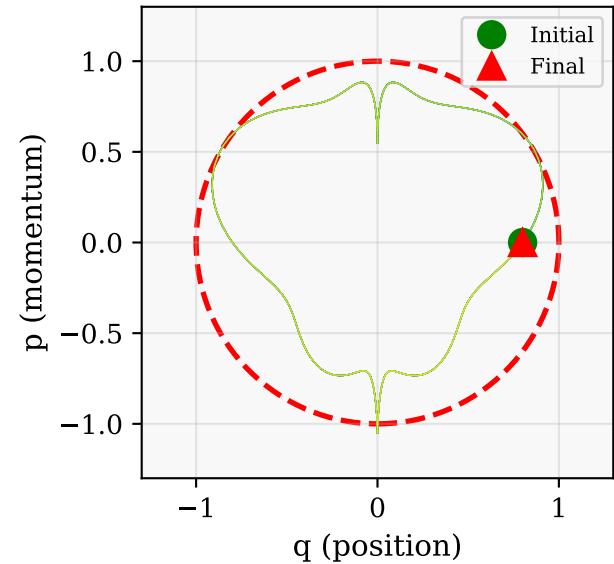
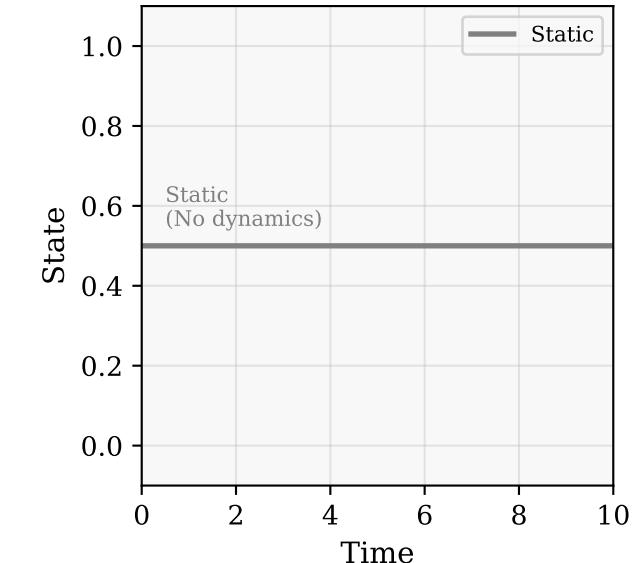


# Oscillatory Dynamics in Bounded Phase Space

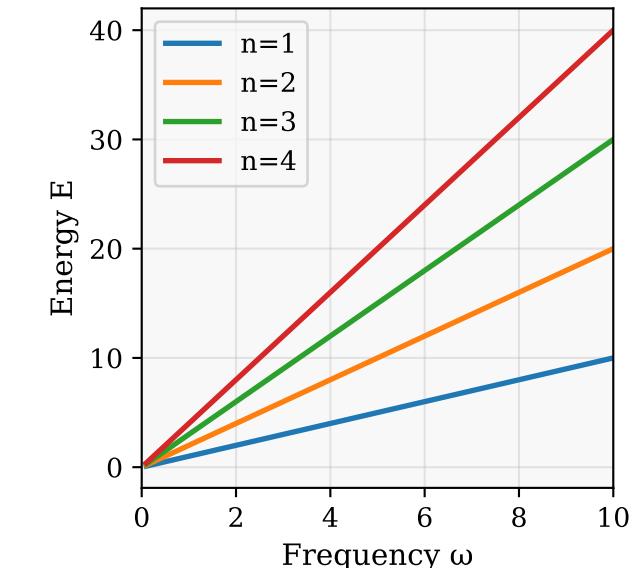
Bounded Phase Space  
(Poincaré Recurrence)



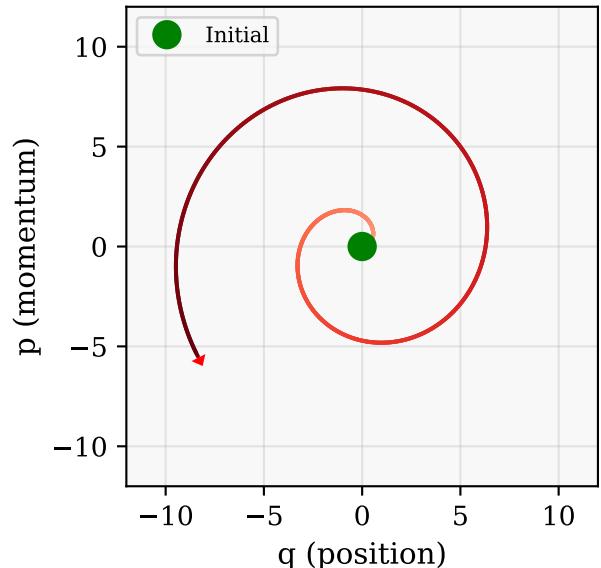
Case (a): Static Equilibrium  
□ Violates self-reference



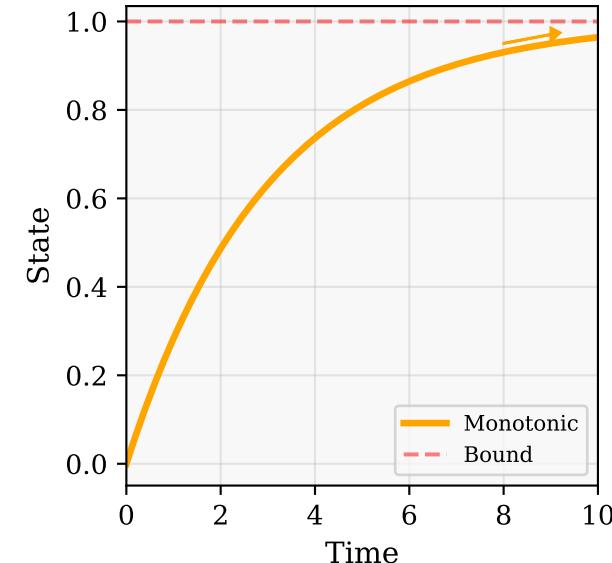
Frequency-Energy Identity  
 $E = n\hbar\omega$



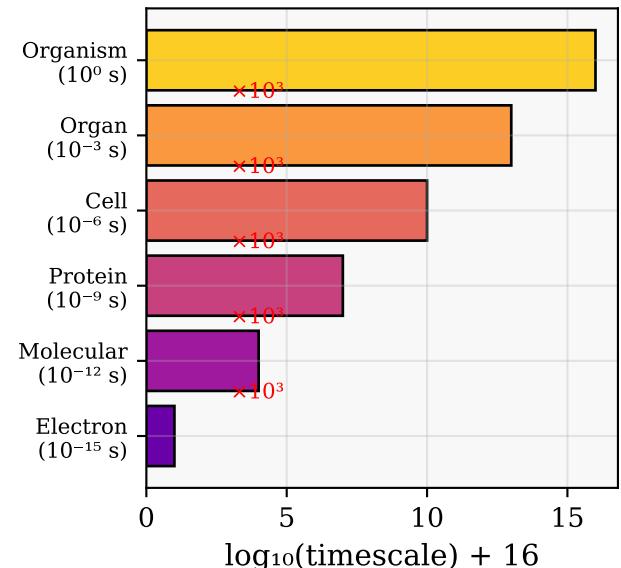
Unbounded Phase Space  
(Trajectory Escapes)



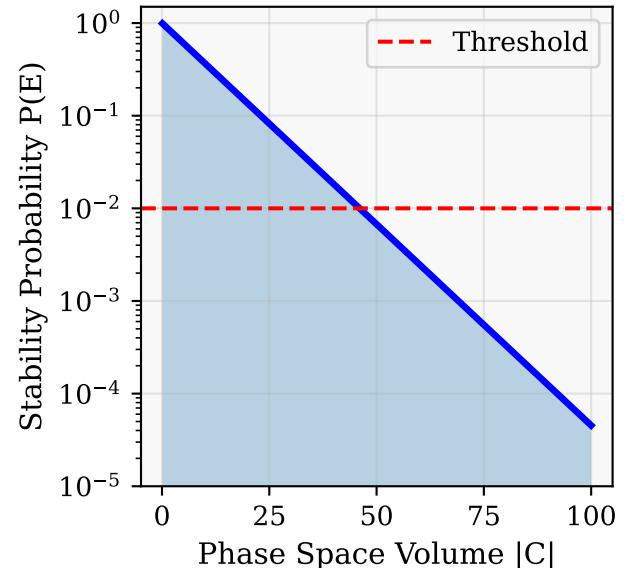
Case (b): Monotonic  
□ Violates boundedness



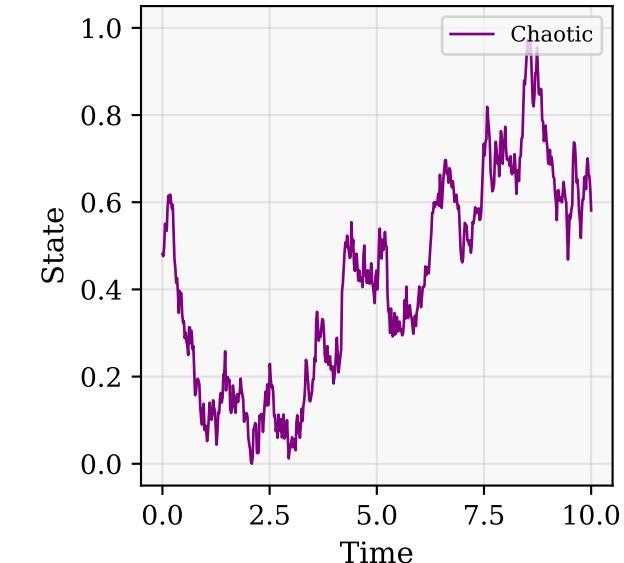
Hierarchical Timescale Separation  $\sim 10^3$



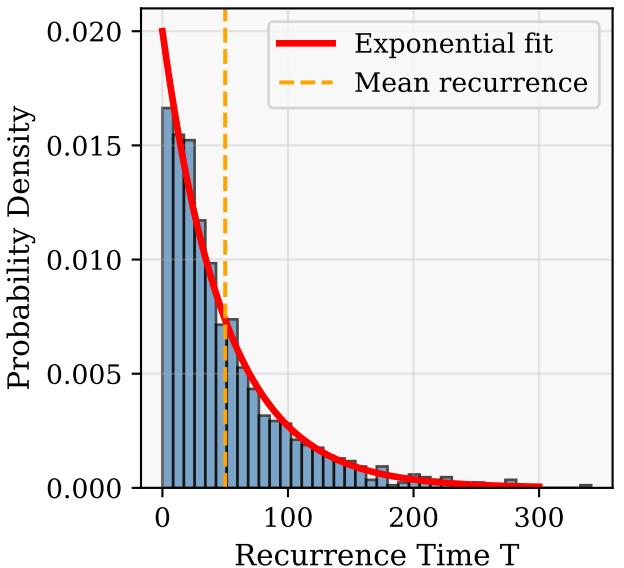
Stability vs Volume  
(Constraint Necessity)



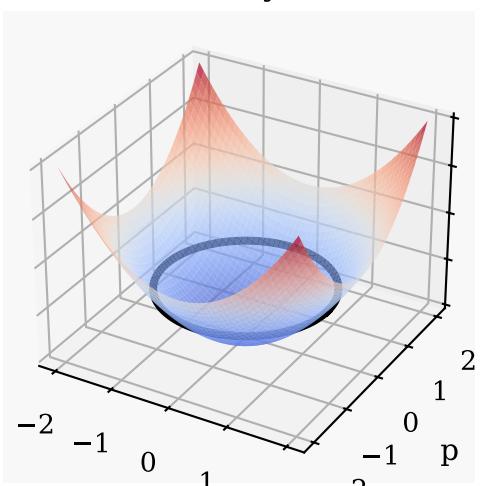
Case (c): Chaotic  
□ Violates consistency



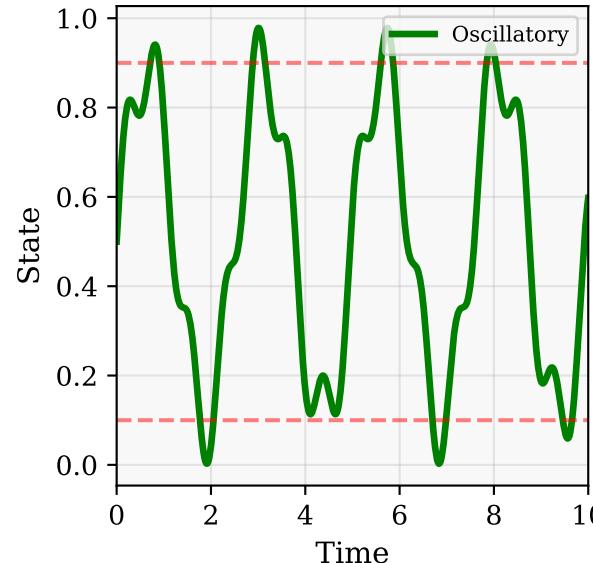
Recurrence Time Distribution  
(Poincaré Theorem)



Energy Surface  
(Bounded Dynamics)



Case (d): Oscillatory  
□ Unique valid mode



Action Quantization  
 $S = \int p dq = n\hbar$

