The KFX Family: A, B, and 10

(Frozen Version v1.0)

KFX-10: https://doi.org/10.5281/zenodo.18469061

Section 1 · Global Freeze Declaration

This document presents the **minimal genealogical structure of the KFX family**.

All terms such as *world*, *observability*, and *phase* are **defined internally within the formal system**.
No physical, empirical, statistical, or psychological interpretation is assumed.

All conclusions hold **only under the preservation of the KFX family invariants**.

This document does **not** address:

- continuous limits,
- probability measures,
- statistical repeatability,
- physical measurement,
- or empirical verifiability.

Section 2 · KFX Family Invariants (Core Constraints, Frozen)

The KFX family is defined as the class of formal systems satisfying the following invariants:

1. The state space is finite;
2. Local generation rules are finite and parameter-free;
3. A world is defined by *candidate trajectories filtered by global constraints*;
4. A world is **not** a set of states, but a set of **valid trajectories**;
5. Valid trajectories have fixed length and satisfy a closure constraint.

Any system violating **any** of the above conditions does **not** belong to the KFX family.

Section 3 · KFX-A: Degenerate Phase Absolute Minimal Kernel (Frozen)

KFX-A (Degenerate Phase Minimal Kernel)
is the zero-th degenerate member of the KFX family.
It addresses the extreme question:

Under complete phase degeneration,
is *local generation + global constraints* already sufficient to define a non-empty world?

Frozen Definition Summary

- **State space**:

$$S = \mathbb{B} \times \mathbb{Z}_1$$

- **Local step rules**:
  a *preserving step* and a *flipping step* are permitted

- **Global constraints**:
  one-step flip + two-step closure

- **World**:
  the set of all trajectories satisfying the constraints

Frozen Interpretation (Critical)

In KFX-A, *observability* refers **only** to the existence of at least one irreducible state distinction (**1 bit**).

This notion excludes probability, measurement, statistical repetition, and external observers.

KFX-A carries no internal notion of time, direction, or phase.
It demonstrates only that a *world* can exist **logically**.

Section 4 · KFX-B: Minimal Non-Degenerate Phase Kernel (Frozen)

KFX-B (Minimal Non-Degenerate Phase Kernel)
is the minimal member of the KFX family in which phase is required to genuinely exist ($| \mathbb{Z} | \geq 2$).

Frozen Definition Summary

- **State space**:

$$S = \mathbb{B} \times \mathbb{Z}_3$$

- **Local step rules**:
  forward step / backward flipping step

- **Global constraints**:
  three-step inversion return + six-step closure
- **Valid step pattern**:
  unique

Frozen Conclusion (Revised)

Under preservation of the KFX family invariants,
phase becomes non-degenerate for the first time and cannot be further collapsed.

KFX-B marks the transition from *pure logical existence*
to *minimal structural existence*.

Section 5 · KFX-10: Minimal Complete Kernel (Frozen Definition)

KFX-10 (Minimal Complete Kernel)
is the first formal system in the KFX family that satisfies **complete kernel rigidity**.

Frozen Definition of "Complete"

In this document, *complete* strictly means simultaneous satisfaction of:

1. non-degenerate phase;
2. midpoint inversion symmetry;
3. closed trajectory constraint;
4. uniqueness of the valid step pattern.

Completeness does **not** imply physical completeness, empirical completeness,
or descriptive universality.

Section 6 · Minimal Genealogical Relation (Frozen)

The minimal genealogy of the KFX family forms a strict inclusion chain:

KFX-A → KFX-B → KFX-10

This relation is one of:

- structural inclusion;
- degeneration / unfreezing;

- **not** parallel modelling.

Any system skipping any node in this chain
cannot simultaneously satisfy the family invariants and minimality conditions.

Section 7 · Final Frozen Statement

- **KFX-A** provides the minimal logical lower bound for *world existence*;
- **KFX-B** provides the minimal structural lower bound for *phase existence*;
- **KFX-10** is the first extensible world template with a fully rigid internal kernel.

Appendix · Formal Definitions of KFX-A and KFX-B

KFX-A: Degenerate Phase Absolute Minimal Kernel

State space
$S = \mathbb{B} \times \mathbb{Z}_1$,
where $\mathbb{B} = \{0,1\}$, $\mathbb{Z}_1 = \{0\}$.

Local step rules

- R1 (preserving step):

$$(b, 0) \to (b, 0)$$

- R2 (flipping step):

$$(b, 0) \to (\neg b, 0)$$

Trajectory

A length-2 trajectory

$$\gamma = (s_0, s_1, s_2)$$

such that $s_i \to s_{i+1}$ for $i = 0,1$.

Global constraints

- C1 (one-step flip):
  if $s_0 = (b, 0)$, then $s_1 = (\neg b, 0)$
- C2 (two-step closure):

$$s_2 = s_0$$

World

$$\mathcal{W}_{\text{KFX-A}} = \{\gamma \mid \gamma \text{ has length 2 and satisfies C1, C2}\}$$

KFX-B: Minimal Non-Degenerate Phase Kernel

State space

$S = \mathbb{B} \times \mathbb{Z}_3$.

Local step rules

- R1 (forward step):

$$(b, p) \to (b, p + 1 mod 3)$$

- R2 (backward flipping step):

$$(b, p) \to (\neg b, p - 1 mod 3)$$

Trajectory

A length-6 trajectory

$\gamma = (s_0, s_1, \dots, s_6)$.

Global constraints

- C1 (three-step inversion return):
  if $s_0 = (b, p)$, then $s_3 = (\neg b, p)$
- C2 (six-step closure):

$$s_6 = s_0$$

World

$$\mathcal{W}_{\text{KFX-B}} = \{\gamma \mid \gamma \text{ has length 6 and satisfies C1, C2}\}$$

One-Sentence Summary

A world exists if and only if there exists a finite trajectory in which difference is forced to appear at the midpoint and forced to be erased at the endpoint.

Kaifanxie_20260204_sydney

悉尼_04022026_谢凯凡