

# Compatibility Analysis of T0 Dimension Formulations

Unification of 4D Torsion Crystal and Fractal Dimension

Documents 149, 018, and 145 Compared

Analysis Report

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## Abstract

This analysis examines the compatibility of dimensional descriptions in three central T0 documents: the 4-dimensional torsion crystal formulation (Documents 149 and 018) and the fractal dimension formulation  $D_f = 3 - \xi$  (Document 145). The central question is: Are these descriptions contradictory or complementary? The analysis shows: **The formulations are fully compatible** and describe the same physical phenomenon from two complementary perspectives – a geometric-topological one (4D torsion crystal) and a fractal-analytical one (effective dimension). The fundamental parameter  $\xi = 4/30000 = 1.333 \times 10^{-4}$  unites both views: topologically the 4 encodes the number of fundamental dimensions, while fractally the factor 4/3 describes sphere packing geometry. Both lead to identical experimental predictions.

## Contents

### 1 Introduction: The Question

#### 1.1 Initial Situation

In T0 theory (FFGFT – Fundamental Fractal Geometric Field Theory), several documents exist that use seemingly different dimensional descriptions of the fundamental spacetime structure:

- **Document 149** (FFGFT-torsion\_En.pdf): Describes a “four-dimensional brain-fold torus”
- **Document 018** (018\_T0\_Anomale-g2-10\_En.pdf): Uses a “4-dimensional torsion lattice”
- **Document 145** (FFGFT\_donat-teil1\_En.pdf): Defines a “fractal dimension  $D_f = 3 - \xi$ ”

## 1.2 Central Question

### Core Question of the Analysis

Are the 4-dimensional formulation (Documents 149, 018) and the fractal dimension formulation  $D_f = 3 - \xi$  (Document 145) compatible with each other, or do they describe contradictory physical models?

## 1.3 Main Result

### Central Answer

**YES – The formulations are fully compatible.**

They describe the same physical phenomenon from two complementary perspectives:

- **Geometric perspective** (149, 018): 4D torsion crystal with compactified 4th dimension
- **Fractal perspective** (145): Effective dimension  $D_f = 3 - \xi$  as result of compactification

The parameter  $\xi = 4/30000$  unites both views and leads to identical physical predictions.

## 2 Document Overview

### 2.1 Document 149: FFGFT-torsion\_En.pdf

#### 2.1.1 Dimensional Description

Document 149 explicitly postulates:

*“The universe is a static **4-dimensional** torsion crystal whose discrete sub-Planck structure generates all observable physical phenomena.”*

**Key characteristics:**

- Four-dimensional brain-fold torus
- 3 spatial dimensions + 1 compactified additional dimension
- The 4th dimension is "rolled up" and not directly accessible
- Energy distribution over  $f^4$  (four-dimensional hypercube)

**2.1.2 Mathematical Structure**

The fundamental number 30000 is interpreted as:

$$30000 = 3 \times 4 \times 1000 \quad (1)$$

where:

- 3 = three observable spatial dimensions
  - 4 = full four-dimensional reality
  - 1000 = scale hierarchy between fundamental and observable
- From this follows:

$$\xi = \frac{4}{30000} = 1.333\bar{3} \times 10^{-4} \quad (2)$$

**2.1.3 Energy Consideration**

The Planck energy distributes over the four-dimensional lattice:

$$E_{\text{Higgs}} = \frac{E_P}{f^4} \quad (3)$$

**Narrative explanation:** In four dimensions, a hypercube of edge length  $f$  contains exactly  $f^4$  cells. The energy distributes evenly over all these cells.

**2.2 Document 018: 018\_T0\_Anomale-g2-10\_En.pdf****2.2.1 Dimensional Description**

Document 018 uses the identical formulation:

*"The T0 theory is based on the principle that **all** physical constants should follow from the geometric structure of a **4-dimensional torsion lattice**."*

## 2.2.2 Physical Interpretation

Leptons are interpreted as winding structures in the 4D lattice:

- **Electron:** Simple winding (1st generation)
- **Muon:** Winding with fractal branching (2nd generation)
- **Tau:** More complex fractal structure (3rd generation)

The anomalous magnetic moments arise from geometric projections of these windings into 3D space.

## 2.3 Document 145: FFGFT\_donat-teil1\_En.pdf

### 2.3.1 Dimensional Description

Document 145 uses different language:

*"The central starting point of the theory is the description of space-time by a **fractal dimension**  $D_f$ , which lies slightly below the topological dimension 3."*

Mathematically:

$$D_f = 3 - \xi, \quad \text{with} \quad \xi = \frac{4}{3} \times 10^{-4} \quad (4)$$

### 2.3.2 Physical Meaning

#### Interpretation of fractal dimension:

- $D_f < 3$  means: Space is not "completely filled"
- There exists a kind of "porosity" or "gappiness"
- These gaps make up  $\xi \approx 0.0001333$  of the dimensionality

#### Scaling behavior:

$$N(r) \propto r^{D_f} = r^{3-\xi} \quad (5)$$

When increasing resolution by factor  $r$ , the number of visible structures increases with  $r^{(3-\xi)}$  instead of  $r^3$ .

### 2.3.3 Geometric Origin

The factor  $4/3$  in  $\xi = (4/3) \times 10^{-4}$  is associated with sphere packing:

- Sphere volume:  $V = \frac{4}{3}\pi r^3$
- Densest sphere packing: Packing density  $\approx 0.74$  ( $\sim 26\%$  gaps)

### 3 Mathematical Compatibility

#### 3.1 The Double Meaning of $\xi = 4/30000$

The fundamental parameter  $\xi$  carries a deep double meaning that unites both perspectives:

##### 3.1.1 Topological Interpretation (Documents 149, 018)

$$\xi = \frac{4}{30000} = \frac{4}{3 \times 4 \times 1000} \quad (6)$$

**Meaning:**

- 4 (numerator) = number of fundamental dimensions
- 3 (denominator) = number of observable dimensions
- 4 (denominator) = repetition of fundamental dimensionality
- 1000 = scale hierarchy

##### 3.1.2 Fractal Interpretation (Document 145)

$$\xi = \frac{4}{3} \times 10^{-4} \quad (7)$$

**Meaning:**

- $\frac{4}{3}$  = geometric factor (sphere volume, packing density)
- $10^{-4}$  = order of magnitude of dimensional deviation
- $D_f = 3 - \xi$  = effective fractal Hausdorff dimension

#### 3.2 Mathematical Equivalence

##### Numerical Identity

Both interpretations lead to the identical numerical value:

$$\xi_{\text{topological}} = \frac{4}{30000} = 0.000133\bar{3} \quad (8)$$

$$\xi_{\text{fractal}} = \frac{4}{3} \times 10^{-4} = 0.000133\bar{3} \quad (9)$$

The formulations are mathematically equivalent!

## 4 Physical Unification

### 4.1 Compactification as Bridge

The connection between both perspectives is established through the concept of **compactification**:

#### Unifying View

##### Fundamental level:

4-dimensional torsion crystal with compact 4th dimension

↓ Compactification at sub-Planck scale

##### Effective level:

3-dimensional space with fractal correction  $D_{\text{eff}} = 3 - \xi$

↓ Observable consequences

##### Experimental level:

~1–2% deviations in precision measurements

## 4.2 Mathematical Formulation

### 4.2.1 Compactification Radius

The 4th dimension is compactified to a circle:

$$r_4 = \xi \cdot \ell_P \approx 1.33 \times 10^{-4} \cdot 1.616 \times 10^{-35} \text{ m} \approx 2.15 \times 10^{-39} \text{ m} \quad (10)$$

This scale is **sub-Planck** and not directly observable.

### 4.2.2 Kaluza-Klein Reduction

After dimensional reduction (standard method of Kaluza-Klein theory), the compact dimension appears as a fractal correction:

$$D_{\text{eff}} = 3 + \left( \frac{r_4}{\ell_{\text{typical}}} \right)^{D_f - 3} \approx 3 - \xi \quad \text{for } \ell_{\text{typical}} \gg r_4 \quad (11)$$

**Interpretation:** The compact 4th dimension “smears out” into a fractal correction!

## 4.3 Common Predictions

Both formulations lead to **identical** physical predictions:

Observable	4D Formulation	Fractal Formulation	Value
$\xi$ -Parameter	$4/30000$	$(4/3) \times 10^{-4}$	$1.333 \times 10^{-4}$
Sub-Planck factor	$f = 7500$	$f = 1/(4\xi)$	7500
Fine structure $\alpha^{-1}$	$\pi^4 \cdot \sqrt{2}$	$\pi^4 \cdot \sqrt{2}$	137.757
Higgs VEV	$E_P/(f^2\sqrt{4\pi})$	Identical	246.71 GeV

**Table 1:** Identical predictions of both formulations

## 5 Detailed Correspondences

### 5.1 Energy Distribution

#### 5.1.1 4D Formulation (Document 149)

$$E_{\text{Higgs}} = \frac{E_P}{f^4} \quad (12)$$

**Narrative:** The Planck energy distributes over  $f^4$  cells of the four-dimensional hypercube.

#### 5.1.2 Fractal Formulation (Document 145)

Scaling law:

$$N(r) \propto r^{D_f} = r^{3-\xi} \quad (13)$$

For large scales ( $r \rightarrow f$ ):

$$N(f) \propto f^{3-\xi} \approx f^3 \cdot (1 - \xi \ln f) \approx f^3 \cdot 0.9867 \quad (14)$$

#### 5.1.3 Connection

The  $f^4$  scaling in 4D corresponds to the fractal correction in 3D:

$f^4 = f^3 \cdot f = (\text{3D volume}) \times (\text{compact dimension})$

(15)

## 5.2 Symmetry Breaking

### 5.2.1 4D Formulation (Document 149)

Pentagonal symmetry breaking:

- Factor:  $5^4 = 625$  appears in  $\xi = 4/30000$
- Golden ratio:  $\varphi = (1 + \sqrt{5})/2$
- Deviation:  $\sim 2\%$  in observables

### 5.2.2 Fractal Formulation (Document 145)

Correction factor:

$$K_{\text{frak}} = 1 - 100\xi \approx 0.9867 \quad (16)$$

Describes cumulative deviation over many orders of magnitude.

### 5.2.3 Equivalence

$$K_{\text{frak}} \approx 0.9867 \Leftrightarrow \text{ca. } 1.33\% \text{ correction} \Leftrightarrow \sim 2\% \text{ in observables} \quad (17)$$

Both describe the same physics!

## 5.3 Sub-Planck Structure

### 5.3.1 4D Formulation (Document 149)

$$\ell_0 = \frac{\ell_P}{f} = \frac{\ell_P}{7500} \quad (18)$$

### 5.3.2 Fractal Formulation (Document 145)

$$\Lambda_0 = \xi \cdot \ell_P = \frac{4}{30000} \cdot \ell_P = \frac{\ell_P}{7500} \quad (19)$$

### 5.3.3 Result

#### Identical Sub-Planck Scale

$$\boxed{\Lambda_0 = \ell_0 = \frac{\ell_P}{7500} \approx 2.15 \times 10^{-39} \text{ m}} \quad (20)$$

Both formulations predict exactly the same fundamental length scale!

## 6 Clarification: No 5 Dimensions

### 6.1 Common Misunderstanding

#### Important Clarification

**Neither Document 149 nor 018 uses 5 spatial dimensions!**

The number "5" appears in the theory as:

- Pentagonal symmetry (5-fold rotational symmetry)
- Golden ratio:  $\varphi = (1 + \sqrt{5})/2$
- Factor  $5^4 = 625$  in the prime factorization of 7500

This does **NOT** mean 5 dimensions, but 5-fold symmetry in 4D space!

### 6.2 The Role of Pentagonal Symmetry

$$\text{4D Torsion Crystal} \xrightarrow{\text{Local Structure}} \text{Tetrahedron (4-fold)} \quad (21)$$

$$\downarrow \quad \text{Global Symmetry} \quad (22)$$

$$\text{Pentagon (5-fold)} \xrightarrow{\text{Incompatibility}} \text{Quasicrystal} \quad (23)$$

$$\downarrow \quad (24)$$

$$\text{Symmetry Breaking} \Rightarrow \sim 2\% \text{ deviations} \quad (25)$$

The 5-fold symmetry is **embedded in** the 4D structure, not an additional dimension!

## 7 Experimental Consequences

### 7.1 Identical Predictions

Both formulations predict the same experimental tests:

#### 7.1.1 Modified Coulomb Law (from Document 145)

$$F_{\text{Coulomb}} \propto \frac{1}{r^{1+\xi}} \approx \frac{1}{r^2} \cdot \left( 1 - \xi \ln \frac{r}{\ell_P} \right) \quad (26)$$

### 7.1.2 Anomalous Magnetic Moments (from Documents 018, 149)

Geometric prediction:

$$a_\tau = f^{1/3} - 1 = 7500^{1/3} - 1 \approx 1.282 \times 10^{-3} \quad (27)$$

### 7.1.3 Higgs Vacuum Expectation Value (from Document 149)

$$v = \frac{E_P}{f^2} \cdot \frac{1}{\sqrt{4\pi}} \approx 246.71 \text{ GeV} \quad (28)$$

**Experimental value:**  $v_{\text{exp}} = 246.22 \text{ GeV}$

**Deviation:** 0.2%

## 7.2 Independence of Formulation

### Experimental Equivalence

All experimental predictions are **independent** of the chosen perspective (4D-geometric vs. fractal-analytical).

An experiment **cannot distinguish** which formulation is "correct" – because both describe the same physics!