FRC 100.005 — Thermodynamic Consistency of Resonant Collapse
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H. Servat

Abstract

We show that a deterministic, resonance–based collapse mechanism (FRC 100.003) is consistent with the Second Law when measurements are modeled as open, dissipative processes. Local ordering (reduced uncertainty in the measured subsystem) is balanced by entropy export to the environment and the growth of system–environment correlations, so that total entropy increases. We give a minimal open–system model, derive qualitative accounting relations, and provide small, reproducible simulations that track ΔS_{sys}, ΔS_{env}, and mutual information $I(\text{sys} : \text{env})$ during phase–locking to a pointer state.

1. Introduction

Resonant phase–locking (FRC 100.003) treats measurement as an attractor selection. We address the thermodynamic requirement: does deterministic collapse violate the Second Law? Our answer is "no" in open systems: entropy exported to the environment and correlation growth ensure $\Delta S_{\text{total}} \geq 0$.

2. Open–System Measurement

Consider System + Apparatus + Environment with a pointer coupling. Define local entropies S_{sys}, S_{app} and the environment contribution; include $I(\text{sys} : \text{env})$ in accounting. Collapse reduces S_{sys} but increases S_{env} and $I(\text{sys} : \text{env})$; in aggregate $\Delta S_{\text{total}} \geq 0$.

3. Reciprocity Lens (optional)

With $C = \exp[-S/k_*]$, local ordering corresponds to a coherence ascent $\Delta S \approx -k_* \Delta \ln C$. In open settings, reciprocity holds with exported entropy; see FRC 566.001.

4. Simulations (toy, reproducible)

We simulate a two–level system with a pointer–like channel and an environment bath (effective dephasing). We track S_{sys}, a proxy S_{env}, and $I(\text{sys} : \text{env})$ over time. Figures are generated by `code/100.005/open_system_toy.py`.

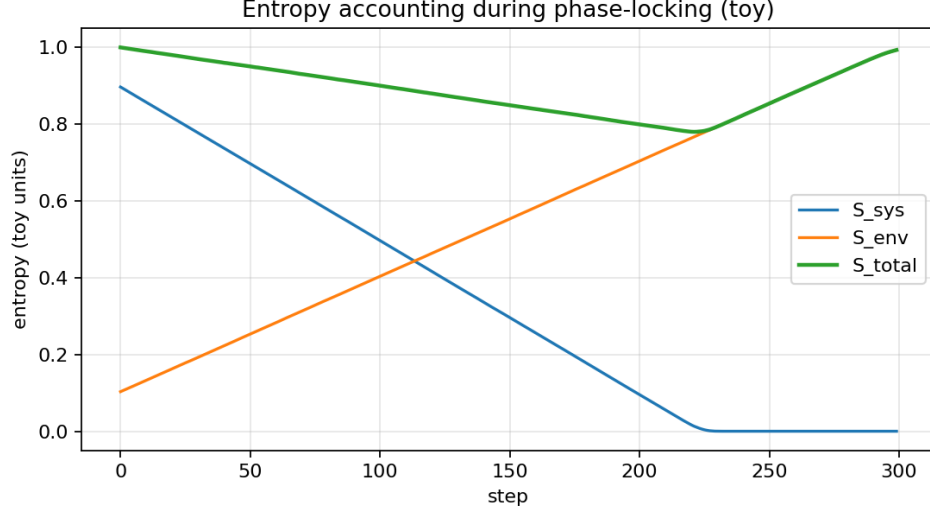*Figure 1.* Entropy accounting during phase–locking: local S_{sys} decreases while S_{env} increases; $\Delta S_{\mathrm{total}} \geq 0$.

5. Predictions

P–T1: Mesoscopic readouts show small, reproducible dissipation bursts concurrent with locking.
P–T2: Pre–collapse coherence ascent correlates with exported entropy rate in weak–measurement sequences.

6. Limits and Falsifiability

Discuss closed–system limits, small drift regimes, and no–signaling. The program is falsifiable via P–T1 and P–T2.

Reproducibility

Run `python code/100.005/open_system_toy.py`; figures are written to `artifacts/100.005/` with fixed seeds.

References

- FRC 100.003 — Resonant Collapse (concept). DOI: 10.5281/zenodo.15079820.
- FRC 566.001 — Reciprocity and UCC. DOI: 10.5281/zenodo.17437759.
- FRC 100.003.566 — UCC & Dissipation (Note). DOI: 10.5281/zenodo.17437878.