# Recursive Instability Under Isochoric Constraint

This section formally outlines the emergence of field instability in Ilianne’s Law under the assumption of isochoric (constant volume) constraints.

## 1. Define the Isochoric Constraint Formally

We define the isochoric constraint as:  
  
 dV\_ψ/dt = 0  
  
where V\_ψ is the effective spatial domain of the recursive field ψ(x, t). This assumes that the field evolves in time, but its spatial extent is fixed. The justification here is that in a fixed volume, any accumulation of recursive energy cannot dissipate outward, leading to local intensification. This mirrors closed thermodynamic systems where pressure rises due to confinement.

## 2. Show That Recursive Contributions Accumulate

Assuming the field ψ evolves via a memory kernel:  
  
 ψ(x, t) = ψ₀(x) + ∫₀^t K(t - t') · ψ(x, t') dt'  
  
This structure causes ψ to accumulate prior states, with the kernel K(t - t') acting as a memory weighting function. If K decays slowly, feedback from earlier times remains active. Under isochoric constraints, this causes energy and stress to accumulate in the same spatial region, creating a positive feedback loop. This leads to intensified local growth in the recursive signal, similar to charge accumulation or thermodynamic pressure increase in a sealed system.

## 3. Define a Singularity Condition

To characterize the instability point, we define a singularity threshold:  
  
 limₜ→tc ∂²ψ/∂t² → ∞  
  
This condition implies that the recursive feedback becomes unsustainable beyond a finite time t\_c. This is consistent with systems undergoing runaway acceleration, such as gravitational collapse or field blow-up in nonlinear systems. The inability of the field to stabilize or dissipate under the isochoric constraint provides a formal mechanism for phase transition or rupture in the recursive structure.

## Summary Table

| Step | Equation | Justification |
| --- | --- | --- |
| 1. Isochoric Constraint | dV\_ψ/dt = 0 | Prevents spatial dispersion; forces accumulation to remain local |
| 2. Recursive Accumulation | ψ = ψ₀ + ∫ K · ψ | Memory-based feedback grows with no spatial relief |
| 3. Singularity Condition | ∂²ψ/∂t² → ∞ as t → t\_c | Signals instability; mirrors collapse in physical systems |