Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.4965  
 collapse\_sigma: 0.1660  
 collapse\_amplitude: 0.7281  
 continuous\_noise\_amplitude: 0.0055  
 density\_decay: 0.9812  
 relativistic\_factor: 0.0004  
Estimated noise exponent (slope): -4.178  
Fitness: -0.8215

# 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': 0.29718308184545555, 'collapse\_sigma': 0.15438996928233076, 'collapse\_amplitude': 0.772715450734613, 'continuous\_noise\_amplitude': 0.007528849693071637, 'density\_decay': 0.9832800902732886, 'relativistic\_factor': 0.0051798447031700815} -> slope: -3.93997185227304  
Config 2: {'collapse\_rate': 0.2968403783941344, 'collapse\_sigma': 0.15455815180255283, 'collapse\_amplitude': 0.7728071511737974, 'continuous\_noise\_amplitude': 0.007543559416243989, 'density\_decay': 0.9833307576256631, 'relativistic\_factor': 0.005138242287755016} -> slope: -3.8484265442999663  
Config 3: {'collapse\_rate': 0.297387092204799, 'collapse\_sigma': 0.15453692949154374, 'collapse\_amplitude': 0.7731233034123609, 'continuous\_noise\_amplitude': 0.007541795788324493, 'density\_decay': 0.983285729451024, 'relativistic\_factor': 0.005183396020048969} -> slope: -3.7995813482300744  
Config 4: {'collapse\_rate': 0.2970492830148933, 'collapse\_sigma': 0.1544474011902775, 'collapse\_amplitude': 0.7732870126571343, 'continuous\_noise\_amplitude': 0.007500021123850364, 'density\_decay': 0.9833882715515333, 'relativistic\_factor': 0.005196567159431171} -> slope: -3.7716417255045  
Config 5: {'collapse\_rate': 0.2972069610716778, 'collapse\_sigma': 0.15448505176489147, 'collapse\_amplitude': 0.7727658098889165, 'continuous\_noise\_amplitude': 0.007502636307173899, 'density\_decay': 0.9833834337934383, 'relativistic\_factor': 0.005266717784134607} -> slope: -3.750233279296724  
Config 6: {'collapse\_rate': 0.29745203108728313, 'collapse\_sigma': 0.15452820237696824, 'collapse\_amplitude': 0.7726117323421816, 'continuous\_noise\_amplitude': 0.007556182750910307, 'density\_decay': 0.9833388287613752, 'relativistic\_factor': 0.005285207043716359} -> slope: -3.727057614437036  
Config 7: {'collapse\_rate': 0.29727372606233615, 'collapse\_sigma': 0.15438821190282587, 'collapse\_amplitude': 0.772936032774468, 'continuous\_noise\_amplitude': 0.007563277800189324, 'density\_decay': 0.9833741763784815, 'relativistic\_factor': 0.005146251435081434} -> slope: -3.62325014829347  
Config 8: {'collapse\_rate': 0.2968410239466946, 'collapse\_sigma': 0.1545712288830315, 'collapse\_amplitude': 0.7731278052180309, 'continuous\_noise\_amplitude': 0.007580042174156931, 'density\_decay': 0.9832942740568739, 'relativistic\_factor': 0.00520457040146536} -> slope: -3.6156001465864644  
Config 9: {'collapse\_rate': 0.2973490739717755, 'collapse\_sigma': 0.1544945396864381, 'collapse\_amplitude': 0.7725049013833746, 'continuous\_noise\_amplitude': 0.00748829505169553, 'density\_decay': 0.9833354936430622, 'relativistic\_factor': 0.005161963096716041} -> slope: -3.615252916588025  
Config 10: {'collapse\_rate': 0.29707167722809136, 'collapse\_sigma': 0.15439248593385635, 'collapse\_amplitude': 0.7726913843814173, 'continuous\_noise\_amplitude': 0.007553141037203997, 'density\_decay': 0.9832738785818222, 'relativistic\_factor': 0.005193987133803232} -> slope: -3.612861699414467  
Config 11: {'collapse\_rate': 0.29726759457286106, 'collapse\_sigma': 0.15441317197883336, 'collapse\_amplitude': 0.7726580408045464, 'continuous\_noise\_amplitude': 0.007553750096996488, 'density\_decay': 0.9833001528854959, 'relativistic\_factor': 0.005220796666902234} -> slope: -3.6009954591053246  
Config 12: {'collapse\_rate': 0.29698035623923286, 'collapse\_sigma': 0.15442239113558476, 'collapse\_amplitude': 0.7725526089228206, 'continuous\_noise\_amplitude': 0.007614807229713714, 'density\_decay': 0.9833212253244135, 'relativistic\_factor': 0.005218424678263876} -> slope: -3.594101634464048  
Config 13: {'collapse\_rate': 0.2969647136334974, 'collapse\_sigma': 0.15439870702626413, 'collapse\_amplitude': 0.7733253827699866, 'continuous\_noise\_amplitude': 0.007490546228295557, 'density\_decay': 0.9833561176623452, 'relativistic\_factor': 0.005142225337268435} -> slope: -3.5804701891041995  
Config 14: {'collapse\_rate': 0.2974140112138151, 'collapse\_sigma': 0.15444147992832488, 'collapse\_amplitude': 0.7730213007341461, 'continuous\_noise\_amplitude': 0.007579937174762148, 'density\_decay': 0.9833533347871342, 'relativistic\_factor': 0.005281348798637631} -> slope: -3.5579983214597006  
Config 15: {'collapse\_rate': 0.2968093079377453, 'collapse\_sigma': 0.15454039558361352, 'collapse\_amplitude': 0.7732708424483785, 'continuous\_noise\_amplitude': 0.007518512707536539, 'density\_decay': 0.9833783563253656, 'relativistic\_factor': 0.00521326489904766} -> slope: -3.550413143439037  
Config 16: {'collapse\_rate': 0.29742052298569316, 'collapse\_sigma': 0.15447543433784341, 'collapse\_amplitude': 0.7732730802244728, 'continuous\_noise\_amplitude': 0.007609180860735161, 'density\_decay': 0.9833683525984653, 'relativistic\_factor': 0.005255245301550981} -> slope: -3.5359299950313297  
Config 17: {'collapse\_rate': 0.2969891171032982, 'collapse\_sigma': 0.15444490029067565, 'collapse\_amplitude': 0.773217944304555, 'continuous\_noise\_amplitude': 0.007550187888276272, 'density\_decay': 0.9832814654924705, 'relativistic\_factor': 0.00518554031005899} -> slope: -3.4931161190912396  
Config 18: {'collapse\_rate': 0.29711692413798924, 'collapse\_sigma': 0.15449396999904924, 'collapse\_amplitude': 0.7727140768228077, 'continuous\_noise\_amplitude': 0.007504206039684749, 'density\_decay': 0.9833360649520192, 'relativistic\_factor': 0.005266825998491218} -> slope: -3.491247444632899  
Config 19: {'collapse\_rate': 0.2968607095816251, 'collapse\_sigma': 0.15445791122891653, 'collapse\_amplitude': 0.7725095684961876, 'continuous\_noise\_amplitude': 0.007519616472309224, 'density\_decay': 0.9833766841482503, 'relativistic\_factor': 0.005286192826489304} -> slope: -3.4907411888372977  
Config 20: {'collapse\_rate': 0.2968276366451688, 'collapse\_sigma': 0.15447973346308774, 'collapse\_amplitude': 0.7727295521118803, 'continuous\_noise\_amplitude': 0.007536089063796434, 'density\_decay': 0.9832692731729795, 'relativistic\_factor': 0.005142800566784272} -> slope: -3.433846955089069

# 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.