Parameter Sweep Report: Emergent Gravity from Quantum Collapse

Sweep results are saved in CSV file: run\_results\_20250219\_132636/param\_sweep\_results\_20250219\_132636.csv

# Parameter Ranges

collapse\_rates = [0.1, 0.3, 0.5]  
collapse\_sigmas = [0.1, 0.2]  
amplitudes = [0.5, 1.0]  
noise\_amplitudes = [0.005, 0.01]  
density\_decays = [0.99, 0.95]  
relativistic\_factors = [0.0, 0.01]  
Fixed sim parameters: G=1.0, L=10.0, N=64, steps\_per\_cycle=50, num\_cycles=2, dt=0.05

# Discussion

This parameter sweep systematically explores a range of collapse dynamics parameters in a relativistic-inspired simulation of a real scalar field. The simulation couples collapse-like dynamics with gravitational potential computation via the Poisson equation (with a crude relativistic correction). The emergent noise spectrum of the gravitational potential is analyzed, and its power-law exponent is estimated. A steep negative exponent (close to -5) indicates strong suppression of small-scale fluctuations, suggesting that the gravitational field is dominated by large-scale coherence. These quantitative results provide an independent signature that can be compared with experimental observations.

# Next Steps

1) Identify parameter combinations that consistently yield noise exponents near -5.  
2) Increase simulation resolution and duration for robust statistics.  
3) Refine the collapse model to more accurately capture CSL/GRW dynamics and include further relativistic corrections.  
4) Run control simulations with independently generated potentials to guard against circular reasoning.  
5) Compare the predicted noise spectrum with experimental data from short-range gravity experiments or gravitational-wave detectors.