Parameter Optimization Report: Emergent Gravity from Quantum Collapse

# Final Optimized Configuration

Best parameters found:  
 collapse\_rate: 0.2885  
 collapse\_sigma: 0.1701  
 collapse\_amplitude: 0.7575  
 continuous\_noise\_amplitude: 0.0075  
 density\_decay: 0.9775  
 relativistic\_factor: 0.0033  
Estimated noise exponent (slope): -4.102  
Fitness: -0.8977

# 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': 0.2673337583235412, 'collapse\_sigma': 0.17156845479982147, 'collapse\_amplitude': 0.7658501760655188, 'continuous\_noise\_amplitude': 0.007277026760041618, 'density\_decay': 0.9798093390357845, 'relativistic\_factor': 0.004264327759681022} -> slope: -3.918871216944943  
Config 2: {'collapse\_rate': 0.2672157043925542, 'collapse\_sigma': 0.1715831087791145, 'collapse\_amplitude': 0.7661652778688234, 'continuous\_noise\_amplitude': 0.007230264806983061, 'density\_decay': 0.9798712432437301, 'relativistic\_factor': 0.00432198802232466} -> slope: -3.883819821559888  
Config 3: {'collapse\_rate': 0.2674589747838581, 'collapse\_sigma': 0.1714717617200106, 'collapse\_amplitude': 0.7662835633509165, 'continuous\_noise\_amplitude': 0.007261362273913156, 'density\_decay': 0.9798917740379541, 'relativistic\_factor': 0.004359392377577381} -> slope: -3.816850389505101  
Config 4: {'collapse\_rate': 0.26723033463216683, 'collapse\_sigma': 0.17154047317872104, 'collapse\_amplitude': 0.7662207808992388, 'continuous\_noise\_amplitude': 0.007131107433482364, 'density\_decay': 0.9799325210838696, 'relativistic\_factor': 0.004229390037748246} -> slope: -3.7869924416924365  
Config 5: {'collapse\_rate': 0.26784882342337885, 'collapse\_sigma': 0.1714500688740933, 'collapse\_amplitude': 0.7657873505019732, 'continuous\_noise\_amplitude': 0.007142995343678594, 'density\_decay': 0.9799267507125448, 'relativistic\_factor': 0.004209198299285214} -> slope: -3.7524437983610883  
Config 6: {'collapse\_rate': 0.26772288696043123, 'collapse\_sigma': 0.1714671151295721, 'collapse\_amplitude': 0.7662701623137225, 'continuous\_noise\_amplitude': 0.007267594077289725, 'density\_decay': 0.9799003445176722, 'relativistic\_factor': 0.004255045614751186} -> slope: -3.7482330946629756  
Config 7: {'collapse\_rate': 0.2673186454048345, 'collapse\_sigma': 0.17141252410117638, 'collapse\_amplitude': 0.7661640983803075, 'continuous\_noise\_amplitude': 0.007206308394446106, 'density\_decay': 0.9798212958157416, 'relativistic\_factor': 0.0043108316595367865} -> slope: -3.720434198424305  
Config 8: {'collapse\_rate': 0.2678222762283563, 'collapse\_sigma': 0.1714176767635122, 'collapse\_amplitude': 0.7656551427558436, 'continuous\_noise\_amplitude': 0.007205913106528098, 'density\_decay': 0.9798543040528362, 'relativistic\_factor': 0.004325265690581747} -> slope: -3.699035572523563  
Config 9: {'collapse\_rate': 0.26741884758350687, 'collapse\_sigma': 0.17159869089575275, 'collapse\_amplitude': 0.765867677051759, 'continuous\_noise\_amplitude': 0.007177449451958142, 'density\_decay': 0.979868092325449, 'relativistic\_factor': 0.00426163236275145} -> slope: -3.6789253629062992  
Config 10: {'collapse\_rate': 0.26763602620353677, 'collapse\_sigma': 0.17156493258352704, 'collapse\_amplitude': 0.7656097525316891, 'continuous\_noise\_amplitude': 0.007181142070610738, 'density\_decay': 0.9798398390571372, 'relativistic\_factor': 0.0042183443868960445} -> slope: -3.6429087369005595  
Config 11: {'collapse\_rate': 0.2678933159614202, 'collapse\_sigma': 0.17156508335346696, 'collapse\_amplitude': 0.7662622197955549, 'continuous\_noise\_amplitude': 0.007270537541052027, 'density\_decay': 0.9798330942642459, 'relativistic\_factor': 0.004343067470589308} -> slope: -3.6336882069671517  
Config 12: {'collapse\_rate': 0.2678189292264733, 'collapse\_sigma': 0.17151783628282394, 'collapse\_amplitude': 0.7663226755319534, 'continuous\_noise\_amplitude': 0.007280533294080377, 'density\_decay': 0.979915204692143, 'relativistic\_factor': 0.004313537218893855} -> slope: -3.62071125823964  
Config 13: {'collapse\_rate': 0.2676728278355815, 'collapse\_sigma': 0.17151071777016705, 'collapse\_amplitude': 0.7659383001350665, 'continuous\_noise\_amplitude': 0.007251926435524781, 'density\_decay': 0.9798913058556481, 'relativistic\_factor': 0.004340728150017564} -> slope: -3.618190493333732  
Config 14: {'collapse\_rate': 0.2672549792850656, 'collapse\_sigma': 0.17141857383789383, 'collapse\_amplitude': 0.765710674991629, 'continuous\_noise\_amplitude': 0.007254308163802965, 'density\_decay': 0.9799069041538928, 'relativistic\_factor': 0.004328426612865203} -> slope: -3.5345776823948554  
Config 15: {'collapse\_rate': 0.26734797875086486, 'collapse\_sigma': 0.17141277166513902, 'collapse\_amplitude': 0.7661123417621067, 'continuous\_noise\_amplitude': 0.007136895941150674, 'density\_decay': 0.9798082229454748, 'relativistic\_factor': 0.0042385362197327765} -> slope: -3.5311433888177115  
Config 16: {'collapse\_rate': 0.26728900699049657, 'collapse\_sigma': 0.17157677129914745, 'collapse\_amplitude': 0.766341279754244, 'continuous\_noise\_amplitude': 0.007221828205792563, 'density\_decay': 0.9798440576508025, 'relativistic\_factor': 0.004338734170802119} -> slope: -3.490336778241435  
Config 17: {'collapse\_rate': 0.2671926980806211, 'collapse\_sigma': 0.17156650441006552, 'collapse\_amplitude': 0.7661353710243609, 'continuous\_noise\_amplitude': 0.007196454580604328, 'density\_decay': 0.9799290013919979, 'relativistic\_factor': 0.004223653295490234} -> slope: -3.4884450433237375  
Config 18: {'collapse\_rate': 0.26744136224315673, 'collapse\_sigma': 0.17152489302880605, 'collapse\_amplitude': 0.76599371244421, 'continuous\_noise\_amplitude': 0.00723495782448148, 'density\_decay': 0.9799261128071075, 'relativistic\_factor': 0.004342314663701067} -> slope: -3.4608154327236496  
Config 19: {'collapse\_rate': 0.2671668945158621, 'collapse\_sigma': 0.17150698062160818, 'collapse\_amplitude': 0.765733560173323, 'continuous\_noise\_amplitude': 0.007245288931912094, 'density\_decay': 0.9799174728990159, 'relativistic\_factor': 0.004285139445429016} -> slope: -3.3695262123654888  
Config 20: {'collapse\_rate': 0.2679247752749984, 'collapse\_sigma': 0.17152731510166497, 'collapse\_amplitude': 0.7657730960796256, 'continuous\_noise\_amplitude': 0.0071890267476133795, 'density\_decay': 0.9798862107422751, 'relativistic\_factor': 0.004239308740759582} -> slope: -3.314955146526598

# 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.