Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.3049  
 collapse\_sigma: 0.1432  
 collapse\_amplitude: 0.5919  
 continuous\_noise\_amplitude: 0.0069  
 density\_decay: 0.9751  
 relativistic\_factor: 0.0052  
Estimated noise exponent (slope): -4.040  
Fitness: -0.9597

# 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': 0.30490792111854387, 'collapse\_sigma': 0.14321883117707424, 'collapse\_amplitude': 0.591903641644656, 'continuous\_noise\_amplitude': 0.006925200573823637, 'density\_decay': 0.9750727038974611, 'relativistic\_factor': 0.005184280672884635} -> slope: -4.040301417107055  
Config 2: {'collapse\_rate': 0.3047686020236448, 'collapse\_sigma': 0.1432631062554247, 'collapse\_amplitude': 0.5919527183035669, 'continuous\_noise\_amplitude': 0.006923804261318594, 'density\_decay': 0.975088720312408, 'relativistic\_factor': 0.005174684767096973} -> slope: -3.860831303861122  
Config 3: {'collapse\_rate': 0.3048043858963758, 'collapse\_sigma': 0.14312701303525482, 'collapse\_amplitude': 0.5922959025993005, 'continuous\_noise\_amplitude': 0.0068961014287359035, 'density\_decay': 0.9749945019912233, 'relativistic\_factor': 0.005247704329797415} -> slope: -3.8085788028263057  
Config 4: {'collapse\_rate': 0.3050250131454109, 'collapse\_sigma': 0.14317604807706644, 'collapse\_amplitude': 0.5920993625302878, 'continuous\_noise\_amplitude': 0.006862879890707202, 'density\_decay': 0.9749980751127012, 'relativistic\_factor': 0.0052459654927305205} -> slope: -3.8064695663154136  
Config 5: {'collapse\_rate': 0.30472660684125147, 'collapse\_sigma': 0.14315344864500434, 'collapse\_amplitude': 0.592073988811002, 'continuous\_noise\_amplitude': 0.0068839179959813345, 'density\_decay': 0.9750923698187447, 'relativistic\_factor': 0.005192694362240968} -> slope: -3.7286820635945817  
Config 6: {'collapse\_rate': 0.3046362971376344, 'collapse\_sigma': 0.14328989586175164, 'collapse\_amplitude': 0.5921441333151101, 'continuous\_noise\_amplitude': 0.006934418334419068, 'density\_decay': 0.9749757451755492, 'relativistic\_factor': 0.005211145862662356} -> slope: -3.7267395567427144  
Config 7: {'collapse\_rate': 0.3044741093878775, 'collapse\_sigma': 0.1432492630951031, 'collapse\_amplitude': 0.5923749155393592, 'continuous\_noise\_amplitude': 0.006920527510716352, 'density\_decay': 0.9749622956871521, 'relativistic\_factor': 0.005276509644938478} -> slope: -3.7209312207217384  
Config 8: {'collapse\_rate': 0.3044973719034414, 'collapse\_sigma': 0.14324199648317967, 'collapse\_amplitude': 0.5926320478316781, 'continuous\_noise\_amplitude': 0.0068378877098362175, 'density\_decay': 0.975065334496046, 'relativistic\_factor': 0.005195118546027878} -> slope: -3.717012178439732  
Config 9: {'collapse\_rate': 0.30455002830780264, 'collapse\_sigma': 0.14327085473912377, 'collapse\_amplitude': 0.5918530117386953, 'continuous\_noise\_amplitude': 0.006812995887781962, 'density\_decay': 0.9749663412337395, 'relativistic\_factor': 0.005249811585513242} -> slope: -3.7094843660635113  
Config 10: {'collapse\_rate': 0.3045227898131311, 'collapse\_sigma': 0.14325127813017563, 'collapse\_amplitude': 0.5922597126755815, 'continuous\_noise\_amplitude': 0.006911820894500347, 'density\_decay': 0.975095680677817, 'relativistic\_factor': 0.00523774204315218} -> slope: -3.7077918943140995  
Config 11: {'collapse\_rate': 0.304609130476305, 'collapse\_sigma': 0.14314012441598845, 'collapse\_amplitude': 0.5925737399208487, 'continuous\_noise\_amplitude': 0.006867088130878928, 'density\_decay': 0.9750054305329586, 'relativistic\_factor': 0.005276824093179307} -> slope: -3.650613809889938  
Config 12: {'collapse\_rate': 0.3045710421511678, 'collapse\_sigma': 0.14320827428395608, 'collapse\_amplitude': 0.591983372235288, 'continuous\_noise\_amplitude': 0.006885150226404645, 'density\_decay': 0.9749692295346822, 'relativistic\_factor': 0.005215337920271509} -> slope: -3.6400099443782077  
Config 13: {'collapse\_rate': 0.3045008828755942, 'collapse\_sigma': 0.1431568663917937, 'collapse\_amplitude': 0.5924704757594139, 'continuous\_noise\_amplitude': 0.006826568066844425, 'density\_decay': 0.9749842126959756, 'relativistic\_factor': 0.005223568594427111} -> slope: -3.628552239184965  
Config 14: {'collapse\_rate': 0.30457782483289736, 'collapse\_sigma': 0.14317217583938832, 'collapse\_amplitude': 0.5926744913918743, 'continuous\_noise\_amplitude': 0.0068433096655791895, 'density\_decay': 0.9750243967385215, 'relativistic\_factor': 0.00522901946288331} -> slope: -3.5821646966448633  
Config 15: {'collapse\_rate': 0.3049306138046606, 'collapse\_sigma': 0.1432081850718884, 'collapse\_amplitude': 0.5926734688233364, 'continuous\_noise\_amplitude': 0.006814435803486575, 'density\_decay': 0.9750557925317577, 'relativistic\_factor': 0.005272347932981017} -> slope: -3.5778206477641117  
Config 16: {'collapse\_rate': 0.30460669841645677, 'collapse\_sigma': 0.14325814111099966, 'collapse\_amplitude': 0.592350352930162, 'continuous\_noise\_amplitude': 0.00694342897774655, 'density\_decay': 0.9749771460964024, 'relativistic\_factor': 0.005268469331072238} -> slope: -3.538929708525819  
Config 17: {'collapse\_rate': 0.30485918946828194, 'collapse\_sigma': 0.14320678404272447, 'collapse\_amplitude': 0.5922683295403118, 'continuous\_noise\_amplitude': 0.006861925913083656, 'density\_decay': 0.9750210922939068, 'relativistic\_factor': 0.005223085124850115} -> slope: -3.5054160975410644  
Config 18: {'collapse\_rate': 0.30469188969510663, 'collapse\_sigma': 0.14318983643530245, 'collapse\_amplitude': 0.592190715925217, 'continuous\_noise\_amplitude': 0.006872604290072488, 'density\_decay': 0.9749841513221554, 'relativistic\_factor': 0.005266819094974546} -> slope: -3.471994901674255  
Config 19: {'collapse\_rate': 0.3048236353034834, 'collapse\_sigma': 0.14324143060254424, 'collapse\_amplitude': 0.5920245329569246, 'continuous\_noise\_amplitude': 0.006932058404273987, 'density\_decay': 0.9750204799288744, 'relativistic\_factor': 0.005239661259084663} -> slope: -3.3191070085353007  
Config 20: {'collapse\_rate': 0.30502881891145195, 'collapse\_sigma': 0.143285863866327, 'collapse\_amplitude': 0.5923327712691742, 'continuous\_noise\_amplitude': 0.006799239637647787, 'density\_decay': 0.9750959230933532, 'relativistic\_factor': 0.00527305809340208} -> slope: -3.315988202305305

# 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.