import numpy as np

import matplotlib.pyplot as plt

# Parameters

S\_quantum = 2.828 # Quantum maximum (Tsirelson bound)

S\_classical = 2.0 # Classical/local realism limit

N = 100

# Collapse goes from 0 (order) to 1 (chaos) and back to 0 (recovery)

C = np.concatenate([np.linspace(0, 1, N), np.linspace(1, 0, N)])

t = np.arange(len(C))

# S decreases as coherence collapses, revives as it heals

S = S\_quantum - (S\_quantum - S\_classical) \* C

# Plot

plt.figure(figsize=(7,5))

plt.plot(t, S, label="Bell S (MBT)", color='slateblue')

plt.axhline(S\_classical, ls="--", color="gray", label="Classical Limit")

plt.axhline(S\_quantum, ls="--", color="purple", label="Quantum Limit")

plt.xlabel("Time (collapse → healing)")

plt.ylabel("Bell S (Order Parameter)")

plt.title("Emergence & Revival of Quantum Order (MBT: S vs. Collapse/Healing)")

plt.legend()

plt.tight\_layout()

plt.show()