MBT Replication Kit 2: BAO and Global Sensitivity

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# Purpose

This kit enables any researcher to test the Motion = Being Theory (MBT) 'Daydream Curve' cosmological model against any public BAO dataset, using the global best-fit parameters and a full sensitivity analysis. You can directly compare MBT’s predictions to BAO observations from SDSS, BOSS, eBOSS, or any future survey.

# How To Use This Kit

1. Open MBT\_Global\_Sensitivity\_Report.docx:  
 - Review the global best-fit MBT parameters:  
 • A = -48560.23  
 • B = 54479.79  
 • α = 0.0425  
 - See how the model behaves as each parameter is varied ±5% and ±10%.  
  
2. Reference the MBT Daydream Curve Formula:  
 d(z) = A \* z/ln(10) + B \* (exp(z/ln(10)) – 1)/(1 + αz)  
 (If your global fit uses a different form, specify it.)  
  
3. Get or Use Any BAO Dataset:  
 - Recommended: SDSS DR12 BAO consensus data (see README in Kit 1).  
 - Or, use your own BAO measurements (z, DM/rd, DH/rd, DV/rd).  
  
4. Compare MBT Predictions to Data:  
 - Use the global best-fit parameters to generate MBT predictions for the same redshifts as your BAO data.  
 - Compare your curves with the observed BAO points.  
 - For deeper analysis, check the model's sensitivity (does a small parameter shift affect the fit?).  
  
5. Optionally:  
 - Re-fit the MBT model to your chosen BAO data, using the provided equation as a template.  
 - Share new parameters and results for open replication!

# Reproducibility Note

All figures, parameter values, and sensitivity tests in this kit are ready for direct reproduction.  
The MBT model can be compared to any BAO dataset: just plug in z, calculate DM/rd, DH/rd, DV/rd, and overlay your data.  
For code, use the Python functions below, adjusting parameters as needed.

# Python Code for BAO Replication

The following code allows direct replication for any BAO dataset (replace the data arrays with your chosen BAO table):

import numpy as np  
import matplotlib.pyplot as plt  
  
# --- Example BAO dataset (replace with your actual or test data) ---  
z = np.array([0.38, 0.51, 0.61]) # Redshift values  
dm\_obs = np.array([10.27, 13.38, 15.67]) # Observed DM/rd  
dh\_obs = np.array([26.27, 21.18, 20.81]) # Observed DH/rd  
dv\_obs = np.array([13.94, 17.86, 19.60]) # Observed DV/rd  
dm\_err = np.array([0.15, 0.17, 0.20])  
dh\_err = np.array([0.86, 0.52, 0.57])  
dv\_err = np.array([0.22, 0.23, 0.27])  
  
# --- MBT global best-fit parameters ---  
A = -48560.23  
B = 54479.79  
alpha = 0.0425  
rd = 147.78 # Sound horizon, Planck 2018 value (Mpc)  
  
def mbt\_distance(z, A, B, alpha):  
 ln10 = np.log(10)  
 return A \* (z / ln10) + B \* (np.exp(z / ln10) - 1) / (1 + alpha \* z)  
  
# MBT predictions for BAO observables:  
def mbt\_dm\_over\_rd(z, A, B, alpha, rd=rd):  
 return mbt\_distance(z, A, B, alpha) / rd  
  
def mbt\_dh\_over\_rd(z, H0=70, rd=rd):  
 c = 299792.458  
 return c / (H0 \* rd) / (1 + z)  
  
def mbt\_dv\_over\_rd(z, A, B, alpha, H0=70, rd=rd):  
 c = 299792.458  
 dm = mbt\_distance(z, A, B, alpha)  
 dh = c / H0 / (1 + z)  
 dv = (dm\*\*2 \* z \* dh)\*\*(1/3)  
 return dv / rd  
  
# --- Plotting: DM/rd ---  
plt.errorbar(z, dm\_obs, yerr=dm\_err, fmt='o', label='Observed BAO (DM/rd)')  
plt.plot(z, mbt\_dm\_over\_rd(z, A, B, alpha), 'r-', label='MBT Global Fit')  
plt.xlabel('Redshift (z)')  
plt.ylabel('DM/rd')  
plt.legend()  
plt.grid(True)  
plt.title('MBT Global Fit vs. BAO DM/rd')  
plt.show()  
  
# --- Plotting: DH/rd ---  
plt.errorbar(z, dh\_obs, yerr=dh\_err, fmt='o', label='Observed BAO (DH/rd)')  
plt.plot(z, mbt\_dh\_over\_rd(z), 'r-', label='MBT Global Fit')  
plt.xlabel('Redshift (z)')  
plt.ylabel('DH/rd')  
plt.legend()  
plt.grid(True)  
plt.title('MBT Global Fit vs. BAO DH/rd')  
plt.show()  
  
# --- Plotting: DV/rd ---  
plt.errorbar(z, dv\_obs, yerr=dv\_err, fmt='o', label='Observed BAO (DV/rd)')  
plt.plot(z, mbt\_dv\_over\_rd(z, A, B, alpha), 'r-', label='MBT Global Fit')  
plt.xlabel('Redshift (z)')  
plt.ylabel('DV/rd')  
plt.legend()  
plt.grid(True)  
plt.title('MBT Global Fit vs. BAO DV/rd')  
plt.show()

# References

SDSS DR12 BAO Consensus Table: Alam et al. 2017 (https://arxiv.org/abs/1607.03155)  
MBT sensitivity and global fit: See attached MBT\_Global\_Sensitivity\_Report.docx