Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.2278  
 collapse\_sigma: 0.1832  
 collapse\_amplitude: 0.7308  
 continuous\_noise\_amplitude: 0.0078  
 density\_decay: 0.9653  
 relativistic\_factor: 0.0042  
Estimated noise exponent (slope): -4.099  
Fitness: -0.9010

# 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': 0.22852497952458609, 'collapse\_sigma': 0.18284113631324767, 'collapse\_amplitude': 0.7326979686164117, 'continuous\_noise\_amplitude': 0.007728071367902025, 'density\_decay': 0.9653692775872389, 'relativistic\_factor': 0.004170113716228365} -> slope: -3.8921793340838664  
Config 2: {'collapse\_rate': 0.22809139241253937, 'collapse\_sigma': 0.1830085781049014, 'collapse\_amplitude': 0.7326814250284843, 'continuous\_noise\_amplitude': 0.007826866635371767, 'density\_decay': 0.9653332870598862, 'relativistic\_factor': 0.004229307775587327} -> slope: -3.877263483562666  
Config 3: {'collapse\_rate': 0.22805256481301933, 'collapse\_sigma': 0.18292921082503244, 'collapse\_amplitude': 0.7325233676261537, 'continuous\_noise\_amplitude': 0.007813616667057204, 'density\_decay': 0.965474579178603, 'relativistic\_factor': 0.004280032976672892} -> slope: -3.840724523537049  
Config 4: {'collapse\_rate': 0.22847984666561133, 'collapse\_sigma': 0.18283164699944465, 'collapse\_amplitude': 0.7327010994288423, 'continuous\_noise\_amplitude': 0.00769204892058694, 'density\_decay': 0.9654550364124997, 'relativistic\_factor': 0.004287398366737719} -> slope: -3.807418177236584  
Config 5: {'collapse\_rate': 0.2284694427878121, 'collapse\_sigma': 0.18299952978072476, 'collapse\_amplitude': 0.7323128971387516, 'continuous\_noise\_amplitude': 0.007785987955998826, 'density\_decay': 0.9654495764056004, 'relativistic\_factor': 0.004192632814475552} -> slope: -3.765691002468768  
Config 6: {'collapse\_rate': 0.22816976329556427, 'collapse\_sigma': 0.1828759582698211, 'collapse\_amplitude': 0.732669600672077, 'continuous\_noise\_amplitude': 0.007834765825207708, 'density\_decay': 0.9654194443524466, 'relativistic\_factor': 0.0041923227571743615} -> slope: -3.667187084212385  
Config 7: {'collapse\_rate': 0.22833333245499318, 'collapse\_sigma': 0.18295149302163913, 'collapse\_amplitude': 0.732263916019602, 'continuous\_noise\_amplitude': 0.007807699769584022, 'density\_decay': 0.9654621149584777, 'relativistic\_factor': 0.004183674068308684} -> slope: -3.6497719795642465  
Config 8: {'collapse\_rate': 0.22801797024783177, 'collapse\_sigma': 0.18288779120085327, 'collapse\_amplitude': 0.7324808514335758, 'continuous\_noise\_amplitude': 0.007803068790837733, 'density\_decay': 0.965351040611906, 'relativistic\_factor': 0.004258105491098421} -> slope: -3.6309146161848735  
Config 9: {'collapse\_rate': 0.22820402420618674, 'collapse\_sigma': 0.18286294438672843, 'collapse\_amplitude': 0.7320897906234526, 'continuous\_noise\_amplitude': 0.007761119897080377, 'density\_decay': 0.9653366490788555, 'relativistic\_factor': 0.004259045834415015} -> slope: -3.6290483934966384  
Config 10: {'collapse\_rate': 0.22828102837336, 'collapse\_sigma': 0.18295130603436094, 'collapse\_amplitude': 0.7319589143490965, 'continuous\_noise\_amplitude': 0.007790350505112435, 'density\_decay': 0.9654434290556989, 'relativistic\_factor': 0.004301622567918349} -> slope: -3.625921816216711  
Config 11: {'collapse\_rate': 0.22797045214995554, 'collapse\_sigma': 0.1828672457300712, 'collapse\_amplitude': 0.7328963879670274, 'continuous\_noise\_amplitude': 0.0077835244654127994, 'density\_decay': 0.9654258689094588, 'relativistic\_factor': 0.004267701880583295} -> slope: -3.5878575819249874  
Config 12: {'collapse\_rate': 0.22822844868789097, 'collapse\_sigma': 0.18285781753977706, 'collapse\_amplitude': 0.7321553489932897, 'continuous\_noise\_amplitude': 0.007809543631314431, 'density\_decay': 0.965361944618186, 'relativistic\_factor': 0.004162593401075944} -> slope: -3.565654031169829  
Config 13: {'collapse\_rate': 0.22857399686707255, 'collapse\_sigma': 0.18291329279703455, 'collapse\_amplitude': 0.7325152216547481, 'continuous\_noise\_amplitude': 0.007737741452630145, 'density\_decay': 0.9653814610879285, 'relativistic\_factor': 0.0042464849734385164} -> slope: -3.5268924746276764  
Config 14: {'collapse\_rate': 0.22849372340040117, 'collapse\_sigma': 0.18293518774373219, 'collapse\_amplitude': 0.7320138862527255, 'continuous\_noise\_amplitude': 0.007712797070297553, 'density\_decay': 0.9653520094390795, 'relativistic\_factor': 0.00415463987929118} -> slope: -3.4953318423505015  
Config 15: {'collapse\_rate': 0.22822129736895427, 'collapse\_sigma': 0.18298619727184437, 'collapse\_amplitude': 0.7321795124975213, 'continuous\_noise\_amplitude': 0.007699282573320784, 'density\_decay': 0.9654767346277704, 'relativistic\_factor': 0.004219850351544142} -> slope: -3.4432546873655987  
Config 16: {'collapse\_rate': 0.22845227166526624, 'collapse\_sigma': 0.18297394475109602, 'collapse\_amplitude': 0.7327528702849306, 'continuous\_noise\_amplitude': 0.00783514382878698, 'density\_decay': 0.9653906551853997, 'relativistic\_factor': 0.004245874452728563} -> slope: -3.4424876311871064  
Config 17: {'collapse\_rate': 0.22848277255003432, 'collapse\_sigma': 0.1830015524965826, 'collapse\_amplitude': 0.7319432698937439, 'continuous\_noise\_amplitude': 0.007725327887584467, 'density\_decay': 0.9654575790929826, 'relativistic\_factor': 0.004209370969453235} -> slope: -3.3801352587902254  
Config 18: {'collapse\_rate': 0.22810142638669215, 'collapse\_sigma': 0.1829749533669559, 'collapse\_amplitude': 0.7323025712814502, 'continuous\_noise\_amplitude': 0.007692324306199896, 'density\_decay': 0.9653627646775971, 'relativistic\_factor': 0.004190228331849742} -> slope: -3.3572636227713466  
Config 19: {'collapse\_rate': 0.22838725472641128, 'collapse\_sigma': 0.18299084648065292, 'collapse\_amplitude': 0.7323181125262562, 'continuous\_noise\_amplitude': 0.007755760326959547, 'density\_decay': 0.9654274892305104, 'relativistic\_factor': 0.004160588761238062} -> slope: -3.31140444413749  
Config 20: {'collapse\_rate': 0.2282603472646317, 'collapse\_sigma': 0.18296208236039774, 'collapse\_amplitude': 0.7328490742355067, 'continuous\_noise\_amplitude': 0.007740636090767233, 'density\_decay': 0.9654609221575032, 'relativistic\_factor': 0.0041599821245886645} -> slope: -3.2287946977692656

# 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.