chapter 4: Projection Transformation Model Between Observational Space and Tensor Space

■ Objective of This Chapter

In this chapter, we aim to geometrically and physically clarify the relationship between the space we observe (observational space) and the hypothesized structural space (tensor space). Although both refer to the same physical domain, their frameworks differ in viewpoint, structure, and order. Therefore, we connect them using the conceptual framework of projection transformation.

■ What is a Projection Transformation?

A projection transformation is a mathematical method that maps the structure of a given space into another dimension or coordinate system. Here, we define how the spatial order based on the tensor structure (t1–t4 for internal axes and x1–x6 for external axes) is projected onto the conventional x, y, z coordinate system of observational space.

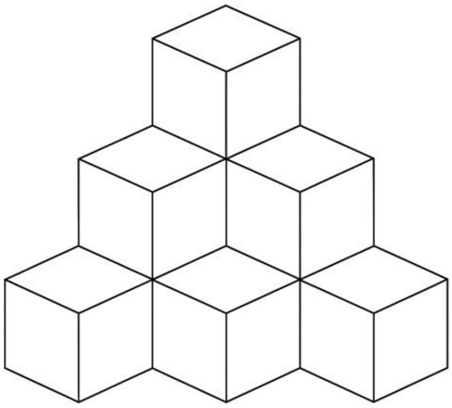
■ Basic Structure of Spatial Projection

- **Tensor Space**: An absolute structure defined by internal axes t1 to t4 and external axes x1 to x6.
- **Observational Space**: A relative coordinate system based on the conventional x, y, z axes with an arbitrary origin.

The core assertion is that all visible objects and structures in observational space are projections of tensor space viewed from specific angular perspectives.

■ Fundamentals of Projection Angles

- Example: Saturn's hexagonal structure is a projection that becomes visible when viewing the x1 to x6 directions head-on from along the t1 axis extension.
- Phenomena in which "alignment becomes visible" are the result of tensor structures being projected into observational space. From this perspective, cosmic microwave background (CMB) anisotropies, galaxy alignments, and other phenomena can be coherently explained as angle-dependent projections from tensor space.



The figure on the left illustrates the tensor cube structure composed of x-axis vectors (x1 through x6). This structure is assumed to be arranged in a continuous manner, filling the surrounding space. Although the t-axis is not depicted in the diagram, when this structure is observed from the extended direction of the t1 axis, the geometric symmetry of the x-axes manifests as a hexagonal configuration. It is hypothesized that this hexagonal formation corresponds to the origin of the hexagonal structure observed at Saturn's north pole.

※ Definition of Projection Angle (θ):

The projection angle θ can be approximately defined as:

$\theta \approx \cos^{-1}$ (angle between the alignment vector and the observation vector).

The smaller this angle, the stronger the alignment and the more clearly the phenomenon is visualized.

■ Introduction of Projection Angle and Transformation Matrix

To quantitatively describe the correspondence between the tensor space (t1–t4, x1–x6) and the observational space (x, y, z), we introduce a mathematical framework for projection transformation.

The relationship of projection can be concisely expressed as:

Observed Structure ≈ Tensor Structure × Projection Direction

■ Definition of Spatial Vectors

- **Observational Space Vector:** v_obs = [x, y, z]
- **Tensor Space Vector:** v_tensor = [t1, t2, t3, t4] or [x1–x6]

■ Examples of Projection Angles

- When the t1 axis ($\theta = 26.7°$) is projected from the z-axis direction, the resulting projection is visualized on the x-y plane.
- When the x1–x6 grid directions are projected from the t1 axis, the resulting pattern corresponds to a regular hexagon.

This framework allows us to explicitly describe how alignment phenomena and pattern formations (e.g., hexagonal symmetry, alignment of rotation axes) appear depending on the direction from which the projection is made.

■ **Significance of Implementation**

This projection transformation model serves as a key to understanding why structures that are aligned within tensor space appear as planar arrangements or rotational patterns in the observational space.

■ **Origin of Observational Anisotropy and Projection Direction**

From the viewpoint of projection transformation, the observed biases and directionality in structure are not due to actual anisotropy of space itself, but rather arise from the direction-dependent projection of a fundamentally symmetric tensor space. In other words, the observed anisotropy is a structural illusion.

■ **Major Causes of Apparent Anisotropy**

1. **Observer's Position:** The projected image varies depending on the direction from which the tensor structure is viewed.
2. **Angle of the Projection Plane:** The visualized patterns change depending on which plane slices through the x1–x6 grid or t1–t4 axes.
3. **Directional Tensor Density:** Variations in tensor density along different directions result in differences in absorption and residual patterns.

■ **Example: Apparent Bias in Galaxy Alignment**

- The observed bias in galactic spin axes—particularly their clustering along the Z-axis—may result from projection along the t1 direction. In this case, the residual matter aligns in such a way that it appears as a spin axis from the observer's perspective.
- In reality, the galaxies are aligned in a three-dimensional structure centered around the tensor axes (t1–t4), which becomes perceived as a two-dimensional alignment due to the observer's projection.

■ **Similar Anisotropy in Light Observation**

Phenomena such as directional deviations in the cosmic microwave background (CMB) and the inclination of redshift distributions also arise as functions of tensor density and directional orientation. The projection-based interpretation enables a structural explanation for these observational asymmetries without altering the fundamental properties of physical space.

■ **Necessity for Reconstructing Observational Space**

If the spatial model based on tensor structures is correct, then conventional interpretations of astronomical data may be significantly flawed. Accordingly, it becomes necessary to reconstruct our cosmological perspective under the assumption that all observations are projections of an underlying tensor space.

※ **Simplified Model of Energy Loss via Projection**

$E = E_0 \times$ Attenuation Coefficient

Where E_0 is the emitted energy, and E is the observed energy. This coefficient varies depending on the alignment angle and direction of tensor traversal.

■ **Reinterpretation of Observational Phenomena**

- **Galaxy Alignment:** Residual matter aligns along tensor axes, giving the appearance of galactic spin axes.
- **Spiral Structures in Galaxies:** Energy remains stable near the center due to low tensor passage loss, while loss increases toward the periphery, forming spiral patterns.
- **Light Attenuation:** Observed dimming is not due to spatial expansion, but rather exponential absorption through tensor structures.
- **Temporal Modulation:** Differences in time progression arise from energy loss as a function of tensor density.

■ **Methodology for Projection-Based Reconstruction**

1. Obtain directional vectors for each observational dataset.
2. Compute the angles between these vectors and the tensor basis axes (t1–t4, x1–x6).
3. Calculate the tensor traversal quantity T(d) and recompute energy loss accordingly.
4. Determine whether the observation aligns with the projection plane.

Using this approach, many phenomena previously labeled as "anomalous" or "unexplained" become rationally interpretable within a geometrically and directionally structured tensor space. This chapter thus represents a foundational step in unifying tensor structure with observational phenomena.

The next chapter will advance to the experimental verification of the relationship between temporal modulation and tensor traversal quantities.