Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.4133  
 collapse\_sigma: 0.1562  
 collapse\_amplitude: 0.8127  
 continuous\_noise\_amplitude: 0.0071  
 density\_decay: 0.9692  
 relativistic\_factor: 0.0027  
Estimated noise exponent (slope): -4.014  
Fitness: -0.9863

# 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': 0.41339496862324643, 'collapse\_sigma': 0.1562452751421396, 'collapse\_amplitude': 0.8123498688017368, 'continuous\_noise\_amplitude': 0.0070704163073801295, 'density\_decay': 0.9691993788101623, 'relativistic\_factor': 0.002631154411066263} -> slope: -3.8740136222910277  
Config 2: {'collapse\_rate': 0.4138858260775881, 'collapse\_sigma': 0.1561583030952632, 'collapse\_amplitude': 0.8130112008591571, 'continuous\_noise\_amplitude': 0.006984993344225139, 'density\_decay': 0.9693009275693313, 'relativistic\_factor': 0.002642393435059553} -> slope: -3.837836076879153  
Config 3: {'collapse\_rate': 0.41352644206988526, 'collapse\_sigma': 0.15619129639777643, 'collapse\_amplitude': 0.812946684752025, 'continuous\_noise\_amplitude': 0.007057317038475457, 'density\_decay': 0.9693127987302264, 'relativistic\_factor': 0.002731984407190222} -> slope: -3.759486363743416  
Config 4: {'collapse\_rate': 0.41369005008492643, 'collapse\_sigma': 0.15624625086626218, 'collapse\_amplitude': 0.8130059194706497, 'continuous\_noise\_amplitude': 0.007046546824055218, 'density\_decay': 0.9693106570272577, 'relativistic\_factor': 0.002694601187675245} -> slope: -3.729753846563216  
Config 5: {'collapse\_rate': 0.41338540342770114, 'collapse\_sigma': 0.1562263713175121, 'collapse\_amplitude': 0.8127585898439772, 'continuous\_noise\_amplitude': 0.007105642725722015, 'density\_decay': 0.9692451654848002, 'relativistic\_factor': 0.00261543218367586} -> slope: -3.7019972101504584  
Config 6: {'collapse\_rate': 0.41396326123034066, 'collapse\_sigma': 0.15612667651510578, 'collapse\_amplitude': 0.8124411991653137, 'continuous\_noise\_amplitude': 0.007045075049796919, 'density\_decay': 0.9692186042091978, 'relativistic\_factor': 0.0026742562753936227} -> slope: -3.7008214617921666  
Config 7: {'collapse\_rate': 0.4133725346990301, 'collapse\_sigma': 0.15617072653248626, 'collapse\_amplitude': 0.8122094490313023, 'continuous\_noise\_amplitude': 0.007057376096586082, 'density\_decay': 0.9692677497711115, 'relativistic\_factor': 0.0026858489076736942} -> slope: -3.6572406195737335  
Config 8: {'collapse\_rate': 0.41320925094616523, 'collapse\_sigma': 0.15627866704932628, 'collapse\_amplitude': 0.8127264867401007, 'continuous\_noise\_amplitude': 0.007074328462037701, 'density\_decay': 0.9691910906827077, 'relativistic\_factor': 0.002739111415340607} -> slope: -3.654938896260736  
Config 9: {'collapse\_rate': 0.4132611421459492, 'collapse\_sigma': 0.15627564985457887, 'collapse\_amplitude': 0.8124881156294759, 'continuous\_noise\_amplitude': 0.007026629579824491, 'density\_decay': 0.9692931665266212, 'relativistic\_factor': 0.00264093939334868} -> slope: -3.6362532325589085  
Config 10: {'collapse\_rate': 0.4135738486643945, 'collapse\_sigma': 0.15613307326451964, 'collapse\_amplitude': 0.8129684735713347, 'continuous\_noise\_amplitude': 0.007016545184360593, 'density\_decay': 0.9692973787643911, 'relativistic\_factor': 0.0026211474893642174} -> slope: -3.635635256658242  
Config 11: {'collapse\_rate': 0.41354690884342815, 'collapse\_sigma': 0.15627434235661664, 'collapse\_amplitude': 0.8121879625130288, 'continuous\_noise\_amplitude': 0.007082268402199481, 'density\_decay': 0.9692847833251479, 'relativistic\_factor': 0.002624278624785628} -> slope: -3.622799324974034  
Config 12: {'collapse\_rate': 0.413402224967189, 'collapse\_sigma': 0.1562916759731611, 'collapse\_amplitude': 0.8121630325834118, 'continuous\_noise\_amplitude': 0.006974552200647466, 'density\_decay': 0.9691976192168362, 'relativistic\_factor': 0.002712244077869942} -> slope: -3.6202565365273416  
Config 13: {'collapse\_rate': 0.4133665692508417, 'collapse\_sigma': 0.15626163011375951, 'collapse\_amplitude': 0.8123740781665227, 'continuous\_noise\_amplitude': 0.007090489804198533, 'density\_decay': 0.9691913269169219, 'relativistic\_factor': 0.002701433914784314} -> slope: -3.605340744201246  
Config 14: {'collapse\_rate': 0.41394068835521847, 'collapse\_sigma': 0.15612861700141292, 'collapse\_amplitude': 0.8123651870533606, 'continuous\_noise\_amplitude': 0.0071010918061992145, 'density\_decay': 0.9693006352764324, 'relativistic\_factor': 0.0026305064598554514} -> slope: -3.5620368036746353  
Config 15: {'collapse\_rate': 0.4135936948970235, 'collapse\_sigma': 0.1561321904551853, 'collapse\_amplitude': 0.8126187668837447, 'continuous\_noise\_amplitude': 0.007021958501139412, 'density\_decay': 0.9692411377139547, 'relativistic\_factor': 0.0026494522036721938} -> slope: -3.545680031370053  
Config 16: {'collapse\_rate': 0.41363126170947884, 'collapse\_sigma': 0.15623472293678922, 'collapse\_amplitude': 0.8124185047725602, 'continuous\_noise\_amplitude': 0.00696206935774346, 'density\_decay': 0.9692464212035772, 'relativistic\_factor': 0.0026334358595302095} -> slope: -3.512685454801575  
Config 17: {'collapse\_rate': 0.413502600090023, 'collapse\_sigma': 0.15626564812318455, 'collapse\_amplitude': 0.8127111540747188, 'continuous\_noise\_amplitude': 0.006960569520043809, 'density\_decay': 0.9692031021536877, 'relativistic\_factor': 0.002741567840480717} -> slope: -3.4033475657445083  
Config 18: {'collapse\_rate': 0.4133876603684581, 'collapse\_sigma': 0.15624569296105628, 'collapse\_amplitude': 0.8127483160574142, 'continuous\_noise\_amplitude': 0.007022881283816444, 'density\_decay': 0.969303065158005, 'relativistic\_factor': 0.002624662468773551} -> slope: -3.400699995241241  
Config 19: {'collapse\_rate': 0.413517701546962, 'collapse\_sigma': 0.15617036690889108, 'collapse\_amplitude': 0.8125756208808588, 'continuous\_noise\_amplitude': 0.00701310441113288, 'density\_decay': 0.9693065692623107, 'relativistic\_factor': 0.00271394340217841} -> slope: -3.356157541663763  
Config 20: {'collapse\_rate': 0.41348537339936037, 'collapse\_sigma': 0.1562752569859317, 'collapse\_amplitude': 0.8128639995465025, 'continuous\_noise\_amplitude': 0.007034205863035408, 'density\_decay': 0.9692407597928766, 'relativistic\_factor': 0.0026494896126075984} -> slope: -3.3515178408238855

# 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.