PWT Protocol for Chaotic Systems (Phase IV)

Project Goal: To test the universality of Prime-Indexed Discrete Scale Invariance (p-DSI) in systems governed by deterministic chaos, specifically targeting the replication of the $\mathbf{3.8 \times}$ stability enhancement ratio.

Hypothesis: Structuring the control parameter of a chaotic system (the Logistic Map) by a prime index (Λ_P) will significantly suppress the system's inherent exponential divergence, achieving a $\sim 3.8 \times$ slower rate of chaos compared to composite indices (Λ_C).

1. Experimental System: The Chaotic Logistic Map

We will use the Logistic Map, $x_{t+1} = r \cdot x_t \cdot (1 - x_t)$, set within the domain where it exhibits deterministic chaos, simulating system evolution over $T=10,000$ iterations.

A. Independent Variable: Structural Scaling Factor (λ)

The control parameter, r, is a structural dimension that determines system stability. We test values in the chaotic band ($\mathbf{r \in [3.7, 4.0]}$) near the stability island at $\lambda=3.7$.

Condition	λ Value (r)	Rationale
Prime Condition (Λ_P)	$\{3.7\}$	The nearest chaotic stability island/attractor based on PWT logic.
Composite Baseline (Λ_C)	$\{3.85\}$	Center of the dense chaotic band; magnitude-matched mean for control.
**Perturbed Prime ($\Lambda_{P\pm}$) **	$\{3.65, 3.75\}$	Tests proximity and sharp quadratic decay (Phase II replication).

2. Dependent Variables: Measuring Suppression of Chaos

The simulation must be run with $N=20$ trials per condition, averaging the results.

Metric	Measurement & Protocol	PWT Prediction (Λ_P vs. Λ_C)
1. Lyapunov Exponent (Λ_{exp})	**The fundamental metric of chaos.** Measures the average exponential rate of divergence between two infinitesimally close starting trajectories. Lower/Negative values indicate stability.	**Significantly Lower** in Λ_P (Closer to zero/stability).
2. Stability Enhancement Ratio	Ratio of chaotic divergence: $\text{Ratio} = \Lambda_{\exp}(\Lambda_C) / \Lambda_{\exp}$	$\sim 3.8 \times$**Stability Factor**(Replication of Quantum/AI

	(\Lambda_P)$.	finding).
3. Spectral Signature	Fourier analysis of the time-series of x_t (position/state) over T iterations.	**Prime Comb**($\omega_{p}=2\pi/\ln p$) in the $\Lambda_P$condition.
4. Attractor Coherence (Optional)	Measures the dimensionality of the strange attractor (e.g., Correlation Dimension, D_2).	**Lower Dimension** in $ \Lambda_P$ (More structured/coherent attractor).

3. Final Validation

The successful execution of this protocol, with independent agents replicating the $\mathbf{\sim 3.8 \times}$ stability factor by achieving lower Lyapunov Exponents in prime-constrained chaotic systems, would provide definitive proof of PWT's universality across all three fundamental domains: Emergence, Quantum Physics, and Chaos Theory.

We are now ready for the implementation phase of the PWT in Chaotic Systems Protocol.