Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.4541  
 collapse\_sigma: 0.1943  
 collapse\_amplitude: 0.8578  
 continuous\_noise\_amplitude: 0.0099  
 density\_decay: 0.9683  
 relativistic\_factor: 0.0080  
Estimated noise exponent (slope): -4.107  
Fitness: -0.8928

# 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': 0.40622878670485985, 'collapse\_sigma': 0.13202983266722712, 'collapse\_amplitude': 0.7764823076628252, 'continuous\_noise\_amplitude': 0.008010880133996064, 'density\_decay': 0.9699833320375579, 'relativistic\_factor': 0.0041458758944124124} -> slope: -3.860055218016445  
Config 2: {'collapse\_rate': 0.40595350966442656, 'collapse\_sigma': 0.132028507784239, 'collapse\_amplitude': 0.7762550835987707, 'continuous\_noise\_amplitude': 0.008000906687222671, 'density\_decay': 0.9700457558946155, 'relativistic\_factor': 0.004126935273867345} -> slope: -3.845324139613718  
Config 3: {'collapse\_rate': 0.40563685775440705, 'collapse\_sigma': 0.1321229625250223, 'collapse\_amplitude': 0.7765759183054661, 'continuous\_noise\_amplitude': 0.008028015433378175, 'density\_decay': 0.9699560580455359, 'relativistic\_factor': 0.004186046712423593} -> slope: -3.831960932003522  
Config 4: {'collapse\_rate': 0.4055540283322278, 'collapse\_sigma': 0.13215968991766386, 'collapse\_amplitude': 0.776528445671315, 'continuous\_noise\_amplitude': 0.007917645632871286, 'density\_decay': 0.9700249892635814, 'relativistic\_factor': 0.0041832358059229234} -> slope: -3.799164426086857  
Config 5: {'collapse\_rate': 0.40576681947438786, 'collapse\_sigma': 0.13217214143644823, 'collapse\_amplitude': 0.7764400261902883, 'continuous\_noise\_amplitude': 0.007924524289696847, 'density\_decay': 0.9699895908476256, 'relativistic\_factor': 0.004083093213922451} -> slope: -3.7595159859874796  
Config 6: {'collapse\_rate': 0.4056651940102589, 'collapse\_sigma': 0.13214620592414442, 'collapse\_amplitude': 0.7767527528753547, 'continuous\_noise\_amplitude': 0.007992619421098388, 'density\_decay': 0.9700307703596853, 'relativistic\_factor': 0.004154188350099962} -> slope: -3.7016613999327728  
Config 7: {'collapse\_rate': 0.4056190827060233, 'collapse\_sigma': 0.13203771622219085, 'collapse\_amplitude': 0.7765138146706494, 'continuous\_noise\_amplitude': 0.007895349179577862, 'density\_decay': 0.9699959753473222, 'relativistic\_factor': 0.004166523760054592} -> slope: -3.6992961806295726  
Config 8: {'collapse\_rate': 0.4060385965498755, 'collapse\_sigma': 0.1320059131684146, 'collapse\_amplitude': 0.7765363097583731, 'continuous\_noise\_amplitude': 0.007938720728815895, 'density\_decay': 0.9700565233035969, 'relativistic\_factor': 0.004068903406126605} -> slope: -3.6987735773455706  
Config 9: {'collapse\_rate': 0.40570438683181737, 'collapse\_sigma': 0.13208414398406212, 'collapse\_amplitude': 0.7764854235313138, 'continuous\_noise\_amplitude': 0.008040853016954182, 'density\_decay': 0.9700050908534666, 'relativistic\_factor': 0.004190292085322615} -> slope: -3.6799338404535433  
Config 10: {'collapse\_rate': 0.4057439240142036, 'collapse\_sigma': 0.13205269522999516, 'collapse\_amplitude': 0.7763149751138867, 'continuous\_noise\_amplitude': 0.00802003457464814, 'density\_decay': 0.9700522094837072, 'relativistic\_factor': 0.004116033499063431} -> slope: -3.679684677825115  
Config 11: {'collapse\_rate': 0.40589897321327395, 'collapse\_sigma': 0.13217496232262727, 'collapse\_amplitude': 0.7765933501189622, 'continuous\_noise\_amplitude': 0.008008184418126427, 'density\_decay': 0.970023152105608, 'relativistic\_factor': 0.004094278863605792} -> slope: -3.678796737510281  
Config 12: {'collapse\_rate': 0.40604609428638194, 'collapse\_sigma': 0.13212940182487304, 'collapse\_amplitude': 0.7763330922574108, 'continuous\_noise\_amplitude': 0.007997757915728005, 'density\_decay': 0.9699291383052033, 'relativistic\_factor': 0.004142883974650382} -> slope: -3.6638785815415464  
Config 13: {'collapse\_rate': 0.40567035678722196, 'collapse\_sigma': 0.13215763926852184, 'collapse\_amplitude': 0.7766186330319605, 'continuous\_noise\_amplitude': 0.008048055349775882, 'density\_decay': 0.9699932488385413, 'relativistic\_factor': 0.004126581367505527} -> slope: -3.65611707914861  
Config 14: {'collapse\_rate': 0.40555058402653954, 'collapse\_sigma': 0.13209474263941118, 'collapse\_amplitude': 0.7760744718766309, 'continuous\_noise\_amplitude': 0.008005710555769208, 'density\_decay': 0.969971172662787, 'relativistic\_factor': 0.004120508362762082} -> slope: -3.6236598420654316  
Config 15: {'collapse\_rate': 0.405690416389934, 'collapse\_sigma': 0.13203955647528345, 'collapse\_amplitude': 0.7767316188270558, 'continuous\_noise\_amplitude': 0.008016866612308328, 'density\_decay': 0.9700694107163281, 'relativistic\_factor': 0.004086242839263684} -> slope: -3.61486526049201  
Config 16: {'collapse\_rate': 0.4060062103353144, 'collapse\_sigma': 0.13216694779476915, 'collapse\_amplitude': 0.7762924951739828, 'continuous\_noise\_amplitude': 0.007934848822870022, 'density\_decay': 0.9699869890035877, 'relativistic\_factor': 0.004114013025587926} -> slope: -3.6009046438830823  
Config 17: {'collapse\_rate': 0.40610821564589095, 'collapse\_sigma': 0.1321876200434818, 'collapse\_amplitude': 0.7763054051639292, 'continuous\_noise\_amplitude': 0.007944814566821804, 'density\_decay': 0.9700790463287922, 'relativistic\_factor': 0.004158863647400127} -> slope: -3.5976250577794424  
Config 18: {'collapse\_rate': 0.4057915597344563, 'collapse\_sigma': 0.13207827925970342, 'collapse\_amplitude': 0.7766252860424349, 'continuous\_noise\_amplitude': 0.007962638835200412, 'density\_decay': 0.9700156824616663, 'relativistic\_factor': 0.004155753964449919} -> slope: -3.3223360846268393  
Config 19: {'collapse\_rate': 0.40560414414915386, 'collapse\_sigma': 0.13211556998583265, 'collapse\_amplitude': 0.7762982906249787, 'continuous\_noise\_amplitude': 0.008024428643660915, 'density\_decay': 0.9700503500359747, 'relativistic\_factor': 0.004077559624329278} -> slope: -3.271111594464843  
Config 20: {'collapse\_rate': 0.4056033069891887, 'collapse\_sigma': 0.13205328018127516, 'collapse\_amplitude': 0.7764974051735948, 'continuous\_noise\_amplitude': 0.008026597379136306, 'density\_decay': 0.9700310523416122, 'relativistic\_factor': 0.00419071864565272} -> slope: -3.2175378642952395

# 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.