Diagram: Stabilization vs Observation

This diagram illustrates the two structural operations governing the framework:

Stabilization. Internal equilibration, decoherence, or gravitational settling. Modeled by an idempotent endofunctor

$$S : \mathcal{C} \to \mathcal{C}, \qquad S^2 \cong S.$$

Observation. Projection to externally accessible descriptions. Modeled by a generally non-faithful functor

$$\Pi : \mathcal{C} \to \mathcal{O}.$$

The diagram compares the two composites:

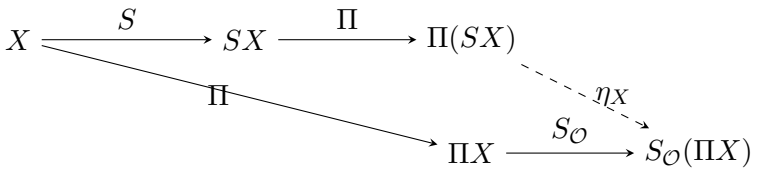
$$\Pi \circ S \quad \text{(stabilize then observe)}$$

and

$$S_{\mathcal{O}} \circ \Pi \quad \text{(observe then coarse-grain).}$$

These are related by a natural transformation

$$\eta_X : \Pi(SX) \longrightarrow S_{\mathcal{O}}(\Pi X).$$



Non-invertibility of η_X expresses a structural mismatch between internal stabilization and observable structure. Persistent non-invertibility characterizes black-hole regions.