# MBT Null Test Comparison Code

This script fetches an SDSS star field from a location far from the MBT well and compares it to an MBT synthetic curvature map to confirm there is no false correlation.

# Step 1: Import required libraries  
import numpy as np  
import matplotlib.pyplot as plt  
from astropy.coordinates import SkyCoord  
from astroquery.sdss import SDSS  
from astropy import units as u  
from scipy.ndimage import zoom  
from skimage import exposure  
  
# Step 2: Define a "null" test coordinate far from known MBT well structure  
coord = SkyCoord(ra=250\*u.degree, dec=50\*u.degree, frame='icrs')  
  
# Step 3: Fetch SDSS image from the 'r' band  
images = SDSS.get\_images(coordinates=coord, band='r', radius=0.05 \* u.deg)  
img\_data = images[0][0].data  
  
# Step 4: Normalize SDSS image for display  
img\_data = img\_data.astype(np.float32)  
img\_data -= np.min(img\_data)  
img\_data /= np.max(img\_data)  
img\_data = exposure.equalize\_adapthist(img\_data, clip\_limit=0.03)  
  
# Step 5: Generate MBT curvature map at a far-away region (off-center)  
grid\_size = img\_data.shape[0]  
x = np.linspace(-2, 2, grid\_size)  
y = np.linspace(-2, 2, grid\_size)  
X, Y = np.meshgrid(x, y)  
log\_dist = np.log10(np.sqrt((X - 1)\*\*2 + (Y - 1)\*\*2) + 1e-4)  
mbt\_curvature = 10\*\*(-2 \* log\_dist)  
  
# Step 6: Resize MBT curvature to match image  
mbt\_resized = zoom(mbt\_curvature, np.array(img\_data.shape) / np.array(mbt\_curvature.shape))  
  
# Step 7: Plot both images side-by-side  
plt.figure(figsize=(12, 5))  
  
plt.subplot(1, 2, 1)  
plt.imshow(img\_data, cmap='gray')  
plt.title("SDSS Star Field (Far Region)")  
plt.axis('off')  
  
plt.subplot(1, 2, 2)  
plt.imshow(mbt\_resized, cmap='plasma')  
plt.title("MBT Synthetic Curvature Field")  
plt.axis('off')  
  
plt.tight\_layout()  
plt.show()