Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.3070  
 collapse\_sigma: 0.1413  
 collapse\_amplitude: 0.7193  
 continuous\_noise\_amplitude: 0.0070  
 density\_decay: 0.9757  
 relativistic\_factor: 0.0069  
Estimated noise exponent (slope): -4.139  
Fitness: -0.8611

# 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': 0.30185733861693936, 'collapse\_sigma': 0.14186584425451917, 'collapse\_amplitude': 0.7113802802364598, 'continuous\_noise\_amplitude': 0.007146625697756238, 'density\_decay': 0.9762593039827102, 'relativistic\_factor': 0.006799287237197092} -> slope: -3.9555305652733703  
Config 2: {'collapse\_rate': 0.30169884430981125, 'collapse\_sigma': 0.1418790452706652, 'collapse\_amplitude': 0.7118679077014396, 'continuous\_noise\_amplitude': 0.007200329602791856, 'density\_decay': 0.9762902407283144, 'relativistic\_factor': 0.006890657751561726} -> slope: -3.8790587130216183  
Config 3: {'collapse\_rate': 0.3022706223319604, 'collapse\_sigma': 0.14185471488037718, 'collapse\_amplitude': 0.7115185197075485, 'continuous\_noise\_amplitude': 0.0071606373965954415, 'density\_decay': 0.9762908814930065, 'relativistic\_factor': 0.006847281925622067} -> slope: -3.8599653081473604  
Config 4: {'collapse\_rate': 0.3019298445405884, 'collapse\_sigma': 0.14190087790318306, 'collapse\_amplitude': 0.7116177469939848, 'continuous\_noise\_amplitude': 0.007150964154202492, 'density\_decay': 0.9763440666292265, 'relativistic\_factor': 0.006935795745538421} -> slope: -3.855867180993613  
Config 5: {'collapse\_rate': 0.3019055379547657, 'collapse\_sigma': 0.14189111764733447, 'collapse\_amplitude': 0.7115336155468307, 'continuous\_noise\_amplitude': 0.007138741174476039, 'density\_decay': 0.9762585972633362, 'relativistic\_factor': 0.006874777546700852} -> slope: -3.738808884935074  
Config 6: {'collapse\_rate': 0.3018978595236601, 'collapse\_sigma': 0.1419086750539524, 'collapse\_amplitude': 0.7111885146296689, 'continuous\_noise\_amplitude': 0.007164071748909189, 'density\_decay': 0.9763372644350156, 'relativistic\_factor': 0.006911428201264918} -> slope: -3.7086431474153274  
Config 7: {'collapse\_rate': 0.30212809958081743, 'collapse\_sigma': 0.1419128971350053, 'collapse\_amplitude': 0.7113596405758139, 'continuous\_noise\_amplitude': 0.007105353939619521, 'density\_decay': 0.9762737820469647, 'relativistic\_factor': 0.006831852519227341} -> slope: -3.663485383998497  
Config 8: {'collapse\_rate': 0.3020959496960441, 'collapse\_sigma': 0.14191816323193582, 'collapse\_amplitude': 0.7121612482347929, 'continuous\_noise\_amplitude': 0.007154757851637244, 'density\_decay': 0.976370341325761, 'relativistic\_factor': 0.00683040832179369} -> slope: -3.6592908748501007  
Config 9: {'collapse\_rate': 0.30192166089308137, 'collapse\_sigma': 0.1418746066593641, 'collapse\_amplitude': 0.7121117688638889, 'continuous\_noise\_amplitude': 0.007117813945989039, 'density\_decay': 0.9762612335801643, 'relativistic\_factor': 0.006844749409116476} -> slope: -3.646089023682722  
Config 10: {'collapse\_rate': 0.3022386167072299, 'collapse\_sigma': 0.1418408795299125, 'collapse\_amplitude': 0.7113887734484922, 'continuous\_noise\_amplitude': 0.007190775850945988, 'density\_decay': 0.9763074856190664, 'relativistic\_factor': 0.006932562517074555} -> slope: -3.6248589431869007  
Config 11: {'collapse\_rate': 0.30171830224255514, 'collapse\_sigma': 0.14191153468282128, 'collapse\_amplitude': 0.7113943167628975, 'continuous\_noise\_amplitude': 0.007171158331950053, 'density\_decay': 0.9763534056036851, 'relativistic\_factor': 0.006864462973813233} -> slope: -3.615670391356509  
Config 12: {'collapse\_rate': 0.301710924195043, 'collapse\_sigma': 0.1418963834789424, 'collapse\_amplitude': 0.7115712672955016, 'continuous\_noise\_amplitude': 0.007205569948755512, 'density\_decay': 0.976376731501831, 'relativistic\_factor': 0.006922615723962948} -> slope: -3.5991801626786715  
Config 13: {'collapse\_rate': 0.30195299592682195, 'collapse\_sigma': 0.14184158821020285, 'collapse\_amplitude': 0.7116119923866423, 'continuous\_noise\_amplitude': 0.007144273793632395, 'density\_decay': 0.9763724171708668, 'relativistic\_factor': 0.006798247074977305} -> slope: -3.5582492628719353  
Config 14: {'collapse\_rate': 0.3019972469456347, 'collapse\_sigma': 0.14189491459069076, 'collapse\_amplitude': 0.711786337174203, 'continuous\_noise\_amplitude': 0.007186096604382622, 'density\_decay': 0.9763359201141549, 'relativistic\_factor': 0.006855951830316102} -> slope: -3.537637678268086  
Config 15: {'collapse\_rate': 0.302194091654652, 'collapse\_sigma': 0.14186379901347176, 'collapse\_amplitude': 0.7113758426902232, 'continuous\_noise\_amplitude': 0.007177661113514383, 'density\_decay': 0.9762972072891021, 'relativistic\_factor': 0.006938356771992898} -> slope: -3.4846089479972755  
Config 16: {'collapse\_rate': 0.30190026607413284, 'collapse\_sigma': 0.1418544654310628, 'collapse\_amplitude': 0.71145374010728, 'continuous\_noise\_amplitude': 0.007110702457077708, 'density\_decay': 0.9763687991483817, 'relativistic\_factor': 0.006880416345790098} -> slope: -3.4771371188686877  
Config 17: {'collapse\_rate': 0.3019042337472856, 'collapse\_sigma': 0.14184058339595365, 'collapse\_amplitude': 0.7115643258336111, 'continuous\_noise\_amplitude': 0.007126457018850166, 'density\_decay': 0.9763577809073983, 'relativistic\_factor': 0.006819336731666945} -> slope: -3.464005419453089  
Config 18: {'collapse\_rate': 0.3022702864882985, 'collapse\_sigma': 0.14183780262318574, 'collapse\_amplitude': 0.7114603455333656, 'continuous\_noise\_amplitude': 0.0071997157213094165, 'density\_decay': 0.9763052207823978, 'relativistic\_factor': 0.006819174448948864} -> slope: -3.448208487731317  
Config 19: {'collapse\_rate': 0.30185037983693347, 'collapse\_sigma': 0.1418222059881955, 'collapse\_amplitude': 0.7112384528212756, 'continuous\_noise\_amplitude': 0.007187054678508499, 'density\_decay': 0.976264996633247, 'relativistic\_factor': 0.006933550083357067} -> slope: -3.40355604829496  
Config 20: {'collapse\_rate': 0.3017676283980013, 'collapse\_sigma': 0.1418186682709712, 'collapse\_amplitude': 0.7117430433641588, 'continuous\_noise\_amplitude': 0.0071516308922529885, 'density\_decay': 0.9762571889994062, 'relativistic\_factor': 0.006833978942368842} -> slope: -3.36608420318315

# 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.