Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.3616  
 collapse\_sigma: 0.1969  
 collapse\_amplitude: 0.9932  
 continuous\_noise\_amplitude: 0.0070  
 density\_decay: 0.9536  
 relativistic\_factor: 0.0028  
Estimated noise exponent (slope): -4.024  
Fitness: -0.9757

# Optimization Process Summary

The optimization algorithm ran for multiple iterations, sampling parameter combinations and evaluating the fitness (defined as -|slope + 5|, with a target slope of -5). In each iteration, the top 20% configurations were selected to refine the parameter ranges. The following table summarizes the final iteration's best configurations:  
Config 1: {'collapse\_rate': 0.2683850998686924, 'collapse\_sigma': 0.18081922646810883, 'collapse\_amplitude': 0.7420005408683268, 'continuous\_noise\_amplitude': 0.007659421821028525, 'density\_decay': 0.9565781470153467, 'relativistic\_factor': 0.005166244985534409} -> slope: -3.8121465443895004  
Config 2: {'collapse\_rate': 0.2680711911289925, 'collapse\_sigma': 0.18084057639325, 'collapse\_amplitude': 0.7421290384904522, 'continuous\_noise\_amplitude': 0.0076407375467971985, 'density\_decay': 0.9564942308454065, 'relativistic\_factor': 0.005024167686751095} -> slope: -3.7517841223654105  
Config 3: {'collapse\_rate': 0.2682906601581538, 'collapse\_sigma': 0.1807606419026281, 'collapse\_amplitude': 0.7427916155105476, 'continuous\_noise\_amplitude': 0.007662676346321077, 'density\_decay': 0.9565804594301377, 'relativistic\_factor': 0.005172317328131231} -> slope: -3.750678840127824  
Config 4: {'collapse\_rate': 0.2681933207356549, 'collapse\_sigma': 0.18075843861782012, 'collapse\_amplitude': 0.7427545723591858, 'continuous\_noise\_amplitude': 0.007703145957886675, 'density\_decay': 0.9565645481903748, 'relativistic\_factor': 0.005161106289758003} -> slope: -3.747259388964072  
Config 5: {'collapse\_rate': 0.26843724424763254, 'collapse\_sigma': 0.18078958744140627, 'collapse\_amplitude': 0.7428568148008965, 'continuous\_noise\_amplitude': 0.007753628445293606, 'density\_decay': 0.9565355957568565, 'relativistic\_factor': 0.005071307975810938} -> slope: -3.7430535011149906  
Config 6: {'collapse\_rate': 0.2680790804098524, 'collapse\_sigma': 0.18082475518621366, 'collapse\_amplitude': 0.7421437298970827, 'continuous\_noise\_amplitude': 0.0077426496550778495, 'density\_decay': 0.9566066286047253, 'relativistic\_factor': 0.005128142252224574} -> slope: -3.733385567293249  
Config 7: {'collapse\_rate': 0.26799663015076, 'collapse\_sigma': 0.18072875489727533, 'collapse\_amplitude': 0.7427634613349642, 'continuous\_noise\_amplitude': 0.0076943331116168185, 'density\_decay': 0.9565321895722404, 'relativistic\_factor': 0.005022529979665964} -> slope: -3.7293070357501725  
Config 8: {'collapse\_rate': 0.268116341018559, 'collapse\_sigma': 0.18076276849458328, 'collapse\_amplitude': 0.7426772271166191, 'continuous\_noise\_amplitude': 0.007753861435856211, 'density\_decay': 0.9565878988758124, 'relativistic\_factor': 0.005082333972706117} -> slope: -3.7194535317679613  
Config 9: {'collapse\_rate': 0.26779114407252336, 'collapse\_sigma': 0.18085125440974872, 'collapse\_amplitude': 0.7424078478073102, 'continuous\_noise\_amplitude': 0.007756054147911431, 'density\_decay': 0.9565547731698391, 'relativistic\_factor': 0.005057495891301923} -> slope: -3.6884658150778074  
Config 10: {'collapse\_rate': 0.26802630538457267, 'collapse\_sigma': 0.1808111142223507, 'collapse\_amplitude': 0.7424323638988567, 'continuous\_noise\_amplitude': 0.00777753172064093, 'density\_decay': 0.9565957400983559, 'relativistic\_factor': 0.0050653945392218755} -> slope: -3.6882730158319705  
Config 11: {'collapse\_rate': 0.26800464893470627, 'collapse\_sigma': 0.1808314496487671, 'collapse\_amplitude': 0.7420757551002264, 'continuous\_noise\_amplitude': 0.0077073888704658105, 'density\_decay': 0.9565890046837534, 'relativistic\_factor': 0.005106353448558384} -> slope: -3.683701899885046  
Config 12: {'collapse\_rate': 0.2682466130187775, 'collapse\_sigma': 0.1808010546185111, 'collapse\_amplitude': 0.742066968024806, 'continuous\_noise\_amplitude': 0.007739607715245759, 'density\_decay': 0.9565524038164497, 'relativistic\_factor': 0.005021793816018412} -> slope: -3.6789586378880235  
Config 13: {'collapse\_rate': 0.2683545407953561, 'collapse\_sigma': 0.18073486447534395, 'collapse\_amplitude': 0.7423149438036151, 'continuous\_noise\_amplitude': 0.007732582864655536, 'density\_decay': 0.9565418140367616, 'relativistic\_factor': 0.0050784372842526135} -> slope: -3.6346338090262633  
Config 14: {'collapse\_rate': 0.26844901306123925, 'collapse\_sigma': 0.18072328598407056, 'collapse\_amplitude': 0.7425564520764476, 'continuous\_noise\_amplitude': 0.007716504495774781, 'density\_decay': 0.956578045113675, 'relativistic\_factor': 0.005108895625129964} -> slope: -3.6282595071200627  
Config 15: {'collapse\_rate': 0.2683730407220725, 'collapse\_sigma': 0.18083293092785602, 'collapse\_amplitude': 0.7427172294101554, 'continuous\_noise\_amplitude': 0.007723018324994165, 'density\_decay': 0.9566199889413007, 'relativistic\_factor': 0.005095089306132573} -> slope: -3.6256725252425146  
Config 16: {'collapse\_rate': 0.2683261982146104, 'collapse\_sigma': 0.18085272809557107, 'collapse\_amplitude': 0.7423326386630652, 'continuous\_noise\_amplitude': 0.007713021950900598, 'density\_decay': 0.9565923793023768, 'relativistic\_factor': 0.0050233034293086535} -> slope: -3.6072683383029736  
Config 17: {'collapse\_rate': 0.26779480084930807, 'collapse\_sigma': 0.1807753193050894, 'collapse\_amplitude': 0.7424246624114897, 'continuous\_noise\_amplitude': 0.007713526263242472, 'density\_decay': 0.9566017494384874, 'relativistic\_factor': 0.005152625621610556} -> slope: -3.5079877985859143  
Config 18: {'collapse\_rate': 0.26838353549238847, 'collapse\_sigma': 0.18079309841811508, 'collapse\_amplitude': 0.7425183530473017, 'continuous\_noise\_amplitude': 0.007689912907418753, 'density\_decay': 0.95657623754601, 'relativistic\_factor': 0.0050796253745573105} -> slope: -3.410300292715979  
Config 19: {'collapse\_rate': 0.2677870902136154, 'collapse\_sigma': 0.18073423961284407, 'collapse\_amplitude': 0.7422152764183587, 'continuous\_noise\_amplitude': 0.007743205187363168, 'density\_decay': 0.9566371915047082, 'relativistic\_factor': 0.005161004569188671} -> slope: -3.314236238139475  
Config 20: {'collapse\_rate': 0.2677449384935332, 'collapse\_sigma': 0.18081379557997151, 'collapse\_amplitude': 0.7422613963260332, 'continuous\_noise\_amplitude': 0.007649807765087107, 'density\_decay': 0.9565214440841827, 'relativistic\_factor': 0.0051042036393109} -> slope: -3.125042036573666

# Next Steps

1) Run higher-resolution simulations using the optimized parameters.  
2) Validate the robustness of the noise exponent with longer simulation durations.  
3) Run control simulations with independently generated potentials to verify the emergent noise signature.  
4) Compare the predicted noise spectrum with experimental data from precision gravity experiments.