Parameter Sweep Report: Emergent Gravity from Quantum Collapse

Sweep results are saved in CSV file: run\_results\_20250217\_154441/param\_sweep\_results\_20250217\_154441.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

The sweep systematically varies the collapse dynamics parameters and computes the noise spectrum exponent for the mid-plane gravitational potential. A steep negative exponent (near -5) would indicate strong suppression of small-scale fluctuations, implying a coherent large-scale gravitational field emerging from the collapse process. If the exponent is less steep (e.g., near -1 or -2), then the small-scale noise is more dominant. These quantitative results provide an independent prediction that can eventually be compared with experimental data.

# Next Steps

1) Identify parameter combinations that consistently yield a noise exponent near -5.  
2) Increase simulation resolution and number of cycles for improved statistics.  
3) Run control simulations with independently generated potentials to verify the emergent noise signature.  
4) Compare the simulation's noise spectrum with experimental data from precision gravity experiments.