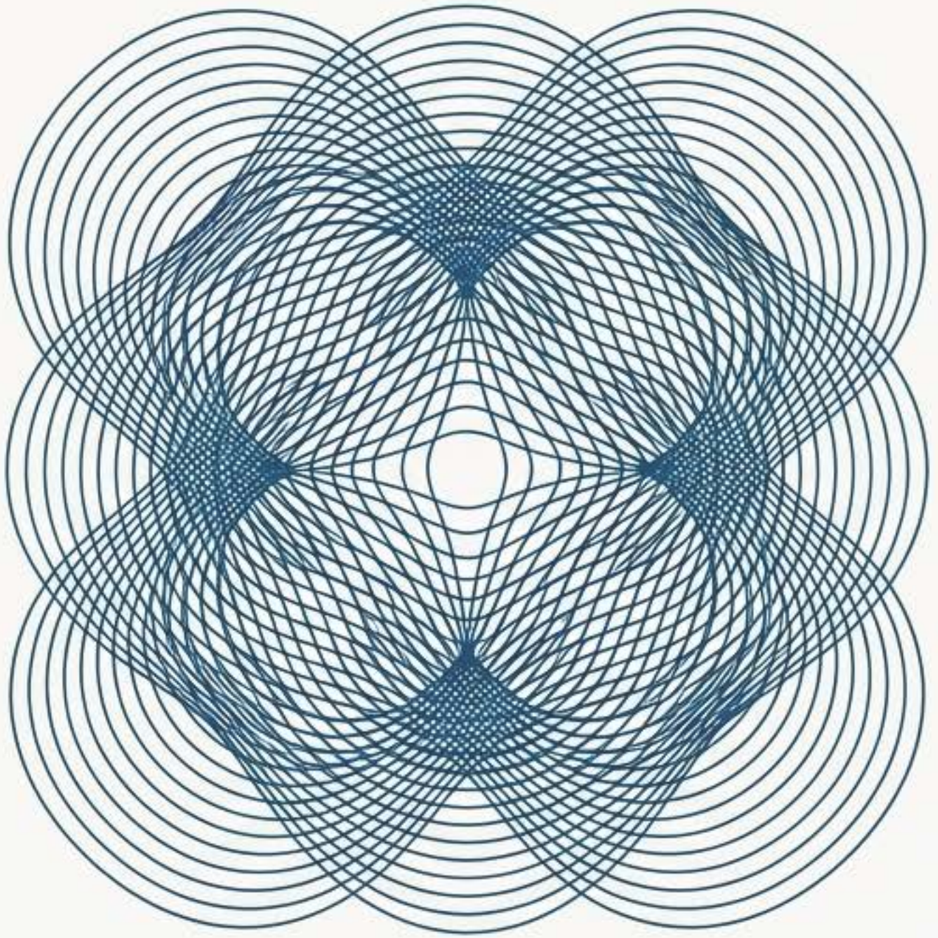
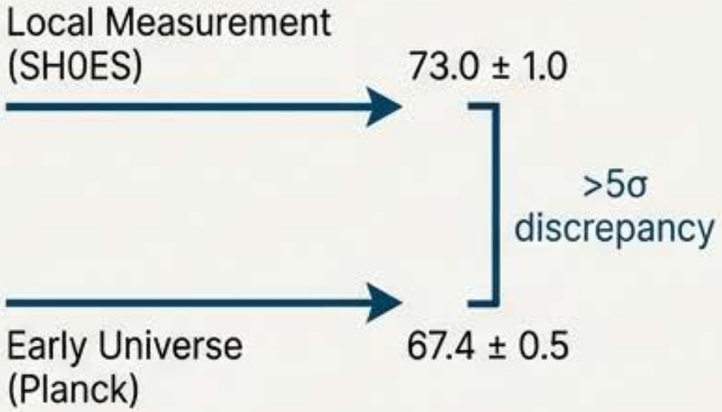
# The Supra-Omega Resonance Theory (SORT)

## A Modular Operator-Projection Framework for Structural Analysis



# Modern cosmology faces persistent structural anomalies

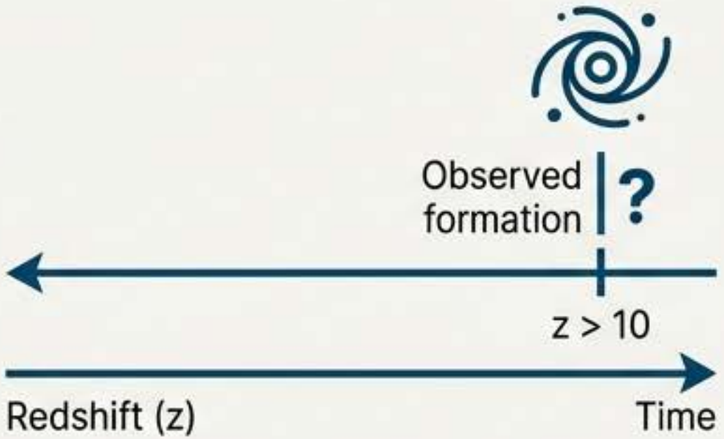
## The Hubble Tension




A persistent >5σ discrepancy in the universe's expansion rate.

- Local Measurement (SH0ES): $73.0 \pm 1.0\ \mathrm{km\ s^{-1}\ Mpc^{-1}}$
- Early Universe (Planck): $67.4 \pm 0.5\ \mathrm{km\ s^{-1}\ Mpc^{-1}}$

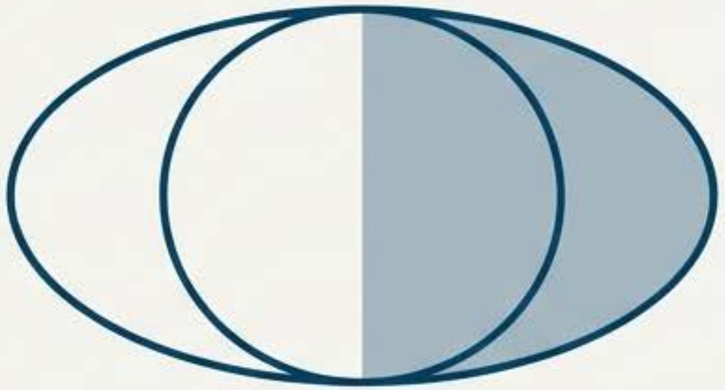
## Early Massive Galaxies




JWST has observed unexpectedly massive galaxies at very high redshifts, challenging formation timelines.

- Observation: Systems with stellar masses $M_* \sim 10^9\ M_\odot$ at redshifts $z > 10$.

## Large-Scale Asymmetries



The Cosmic Microwave Background (CMB) exhibits statistically significant anomalies at large angular scales.

- Observation: Low-$\ell$ hemispherical power asymmetry ($A_\ell \approx 10^{-3}$).

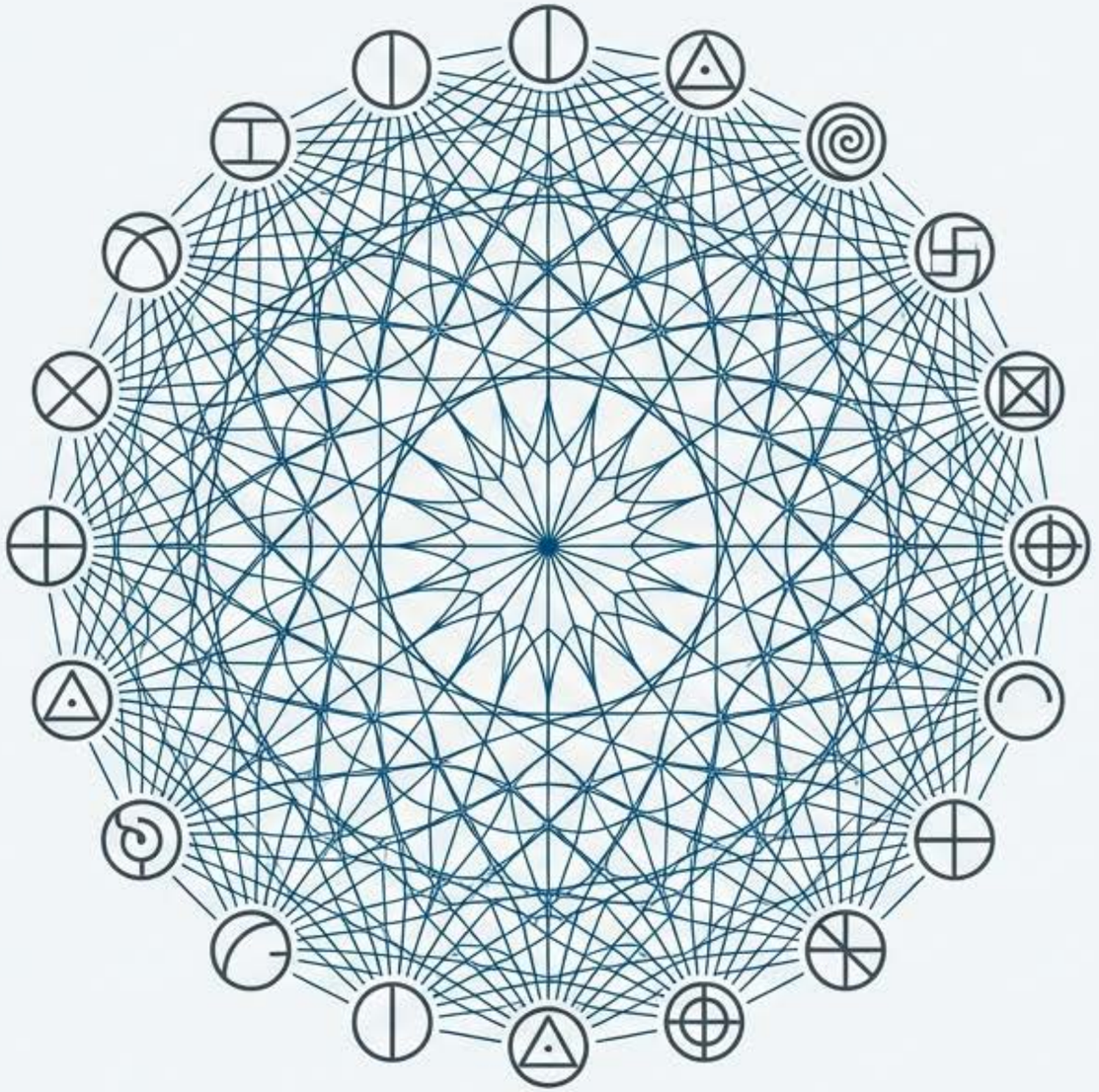
# SORT offers a new perspective: from dynamics to structure

SORT is not a replacement for ΛCDM or General Relativity. It is a projection-based structural layer that operates in conjunction with established theories. The central idea is to shift focus from postulating new **dynamics** (e.g., new particles, modified gravity) to analyzing **structural consistency** and **information distribution** across scales. Observed tensions are interpreted as manifestations of projection effects within a constrained, self-coherent mathematical architecture.

# The framework is built from 22 resonance operators

The mathematical core of SORT is a closed, finite set  of 22 idempotent operators, $\{\hat{O}_i\}$ for $i = 1...22$. Each operator represents a distinct structural fragment of a "resonance manifold," acting on a projective Hilbert space $H_R$.

**Why 22?** This number is not a postulate. It is the consequence of an iterative consolidation process to find a minimal, algebraically closed set of structural motifs that are independent and generate no new operators under composition.

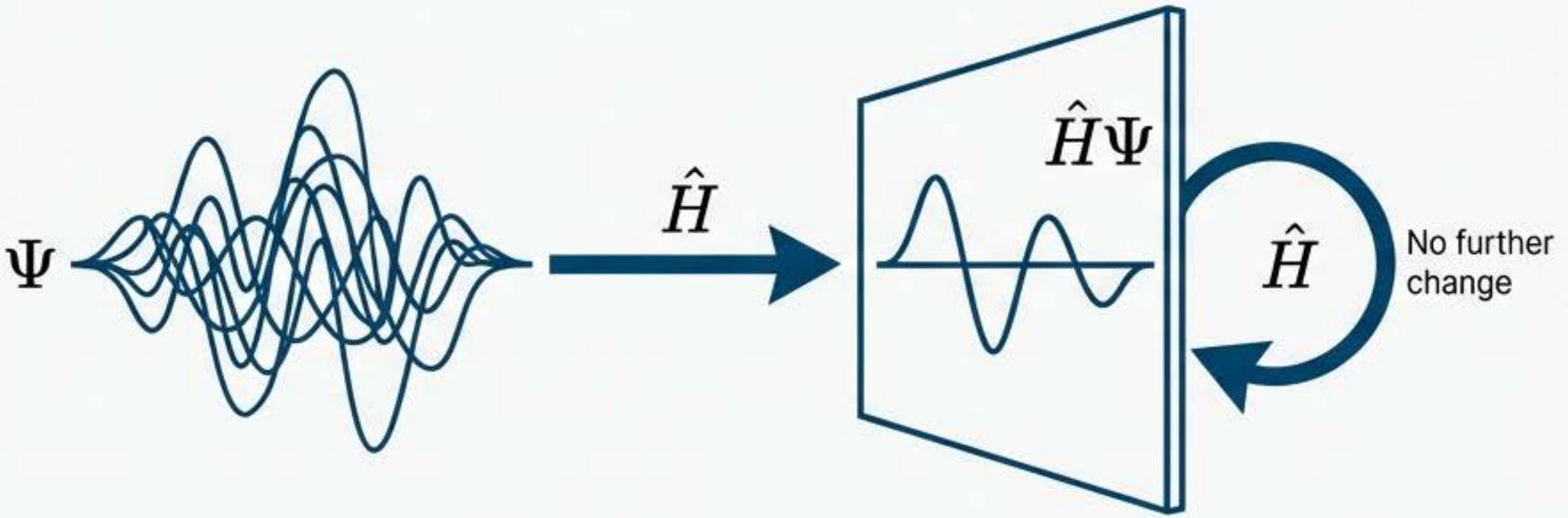


# Pillar 1: Idempotency ensures structural stability

Every individual operator $\hat{O}_i$, and the total global projector $\hat{H}$, is idempotent. This is the property of structural self-consistency.

**Mathematical Definition:** $\hat{O}_i^2 = \hat{O}_i$ and $\hat{H}^2 = \hat{H}$.

**Conceptual Interpretation:** Applying a projection or structural operation more than once does not alter the resulting state. The system acts as a stable fixed point under repeated application. This formalizes a principle of universal self-coherence, ensuring that the structural components of the theory are stable and well-defined.



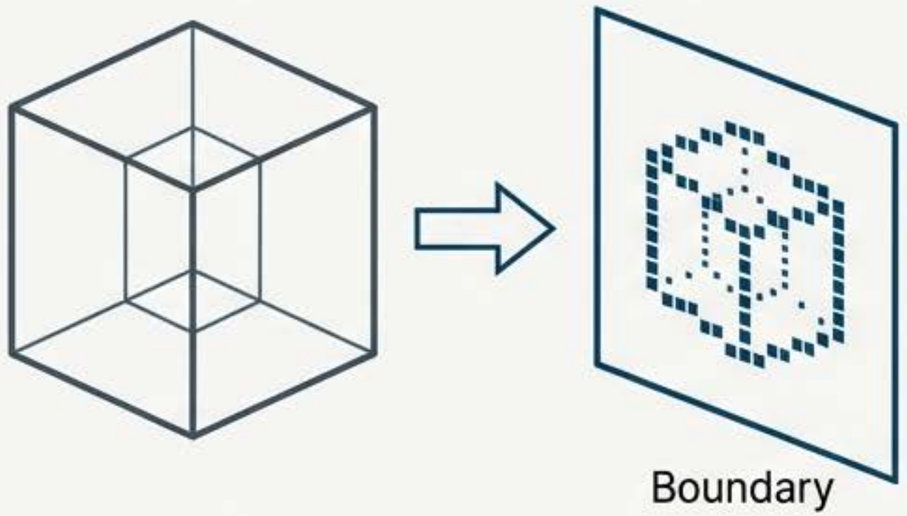
# Pillar 2: Light Balance ensures energetic neutrality

The 22 operators are partitioned into two subsets of equal cardinality (11 constructive, 11 reductive), with normalized weights $c_i$. The total system adheres to a strict light-balance condition.
**Mathematical Definition:** $\sum c_i = 0$ (verified numerically to machine precision, ≈ $10^{-15}$)
**Conceptual Interpretation:** The sum of all resonance contributions equals zero, signifying a perfect cancellation of all positive and negative components. This establishes an equilibrium between emission and absorption within the projection framework, ensuring the total projection is energetically neutral.


$$\sum c_i = 0$$

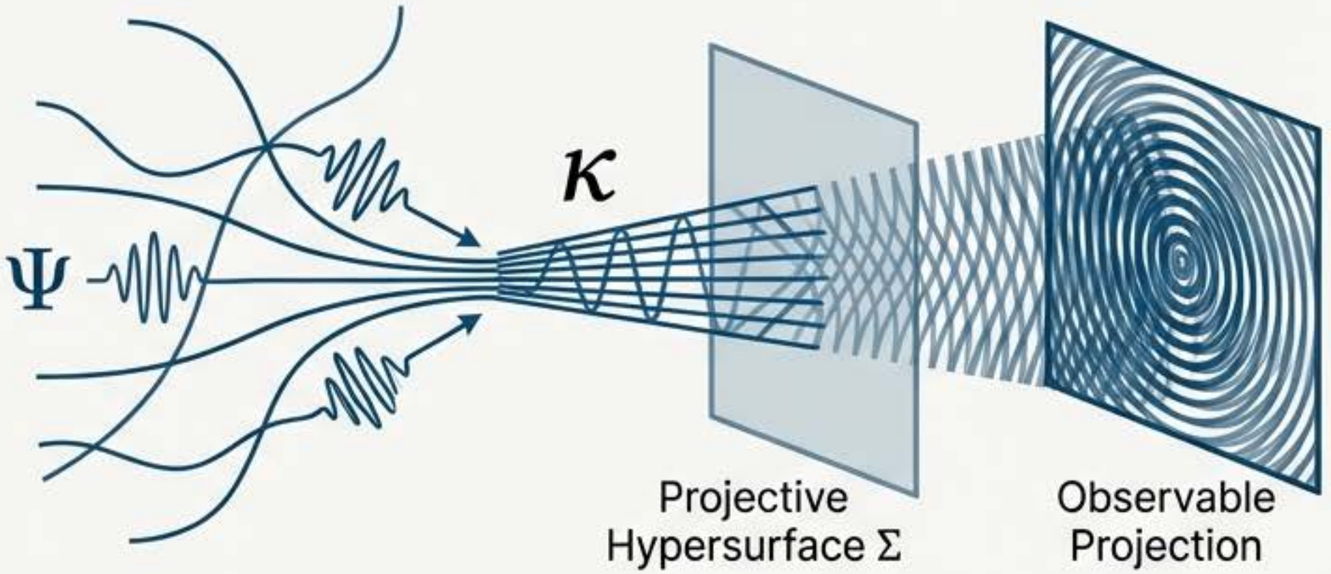
# The core mechanism extends holography to dynamic resonance projection

## Classical Holography (e.g., AdS/CFT)




Information about a bulk volume is statically encoded on a lower-dimensional boundary.

## SORT's Resonance Projection




An unobservable state $\Psi$ is mapped to an observable projection $\Psi_{\text{proj}}$ via an integral transform with a non-local **resonant kernel** $\kappa[\Sigma; \phi_+, \phi_-]$.

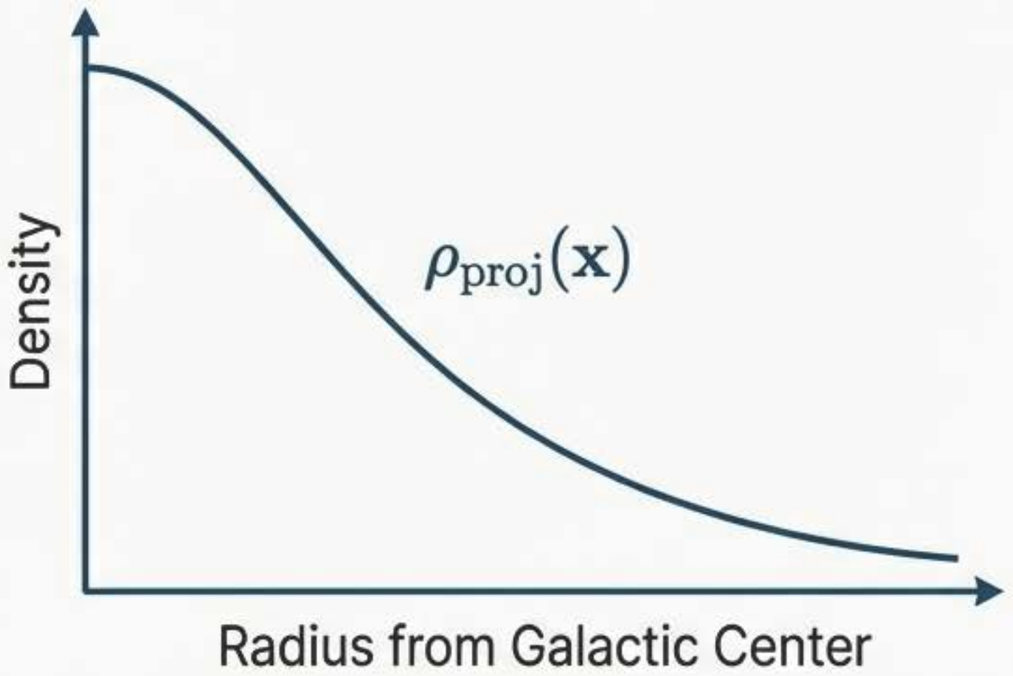
$$\Psi_{\text{proj}}(\mathbf{x}) = \int_{\Sigma} \kappa[\Sigma; \phi_+, \phi_-] \Psi(\phi_-) d\phi_-$$

This kernel couples conjugate field configurations ($\phi_+$, $\phi_-$) on a projective hypersurface $\Sigma$, transforming a static map into a dynamic interference field.

# The projection's interference pattern generates an observable gravitational potential

The dynamic interference of fields within the projection generates a **projective energy density**, $\rho_{\text{proj}}(\mathbf{x})$. This energy density acts as the **gravitational potential** conventionally attributed to dark matter. It is this quantity that maintains the structural coherence of space and form, explaining phenomena like galactic rotation curves and large-scale structure without requiring a separate particle system.

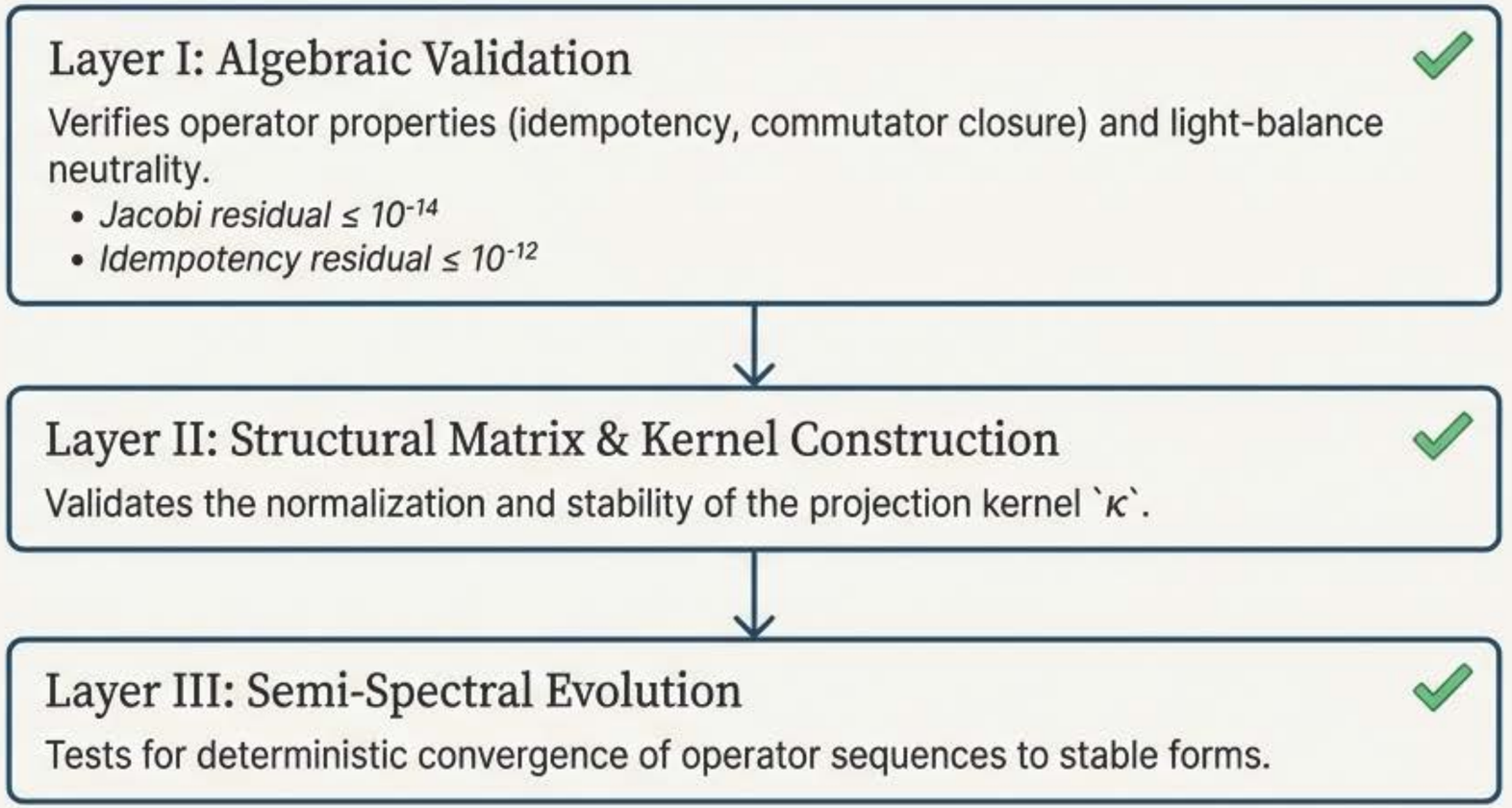
$$\rho_{\text{proj}}(\mathbf{x}) = \alpha |\Psi_{\text{proj}}(\mathbf{x})|^2$$



# The framework's architecture is validated for internal consistency

Before empirical testing, SORT's structural consistency was verified within the **MOCK v4 environment**, a deterministic simulation framework.

The validation follows a strict three-layer model:



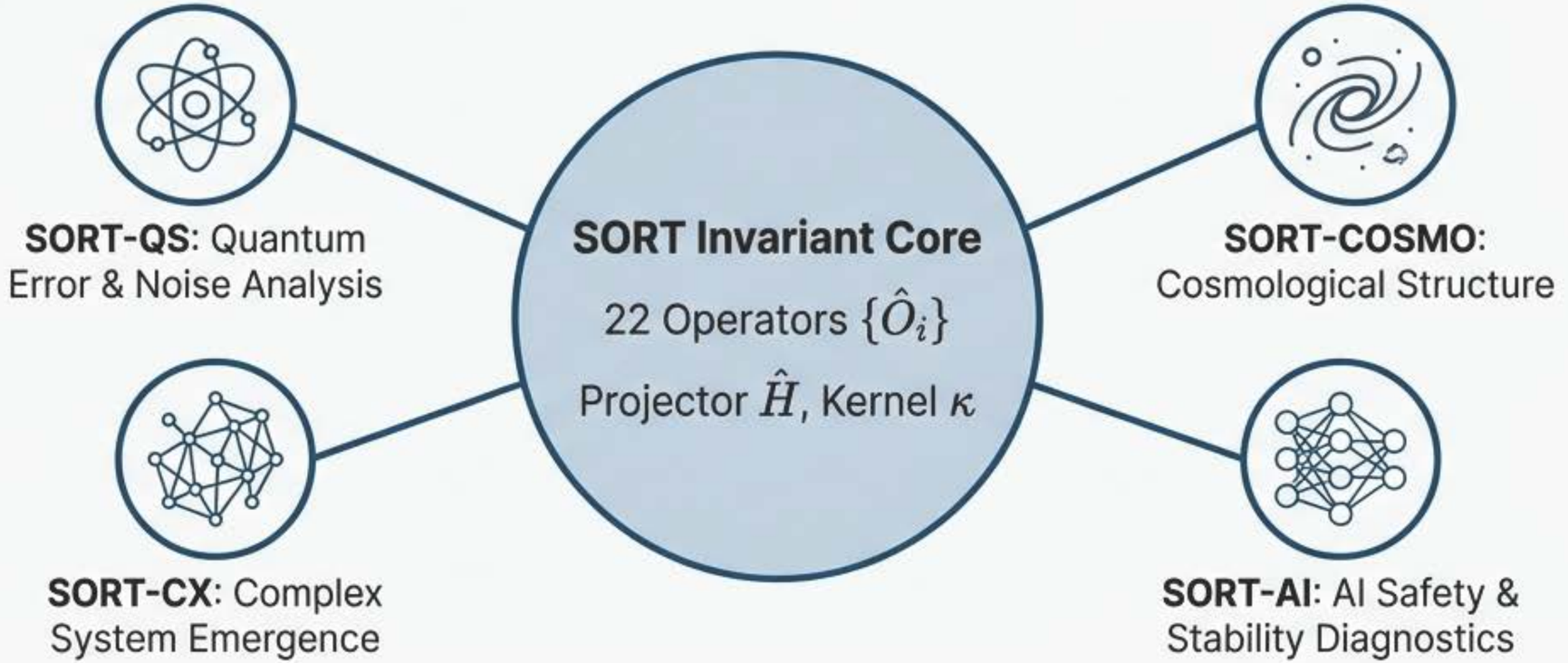

This process confirms the framework is mathematically stable and self-coherent.

# SORT is a modular, domain-agnostic core for structural analysis

The 22 operators and projection kernel form an invariant mathematical core that is domain-agnostic. Specific applications are implemented as independent modules that interpret these core structures in different contexts.

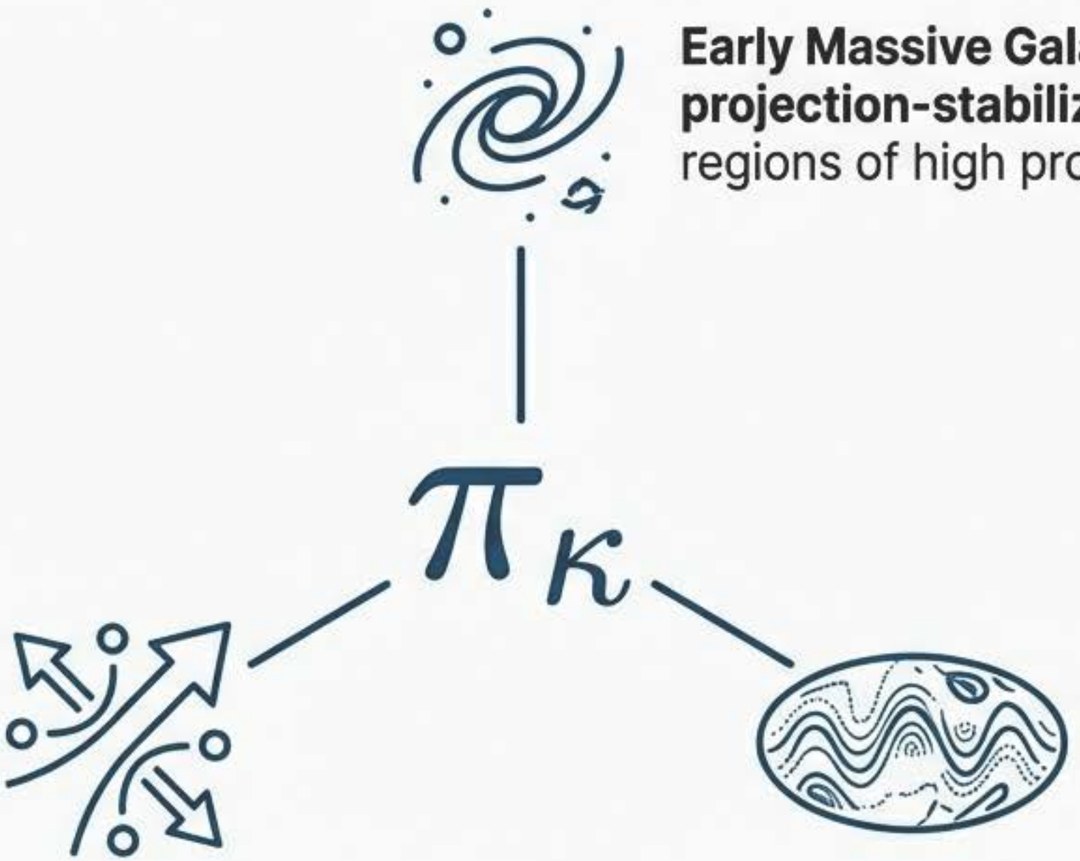
This architecture consists of:

1. A **Public Core API**: The stable, published mathematical foundation.
2. **Domain Modules**: Interpretations of the core for specific fields.



# The SORT-COSMO module provides a unified structure for cosmological anomalies

The framework organizes seemingly disconnected phenomena as different manifestations of the same underlying projection mechanism.




**Early Massive Galaxies** are interpreted as **projection-stabilized structures** forming in regions of high projective density $\rho_{\text{proj}}$.

The **Hubble Tension** is described as a **scale-dependent projection drift**, where the local expansion rate is modulated by the projection field.

**CMB Asymmetries** are seen as **large-scale projection features**—interference signatures of the global projection field imprinted on the microwave background.

# A key testable prediction: The Hubble Drift

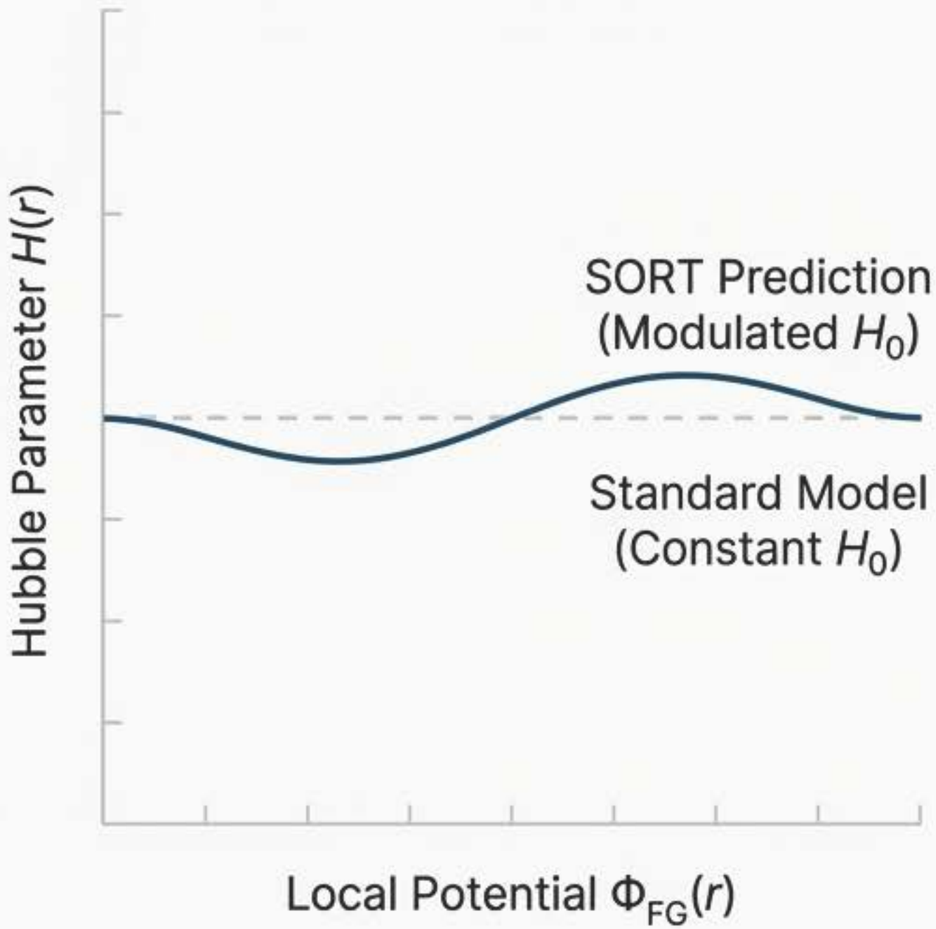
SORT predicts that the local Hubble parameter $H_0$ is not a universal constant but is modulated by the local gravitational potential induced by the projection field, $\Phi_{\mathrm{FG}}$. This leads to a specific, testable relationship for the Hubble drift:

$$\delta H(r) \propto \nabla^2 \Phi_{\mathrm{FG}}(r)$$

The operator algebra itself yields an internal, characteristic scale for this drift, which is not fit from data:

$$\delta H_0 = \pm(7.0 \pm 1.1)\,\mathrm{km\,s^{-1}\,Mpc^{-1}}$$

This value is remarkably consistent with the observed tension between local and early-universe measurements.



# The path forward: from architectural completion to empirical validation

The SORT project is organized into phased releases with increasing empirical engagement.

**2025**

### Version 6 (This Work)

Establishes the complete and stable mathematical architecture, validated internally within the MOCK v4 environment.

**2026+**

### Version 7 (Planned, 2026)

Will focus on large-scale numerical validation using High-Performance Computing (HPC) and systematic empirical tests against observational data.

## Key Future Observational Tests:

Euclid

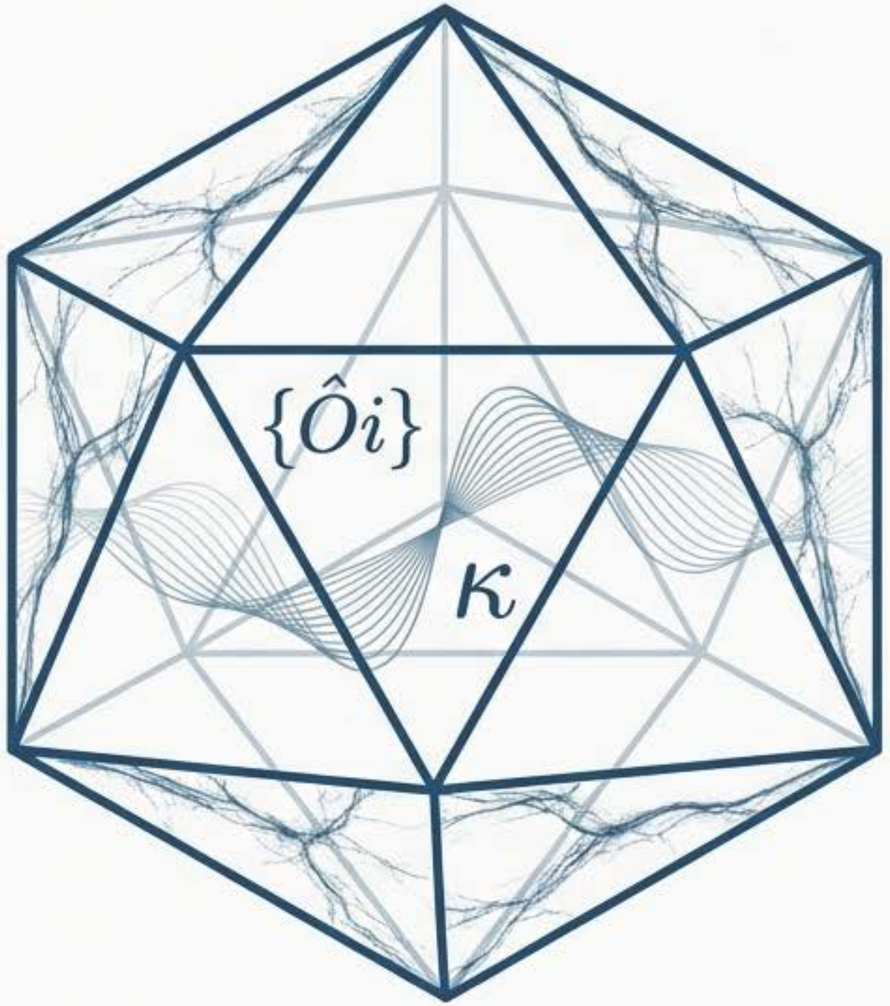
Euclid (2027): Precision weak-lensing surveys to test the radial dependence of $H_0(r)$.

JWST Deep Fields: Probing the $\Phi_{FG}$–luminosity correlation at $z > 10$.

CMB-S4

CMB-S4: Higher-order multipole analysis of resonance-induced CMB anisotropies.

# A new language for cosmic structure




The Supra-Omega Resonance Theory offers a new perspective founded on two principles: the structural stability of **idempotent operators** and the balanced neutrality of a **dynamic projection**.

It reframes cosmological anomalies not as failures of dynamics, but as observable manifestations of how information and structure are projected into our universe.

By providing a unified, testable, and extensible architecture, SORT offers a potential path toward a comprehensive structural theory that complements and extends our established understanding of the cosmos.