Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.3419  
 collapse\_sigma: 0.1627  
 collapse\_amplitude: 0.8366  
 continuous\_noise\_amplitude: 0.0078  
 density\_decay: 0.9651  
 relativistic\_factor: 0.0081  
Estimated noise exponent (slope): -4.003  
Fitness: -0.9965

# 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': 0.33766843250842865, 'collapse\_sigma': 0.1629082162501712, 'collapse\_amplitude': 0.841248227564281, 'continuous\_noise\_amplitude': 0.00764624558663523, 'density\_decay': 0.9652444420092736, 'relativistic\_factor': 0.008042976753621756} -> slope: -3.8872128478895274  
Config 2: {'collapse\_rate': 0.3377617445151149, 'collapse\_sigma': 0.16288565420281345, 'collapse\_amplitude': 0.8411611627781894, 'continuous\_noise\_amplitude': 0.007712059714598602, 'density\_decay': 0.9652375468750295, 'relativistic\_factor': 0.008072638319320096} -> slope: -3.873598568960427  
Config 3: {'collapse\_rate': 0.33744819816004573, 'collapse\_sigma': 0.16296292603483434, 'collapse\_amplitude': 0.8410177328227204, 'continuous\_noise\_amplitude': 0.007754421114347926, 'density\_decay': 0.9652225917770618, 'relativistic\_factor': 0.008015542336549684} -> slope: -3.803697809349312  
Config 4: {'collapse\_rate': 0.3374447725273929, 'collapse\_sigma': 0.16291058949386766, 'collapse\_amplitude': 0.8409245177583581, 'continuous\_noise\_amplitude': 0.007762793239027191, 'density\_decay': 0.9652579767425523, 'relativistic\_factor': 0.008130416167137139} -> slope: -3.755395614369685  
Config 5: {'collapse\_rate': 0.3378469027331233, 'collapse\_sigma': 0.16289998108978723, 'collapse\_amplitude': 0.8413702986494696, 'continuous\_noise\_amplitude': 0.007734237794285352, 'density\_decay': 0.9651658567424009, 'relativistic\_factor': 0.00811314373055743} -> slope: -3.7503502502310964  
Config 6: {'collapse\_rate': 0.33768633146013965, 'collapse\_sigma': 0.16299419295000978, 'collapse\_amplitude': 0.8408365399510525, 'continuous\_noise\_amplitude': 0.007759845899567998, 'density\_decay': 0.9652872913234293, 'relativistic\_factor': 0.008151566598942638} -> slope: -3.7417043954399953  
Config 7: {'collapse\_rate': 0.3374144756713774, 'collapse\_sigma': 0.1628741481316619, 'collapse\_amplitude': 0.8413713180237579, 'continuous\_noise\_amplitude': 0.007657008720999483, 'density\_decay': 0.9652118734317227, 'relativistic\_factor': 0.008007093207480168} -> slope: -3.6987044513909235  
Config 8: {'collapse\_rate': 0.3375620964741625, 'collapse\_sigma': 0.16289940889460544, 'collapse\_amplitude': 0.8414185972921834, 'continuous\_noise\_amplitude': 0.007751301587665696, 'density\_decay': 0.9652836186718065, 'relativistic\_factor': 0.008106974687188377} -> slope: -3.684772009940793  
Config 9: {'collapse\_rate': 0.33734075937759955, 'collapse\_sigma': 0.16294685539982362, 'collapse\_amplitude': 0.8409226162400992, 'continuous\_noise\_amplitude': 0.0077443538085678245, 'density\_decay': 0.965209701729292, 'relativistic\_factor': 0.008041337701761396} -> slope: -3.6806643411580144  
Config 10: {'collapse\_rate': 0.3375028601430139, 'collapse\_sigma': 0.16287860837290377, 'collapse\_amplitude': 0.8412282231165573, 'continuous\_noise\_amplitude': 0.007708091194082705, 'density\_decay': 0.9651976883010471, 'relativistic\_factor': 0.008041276102038022} -> slope: -3.6732427180763283  
Config 11: {'collapse\_rate': 0.33775084666640004, 'collapse\_sigma': 0.16287121248048103, 'collapse\_amplitude': 0.8409932123409949, 'continuous\_noise\_amplitude': 0.007712389707904703, 'density\_decay': 0.9652963387231926, 'relativistic\_factor': 0.008051720101798453} -> slope: -3.657855275410674  
Config 12: {'collapse\_rate': 0.3375223353503206, 'collapse\_sigma': 0.16289648448488003, 'collapse\_amplitude': 0.84133667286735, 'continuous\_noise\_amplitude': 0.007780328342820322, 'density\_decay': 0.9651900140590525, 'relativistic\_factor': 0.008145541410406163} -> slope: -3.6458396075149873  
Config 13: {'collapse\_rate': 0.3373422668443114, 'collapse\_sigma': 0.16290038589146558, 'collapse\_amplitude': 0.8408077016972741, 'continuous\_noise\_amplitude': 0.0077216200484862725, 'density\_decay': 0.9652518854949721, 'relativistic\_factor': 0.008059274894654482} -> slope: -3.615678682709859  
Config 14: {'collapse\_rate': 0.3379226580233391, 'collapse\_sigma': 0.16294276032523455, 'collapse\_amplitude': 0.8409803415124801, 'continuous\_noise\_amplitude': 0.007769390192676674, 'density\_decay': 0.9651684400270472, 'relativistic\_factor': 0.008092299947714172} -> slope: -3.6096415224344707  
Config 15: {'collapse\_rate': 0.33753077478154, 'collapse\_sigma': 0.16290270832949696, 'collapse\_amplitude': 0.8410116275544353, 'continuous\_noise\_amplitude': 0.007729689929852274, 'density\_decay': 0.965191250652223, 'relativistic\_factor': 0.00803335246284357} -> slope: -3.601375234410249  
Config 16: {'collapse\_rate': 0.3374133116958765, 'collapse\_sigma': 0.16295012888980076, 'collapse\_amplitude': 0.8408644935455684, 'continuous\_noise\_amplitude': 0.007709796917298967, 'density\_decay': 0.9652353567738176, 'relativistic\_factor': 0.008105883867552604} -> slope: -3.5832516890818167  
Config 17: {'collapse\_rate': 0.3378598272660188, 'collapse\_sigma': 0.16286646298975815, 'collapse\_amplitude': 0.841377416277755, 'continuous\_noise\_amplitude': 0.007699956067108618, 'density\_decay': 0.9652633130087139, 'relativistic\_factor': 0.007999037236843594} -> slope: -3.5680952471446163  
Config 18: {'collapse\_rate': 0.33767119493827763, 'collapse\_sigma': 0.16286524250056947, 'collapse\_amplitude': 0.8413789145260101, 'continuous\_noise\_amplitude': 0.007638146303371453, 'density\_decay': 0.9651636682024547, 'relativistic\_factor': 0.008112053733198064} -> slope: -3.3615497050913343  
Config 19: {'collapse\_rate': 0.3377088758704954, 'collapse\_sigma': 0.16290277972918515, 'collapse\_amplitude': 0.84106692224826, 'continuous\_noise\_amplitude': 0.0076685135067051415, 'density\_decay': 0.9652543121588871, 'relativistic\_factor': 0.00802213211432407} -> slope: -3.3577104269956686  
Config 20: {'collapse\_rate': 0.3378123457208098, 'collapse\_sigma': 0.16288436785971816, 'collapse\_amplitude': 0.8413697596219565, 'continuous\_noise\_amplitude': 0.007763679908529987, 'density\_decay': 0.965176960418017, 'relativistic\_factor': 0.008125215561176409} -> slope: -3.221568545023243

# 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.