Parameter Sweep Report: Emergent Gravity from Quantum Collapse

Sweep results are saved in CSV file: run\_results\_20250218\_115750/param\_sweep\_results\_20250218\_115750.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 simulation parameters: G=1.0, L=10.0, N=64, steps\_per\_cycle=50, num\_cycles=2, dt=0.05

# Results Evaluation

The average noise exponent (slope) over the valid parameter combinations is -3.575 with a standard deviation of 0.194. A steep negative slope (around -5) suggests that small-scale fluctuations in the gravitational potential are strongly suppressed, yielding a coherent large-scale field—consistent with the hypothesis. If many parameter combinations produce slopes near -5, this would provide encouraging evidence that quantum collapse dynamics could be responsible for an emergent gravitational field. Conversely, if the slopes are significantly less steep, the emergent effect may be weaker. Further high-resolution simulations and comparisons with experimental data are needed to confirm these trends.

# Next Steps

1) Increase simulation resolution (N) and duration (steps\_per\_cycle, num\_cycles) for robust statistics.  
2) Identify parameter combinations that consistently yield slopes near -5 and refine those further.  
3) Run control simulations with independently generated potentials to avoid circularity.  
4) Compare the predicted noise spectrum with experimental data from short-range gravity experiments or gravitational-wave detectors.