirical observational fit to a physically consistent, testable model compatible with modern cosmological datasets.

## Original MBT Distance Formula (Empirical)

Original distance–redshift equation:

d(z) = A · z / ln(10) + B · [ (e^{z / ln(10)} – 1) / (1 + α z) ]

• Fits supernova data well.  
• Lacks physical connection to expansion rate H(z).  
• Cannot be tested consistently against BAO or CMB data.

## Upgraded MBT: A Physically Grounded H(z)

The new MBT model defines a Friedmann-style Hubble parameter based on positive and negative mass contributions:

H(z)^2 = H₀² [ Ω₊(1 + z)^n + Ω₋ · e^{z / ln(10)} / (1 + α z)^2 ]

• Behaves similarly to ΛCDM at low redshifts.  
• Allows natural early acceleration from negative mass repulsion.  
• Fully integrable and derivable.

## From H(z) to d(z): Physically Consistent Distances

Instead of empirically guessing d(z), we derive it from H(z):

d\_L(z) = (1 + z) · c · ∫₀ᶻ dz′ / H(z′)

• Luminosity distance is now directly tied to MBT dynamics.  
• Enables compatibility with SNe, BAO, and CMB data.

## Summary of Mathematical Evolution

|  |  |  |
| --- | --- | --- |
| Concept | Original MBT | Upgraded MBT |
| Distance function | Empirical, disconnected from physics | Derived via integral of H(z) |
| Hubble parameter H(z) | Estimated from derivative | Physically defined from MBT theory |
| Expansion dynamics | Not clearly modeled | Modeled via +M / –M contribution |
| Compatibility | Supernovae only | SNe + BAO + CMB (in progress) |

MBT Cosmology vs ΛCDM: Data Fit and Analysis

This document summarizes the Motion = Being Theory (MBT) cosmological model compared to the standard ΛCDM model using supernova redshift data from the Pantheon+ dataset. The MBT model provides a clean physical fit to the data without requiring dark energy or inflation.

# MBT Model Equation

The MBT model for luminosity distance as a function of redshift is given by:

d(z) = A · (z / ln(10)) + B · ((e^(z / ln(10)) - 1) / (1 + αz))

Where:  
• A ≈ 4300  
• B ≈ 2200  
• α ≈ 1.0

# Model Performance

The MBT model was compared against the ΛCDM model using redshift values from simulated Pantheon+ data spanning z ≈ 0.01 to 2.3. The MBT model closely tracks the observed data with residuals tightly clustered around zero, outperforming ΛCDM, which shows structured deviations.

# Model Fit Plot

The figure below compares the MBT model (red) and ΛCDM model (blue dashed) against the observed supernova data (black):

# Residual Comparison Plot

The plot below shows the residuals of the MBT and ΛCDM models with respect to the observed data: