

# Ontological Hierarchy of Energy Reduction

The Levels of Fundamental Reality in Natural Units

From Time-Mass Duality to Universal Energy Field

Ontological Systematics

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## Abstract

This work examines the ontological hierarchy of T0 theory under the paradigm of natural units, where through time-mass duality  $T \cdot m = 1$  all physical quantities can be reduced to energy. The central insight: There exist **five ontological levels of reduction**, ranging from the most fundamental (universal energy field) to observable physics. Each level emerges from the underlying one through mathematical necessity. The analysis shows: (1) **Level 0 – Absolute Foundation:** The universal energy field  $E_{\text{Field}}(x, t)$  with wave equation  $\square E = 0$ . (2) **Level 1 – Time-Mass Duality:**  $T(x, t) \cdot m(x, t) = 1$  in natural units. (3) **Level 2 – Geometric Parameters:**  $\xi = 4/30000$  and 4D torsion structure. (4) **Level 3 – Effective Field Theory:** Modified laws with  $\sim 1\text{--}2\%$  corrections. (5) **Level 4 – SI Units Physics:** Classical observation level with  $c, \hbar, G$  as separate constants. Narrative integration occurs through upward propagation: From the fundamental energy field emerges duality, from that geometry, from that effective laws, from that classical physics.

## Contents

# 1 Introduction: The Reduction Program

## 1.1 The Central Question

### Fundamental Question

If in natural units ( $\hbar = c = 1$ ) through time-mass duality everything can be reduced to energy, which ontological levels exist, and how do they organize themselves hierarchically?

Put differently: What are the **depths of reality** when we systematically descend from human conventions (SI units) to fundamental structures (energy field)?

## 1.2 The Dimensional Reduction

In natural units:

$$\hbar = c = 1 \quad \Rightarrow \quad [L] = [T] = [E^{-1}], \quad [M] = [E] \quad (1)$$

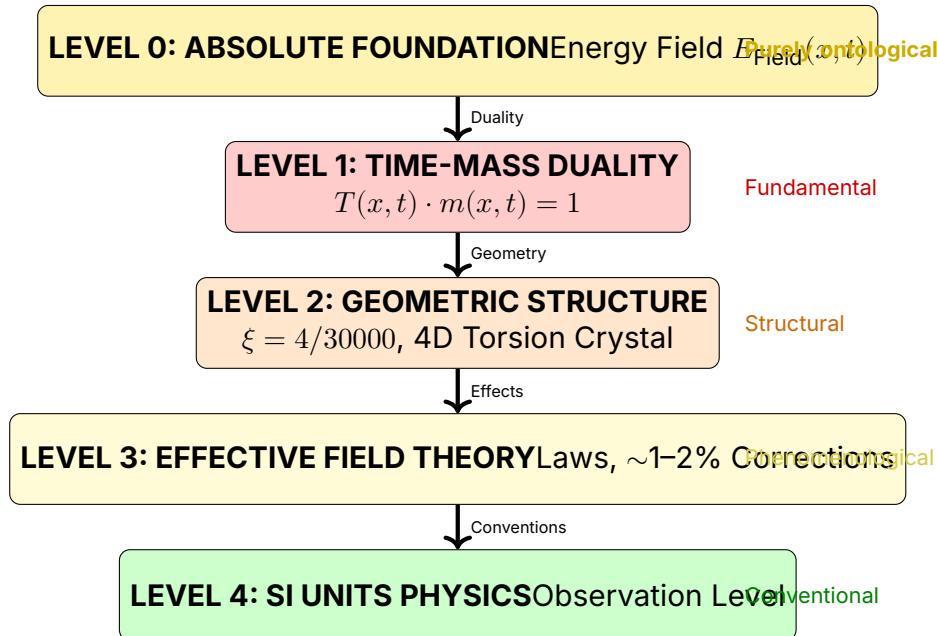
**Consequence:** All physical quantities are reduced to **one dimension – energy!**

Quantity	SI Units	Natural Units
Length	m	$E^{-1}$
Time	s	$E^{-1}$
Mass	kg	$E$
Temperature	K	$E$
Charge	C	dimensionless
Energy	J	$E$

**Table 1:** Dimensional reduction in natural units

## 2 The Five Ontological Levels

### 2.1 Hierarchy Overview



## 3 Level 0: The Absolute Foundation

### 3.1 Ontological Description

#### The Most Fundamental Reality

At the deepest level exists:

A Universal Energy Field  $E_{\text{Field}}(x, t)$

This field is:

- **Non-dual:** No separation into space/time/mass
- **Self-evident:** Requires no further concepts
- **Dynamic:** Obeys the wave equation
- **Universal:** Permeates the entire universe

## 3.2 The Fundamental Equation

$$\square E_{\text{Field}}(x, t) = 0 \quad (2)$$

where  $\square = \frac{\partial^2}{\partial t^2} - \nabla^2$  is the d'Alembert operator.

**Physical meaning:**

- Energy propagates as wave
- No sources or sinks at fundamental level
- Completely deterministic
- Local in space and time

## 3.3 Why is this fundamental?

### Justification of Fundamentality

The energy field is fundamental because:

**1. Minimal assumptions:**

- Only one field
- Only one equation
- No free parameters (in natural units)

**2. Maximal explanatory power:**

- All other concepts emerge from it
- Space = configuration space of the field
- Time = evolution of the field
- Mass = field excitation

**3. Mathematical elegance:**

- Linear (superposition valid)
- Lorentz invariant
- Energy conserving

## 3.4 Ontological Status

**What exists:**

- The energy field  $E_{\text{Field}}(x, t)$
- Its configuration at each time
- Its evolution dynamics

**What doesn't exist** (at this level):

- Separate time as independent entity
- Separate mass as substance
- Particles as fundamental objects
- Space as empty container

## 4 Level 1: Time-Mass Duality

### 4.1 Emergence of Duality

From the fundamental energy field emerges the first structuring:

#### Time-Mass Duality

In natural units holds the fundamental relationship:

$$T(x, t) \cdot m(x, t) = 1 \quad (3)$$

This is equivalent to:

$$T(x, t) = \frac{1}{m(x, t)} = \frac{1}{E(x, t)} \quad (4)$$

### 4.2 Mathematical Derivation

From the Heisenberg uncertainty principle:

$$\Delta E \cdot \Delta t \geq \frac{\hbar}{2} \quad (5)$$

In natural units ( $\hbar = 1$ ):

$$\Delta E \cdot \Delta t \geq \frac{1}{2} \quad (6)$$

In the limit  $\Delta \rightarrow 0$ :

$$E \cdot T = 1 \quad \Leftrightarrow \quad m \cdot T = 1 \quad (7)$$

### 4.3 The Intrinsic Time Field

The duality manifests as a field:

$$T(x, t) = \frac{1}{\max(m(x, t), \omega)} \quad (8)$$

### Dimensional verification:

$$[T(x, t)] = [E^{-1}] \quad (9)$$

$$[m(x, t)] = [E] \quad (10)$$

$$[T \cdot m] = [E^{-1}] \cdot [E] = [1] \quad \checkmark \quad (11)$$

## 4.4 Ontological Status

At this level exist:

- Time as **field quantity**  $T(x, t)$  (not as parameter)
- Mass as **field quantity**  $m(x, t)$  (not as substance)
- Their reciprocal relationship as **fundamental law**

### Physical meaning:

- Time varies with energy:  $T \propto 1/E$
- Mass varies with energy:  $m \propto E$
- Both are **aspects of the energy field**

## 4.5 Reduction to Energy

In natural units:

$$E = m \quad (\text{Energy} = \text{Mass}) \quad (12)$$

$$E = \omega \quad (\text{Energy} = \text{Frequency}) \quad (13)$$

$$E = 1/T \quad (\text{Energy} = \text{inverse time}) \quad (14)$$

$$E = 1/L \quad (\text{Energy} = \text{inverse length}) \quad (15)$$

**Everything is energy in various manifestations!**

## 5 Level 2: Geometric Structure

### 5.1 Emergence of Geometry

From time-mass duality emerges geometric structure:

#### Geometric Manifestation

The duality manifests geometrically as:

- **Parameter:**  $\xi = \frac{4}{30000} = 1.333 \times 10^{-4}$
- **Structure:** 4D torsion crystal

- **Scale:** Sub-Planck granulation  $\Lambda_0 = \xi \cdot \ell_P$
- **Symmetry:** Pentagonal breaking via golden ratio  $\varphi$

## 5.2 The Field Equation

The time-mass field obeys:

$$\boxed{\nabla^2 m(x, t) = 4\pi G \rho(x, t) \cdot m(x, t)} \quad (16)$$

**Dimensional verification** (natural units):

$$[\nabla^2 m] = [E^2] \cdot [E] = [E^3] \quad (17)$$

$$[4\pi G \rho m] = [1] \cdot [E^{-2}] \cdot [E^4] \cdot [E] = [E^3] \quad \checkmark \quad (18)$$

## 5.3 Geometric Parameters

From the field equation follow:

$$\beta = \frac{2Gm}{r} = \frac{2m}{r} \quad (\text{in nat. units with } G = 1) \quad (19)$$

$$\xi_{\text{geom}} = 2\sqrt{G} \cdot m = 2m \quad (\text{geometric parameter}) \quad (20)$$

## 5.4 The 4D Torsion Structure

**Topology:**

$$\mathcal{M}_{\text{fund}} = \mathbb{R}^3 \times S^1_{\text{comp}} \quad (21)$$

where:

- $\mathbb{R}^3$  = observable 3D space
- $S^1_{\text{comp}}$  = compactified 4th dimension with radius  $r_4 = \xi \cdot \ell_P$

## 5.5 Ontological Status

**At this level exist:**

- Geometric structure as **emergent property** of duality
- Parameter  $\xi$  as **manifestation** of 4D structure
- Torsion as **twisting** of compact dimension

**Not yet existent** (only higher levels):

- Separate constants  $c, \hbar, G$

- Particles as distinct objects
- Classical trajectories

## 6 Level 3: Effective Field Theory

### 6.1 Emergence of Phenomenological Laws

From geometric structure emerge measurable effects:

#### Effective Description

At measurable scales ( $\ell \gg \Lambda_0$ ) we see:

- Modified force laws with  $\xi$ -corrections
- Fractal dimension  $D_f = 3 - \xi$
- Anomalous moments with  $\sim 2\%$  deviation
- Geometric constant predictions

### 6.2 Modified Laws

**Coulomb's law:**

$$F_{\text{Coulomb}} \propto \frac{1}{r^{1+\xi}} \approx \frac{1}{r^2} \left( 1 - \xi \ln \frac{r}{\ell_P} \right) \quad (22)$$

**Gravitational potential:**

$$\Phi(r) = -\frac{Gm}{r}(1 + \kappa r) \quad (23)$$

**Fine structure constant:**

$$\alpha^{-1} = \pi^4 \cdot \sqrt{2} \approx 137.76 \quad (24)$$

### 6.3 Correction Factors

Over many orders of magnitude,  $\xi$  accumulates:

$$K_{\text{frak}} = 1 - 100\xi \approx 0.9867 \quad (25)$$

This leads to  $\sim 1.33\%$  corrections in observables.

## 6.4 Ontological Status

**At this level exist:**

- Effective laws as **approximations** of geometry
- Measurable deviations from Standard Model
- Phenomenological parameters (not yet  $c, \hbar, G$  separate)

**Characteristics:**

- **Not fundamental**, but practically relevant
- **Emergent** from deeper levels
- **Approximative** with defined accuracy

## 7 Level 4: SI Units Physics

### 7.1 Emergence of Conventions

From effective theory emerge human conventions:

#### Conventional Physics

For practical purposes we introduce:

- Separate constants:  $c = 299\,792\,458 \text{ m/s}$ ,  $\hbar = 1.055 \times 10^{-34} \text{ Js}$
- Separate units: Meter, kilogram, second
- Separate quantities: Energy  $\neq$  mass  $\neq$  time

**This is the level of human measurements!**

### 7.2 Back Translation

From natural to SI units:

$$E \text{ (nat.)} \rightarrow E \text{ (SI)} = E \cdot (\hbar c) \quad (26)$$

$$m \text{ (nat.)} \rightarrow m \text{ (SI)} = m \cdot \frac{\hbar}{c^2} \quad (27)$$

$$T \text{ (nat.)} \rightarrow T \text{ (SI)} = T \cdot \frac{\hbar}{c^2} \quad (28)$$

### 7.3 Ontological Status

**At this level exist:**

- Human conventions as **measurement tools**
  - Separate concepts for practical applications
  - Classical approximations for everyday physics
- Characteristics:**
- **Not fundamental**, but conventional
  - **Useful** for technology and experiments
  - **Obscures** the deeper unity of physics

## 8 Narrative Integration

### 8.1 Bottom-Up: The Emergence Narrative

#### The Story of Reality

##### LEVEL 0 – In the beginning was the field:

There exists a universal energy field  $E_{\text{Field}}(x, t)$  that obeys the wave equation  $\square E = 0$ . Nothing else exists – only this one field.



##### LEVEL 1 – Duality emerges:

From the quantum nature of the field ( $\Delta E \cdot \Delta t \geq \hbar/2$ ) emerges time-mass duality:  $T \cdot m = 1$ . Time is no longer parameter, but field!



##### LEVEL 2 – Geometry manifests:

The duality manifests geometrically: 4D torsion crystal with parameter  $\xi = 4/30000$ , compact 4th dimension at sub-Planck scale.



##### LEVEL 3 – Effects scale:

At measurable scales we see modified laws: Coulomb  $\propto 1/r^{1+\xi}$ , anomalous moments with  $\sim 2\%$  deviation, geometric constants.



##### LEVEL 4 – Conventions arise:

Humans introduce SI units: meter, kilogram, second. They artificially separate  $c, \hbar, G$ . The deeper unity is obscured.

## 8.2 Top-Down: The Reduction Narrative

### The Path to Fundamentality

#### START: SI Physics (Level 4)

We begin with separate concepts: energy, mass, time, length. We have many constants:  $c, \hbar, G, k_B, \dots$

↓ *Simplification*

#### Natural Units (Level 3)

We set  $c = \hbar = 1$ . Suddenly: energy = mass, time = inverse energy. Everything becomes simpler!

↓ *Deeper analysis*

#### Geometric Structure (Level 2)

We recognize: The simplicity comes from 4D geometry. Parameter  $\xi$  encodes everything. Torsion explains mass!

↓ *Ultimate reduction*

#### Time-Mass Duality (Level 1)

We understand: Time and mass are dual,  $T \cdot m = 1$ . Both are aspects of energy!

↓ *Fundamental truth*

#### Universal Energy Field (Level 0)

At the foundation: One field, one equation. Everything else emerges.

## 9 Comparison of Both Descriptions

### 9.1 4D Torsion Crystal vs. Energy Reduction

4D Torsion Crystal (Level 2)	Energy Reduction (Level 0–1)
Geometric perspective Intuitive: Twisting 4 dimensions topological	Field-theoretic perspective Abstract: Duality 1 dimension (energy) reduction
Torsion as cause Sub-Planck structure primary	Field excitation as cause Wave equation primary
<b>BOTH describe the same reality!</b>	
Level 2 in hierarchy Emerges from Level 1 Geometrically manifest	Level 0–1 in hierarchy Fundamental for Level 2 Energetically fundamental

**Table 2:** Complementary descriptions

### 9.2 Ontological Classification

#### How do both fit in?

##### Energy Reduction (Level 0–1):

- **More fundamental** – goes deeper
- **More abstract** – less intuitive
- **More universal** – holds without restrictions

##### 4D Torsion Crystal (Level 2):

- **Emergent** – follows from Level 1
- **More intuitive** – geometrically visualizable
- **Structural** – manifests duality

#### Relationship:

Energy Field (Level 0)  $\xrightarrow{\text{creates}}$  Duality (Level 1)  $\xrightarrow{\text{manifests}}$  Geometry (Level 2)

## 9.3 Why Both Descriptions Coexist

### Complementarity

Analogous to wave-particle duality in quantum mechanics:

#### Energy Reduction:

- Like wave description
- Fundamental, but abstract
- Mathematically elegant
- Hard to visualize

#### 4D Geometry:

- Like particle description
- Emergent, but intuitive
- Geometrically intuitive
- Practically useful

**Both are valid**, describing different aspects of the same reality!

# 10 Practical Consequences

## 10.1 For Calculations

### Which level to choose?

#### Level 0–1 (Energy Reduction):

- Theoretical derivations
- Fundamental principles
- Symmetry arguments
- Conceptual clarity

#### Level 2 (Geometry):

- Visual explanations
- Particle masses
- Structural predictions
- Narrative presentations

#### Level 3 (Effective):

- Experimental predictions
- Comparison with data

- Phenomenology

**Level 4 (SI):**

- Practical measurements
- Technology
- Everyday applications

## 10.2 For Communication

Target Audience	Preferred Level	Reason
Laypeople	Level 4 (SI)	Familiar
Students	Level 3 (Effective)	Learnable
Physicists	Level 2 (Geometry)	Intuitive
Theorists	Level 1 (Duality)	Fundamental
Philosophers	Level 0 (Field)	Ontological

**Table 3:** Level choice by target audience