# Ethon-Space (source)

## 1. Introduction

- **Problem**: limitations of current models regarding mass, dimensions, and the structure of space.
- **Hypothesis**: space possesses a compressible elementary structure.

## 2. Fundamental postulate: the ethon as minimal spatial brick

- Indivisible but not rigid.
- Existence of a stable dimensional window.

## 3. Dimensional variability and compressibility of space

- Effective length of the ethon.
- Link between local compression and space metric.

## 4. Torsion, density and emergence of mass

- Photons, massive particles, highly compressed states.
- Mass as geometric manifestation, not as fundamental attribute.

## 5. Apparent dimensions vs internal dimensions

- Atoms, particles, interatomic distances.
- External view vs internal view (local observer).

## 6. Multi-scale consequences

- Atomic physics
- Particle physics
- Cosmology (unaccounted compressed space)

## 7. Current limitations and perspectives

- What the model already explains.
- What remains to be mathematically formalized.
- Indirect experimental approaches.

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# Ethon-Space

## Compressible structure of space and physical consequences

### 1. Introduction

Current descriptions of space are based on a continuous and globally rigid metric, modulated by gravitational curvature. This approach works remarkably well at large scale, but it reaches its limits when attempting to coherently relate mass, inertia, internal dimensions of particles, and transitions between radiative and massive states.

Ethon-Space proposes a minimal hypothesis: space itself possesses an elementary structure, capable of compression and torsion, and this structure directly conditions observable physical properties.

### 2. Fundamental postulate: a minimal compressible spatial brick [1]

We postulate the existence of a fundamental brick of space, called the ethon, which satisfies three essential properties:

- **Indivisibility**: the ethon cannot be fragmented without loss of physical coherence.
- **Non-rigidity**: the ethon is not an absolute fixed length.
- **Bounded stability**: its effective dimension belongs to a narrow and universal window.

This hypothesis breaks with the implicit idea that a fundamental entity should be perfectly rigid. On the contrary, absolute rigidity would prevent any torsion, any compression and, consequently, any emergence of complex physical structures.

[1] A. Einstein, Die Grundlage der allgemeinen Relativitätstheorie, Annalen der Physik 49, 769–822 (1916); J. A. Wheeler, Geometrodynamics, Academic Press (1962). These works establish the curvature of the metric as a response to energy-momentum, without prejudging the microscopic structure of space.

### 3. Dimensional window of the ethon [2]

The effective length of the ethon is not constant but bounded between two physical limits:

- **lower bound**: on the order of the Planck length
- **upper bound**: approximately twice this value

Within this interval, the ethon remains indivisible, coherent, and fundamental.

This minimal variability is not a technical detail: it is a necessary condition for the existence of matter.

If the ethon were strictly frozen at the Planck length:

- no torsion would be possible,
- no compression could occur,
- no local densification of space could emerge,
- and no mass could appear.

[2] M. Planck, Über irreversible Strahlungsvorgänge, Annalen der Physik 306, 69–122 (1900); G. Amelino-Camelia, Quantum-gravity phenomenology, Living Reviews in Relativity 16, 5 (2013). The existence of a minimal scale is recognized, without imposing absolute rigidity of space.

### 4. Compression, torsion and emergent physical properties [3] [4]

Compression of space in Ethon-Space does not correspond to a disappearance of space, but to a local increase in its structural density.

Three regimes naturally emerge:

- **Weakly constrained regime**: quasi-rectilinear structure of space, associated with massless radiative phenomena.
- **Stable twisted regime**: moderate compression and closed geometric torsion, associated with stable massive particles.
- **Extreme compression regime**: maximum density of space, leading to confinement and gravitational limits.

In this view, mass is not an added property, but the geometric manifestation of a state of torsion and compression of space itself.

[3] R. P. Feynman, QED: The Strange Theory of Light and Matter, Princeton University Press (1985); S. Weinberg, The Quantum Theory of Fields, Vol. I, Cambridge University Press (1995). The photon is described as a massless state propagating at velocity c.

[4] P. A. M. Dirac, The Quantum Theory of the Electron, Proceedings of the Royal Society A 117, 610–624 (1928). The relationship between internal structure, spin and mass already appears in the relativistic formulation of the electron.

## 5. Apparent dimensions and internal dimensions [5] [6]

A direct consequence of the model is the distinction between:

- **apparent dimensions**, measured by an external observer in weakly compressed space;
- **real internal dimensions**, proper to regions of high spatial density.

Thus:

- a particle is not punctual but a structure of strongly contracted space;
- an atom does not possess a unique size, but a superposition of different internal metrics;
- measured interatomic distances correspond to already dilated space.

From the point of view of a local observer situated in a region of strong compression (for example near a black hole), electronic structures appear extremely distant, while they seem very close for an external observer looking at the local observer and their environment.

The notion of distance thus becomes relative to the local state of space compression.

[5] E. Mach, Die Mechanik in ihrer Entwicklung, Brockhaus (1883); A. Einstein, The Meaning of Relativity, Princeton University Press (1922). Foundational discussions on inertia as a relational property.

[6] J. Barbour, The End of Time, Oxford University Press (1999). Modern geometric interpretation of inertia and resistance to change of state.

## 6. Unaccounted compressed spaces and cosmological implications [7]

At large scale, Ethon-Space implies that the real volume of the universe is not equivalent to its apparent metric volume.

Strongly compressed regions — stellar cores, galactic nuclei, zones of extreme density — contain real space, but in a contracted form that escapes classical cosmological measurements.

This leads to several major consequences:

- the universe may contain much more space than it appears,
- certain regions can store a large amount of spatial structure without apparent volumic contribution,
- measured cosmological age and size reflect an average metric, not the entirety of existing space.

This approach offers an alternative reading of phenomena usually attributed to additional entities, without introducing new ad hoc fields.

[7] A. Friedmann, Über die Krümmung des Raumes, Zeitschrift für Physik 10, 377–386 (1922); G. F. R. Ellis, Relativistic Cosmology, Enrico Fermi School (1971); R. Penrose, The Road to Reality, Jonathan Cape (2004). Distinction between observed metric and real structure of space-time.

## 7. Current framework, limitations and perspectives [8]

Ethon-Space does not claim to replace existing theories in their domains of validity. It proposes an underlying geometric framework capable of:

- relating mass, inertia and spatial structure,
- explaining the variability of internal dimensions,
- unifying atomic, subatomic and cosmological phenomena through a single compression mechanism.

Future developments will need to:

- mathematically formalize the relationships between torsion and spatial density,
- identify indirect experimental signatures,
- specify boundary conditions for extreme regimes.

[8] W. V. O. Quine, On What There Is, Review of Metaphysics (1948); K. Popper, The Logic of Scientific Discovery, Routledge (1959). Principles of ontological economy and scientific refutability.

## Conclusion

Ethon-Space rests on a simple but structural idea: space is not a passive support, but a structured, compressible and malleable entity capable of carrying fundamental physical properties.

This hypothesis complicates the intuitive vision inherited from classical geometry, but in return it brings remarkable coherence between previously disjointed domains.

It invites us to consider that what we measure is not total space, but space as it is locally relaxed.

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## Ethon-Space — Correspondence boxes with established physics

### Box A — General Relativity (GR)

**Correspondence**: local compression of space ↔ metric curvature.

In GR, gravitation is described as a curvature of space-time induced by energy-momentum. Ethon-Space reformulates this fact upstream: the structural compression of space (increased density of the minimal brick) is the mechanical origin of curvature. Mass generates a pinching of Ethon-Space. This three-dimensional curvature implies that bodies are pushed toward the deformation and not attracted by the mass. EM forces are the only ones acting by pressure on bodies to direct them toward compressed media.

➡️ **Compatibility**: no Einstein equation is violated; the source of curvature is specified. ➡️ **Conceptual gain**: curvature is no longer primitive, it becomes a consequence.

### Box B — Planck length and metric bounds

**Correspondence**: lower bound of effective length ↔ Planck invariants.

Planck physics identifies a minimal scale where continuous descriptions cease to be operative. Ethon-Space strictly respects this bound, while allowing bounded variability above the minimal scale.

➡️ **Compatibility**: no sub-Planckian postulated. ➡️ **Conceptual gain**: minimal length does not imply absolute rigidity, a necessary condition for structure formation.

### Box C — Photons, mass and geometric states

**Correspondence**: massless states ↔ wave-like EM impulse geometry;

In QED, the photon is massless and propagates at c. Ethon-Space recovers this result by associating the absence of mass with a weakly constrained geometry of space.

➡️ **Compatibility**: no modification of propagation laws. ➡️ **Conceptual gain**: Its nature is purely wave-like and EM.

### Box D — Inertia

**Correspondence**: inertia ↔ resistance to geometric deformation.

The principle of inertia stipulates resistance to change of state of motion. In Ethon-Space, this resistance is interpreted as the stability of a compressed spatial configuration facing an attempt at reorganization.

➡️ **Compatibility**: F=ma remains locally valid. ➡️ **Conceptual gain**: inertia becomes a structural property, not an axiom.

#### Box E — Apparent dimensions (QM / atomic)

**Correspondence**: measured radii ↔ relaxed metric; internal dimensions ↔ compressed metric.

Atomic "radii" and measured interatomic distances correspond to regions of low structural density. Ethon-Space distinguishes these apparent dimensions from real internal dimensions, proper to compressed regions.

➡️ **Compatibility**: no standard atomic prediction is altered. ➡️ **Conceptual gain**: resolution of the "void/full" paradox of the atom.

#### Box F — Cosmology (unaccounted volumes)

**Correspondence**: observed metric volume ↔ average relaxed space.

Cosmological models measure an average metric volume. Ethon-Space emphasizes that strongly compressed regions contain real space not metrically accounted for.

➡️ **Compatibility**: FLRW metrics locally unchanged. ➡️ **Conceptual gain**: alternative reading of global balances without ad hoc fields.

#### Box G — Principle of parsimony

**Correspondence**: no new fields, no new constants.

Ethon-Space adds no fundamental field or free constant. It repositions existing notions (curvature, mass, inertia) on a minimal compressible structure.

➡️ **Compatibility**: principle of economy respected. ➡️ **Conceptual gain**: unification by structure, not by accumulation.

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## Ethon-Space — Essential physical references

(These references are chosen for their fundamental status, not to support a particular interpretation. Ethon-Space relates to them by coherence, not by dependence.)

#### General relativity — curvature, metric, density

1. A. Einstein, *Die Grundlage der allgemeinen Relativitätstheorie*, Annalen der Physik 49, 769–822 (1916). → Foundation of metric curvature as response to energy-momentum.
2. J. A. Wheeler, *Geometrodynamics*, Academic Press (1962). → Vision of gravitation as manifestation of space structure.
3. C. W. Misner, K. S. Thorne, J. A. Wheeler, *Gravitation*, Freeman (1973). → Standard reference relating geometry, energy and dynamics.

**Planck scale — fundamental limits**

4. M. Planck, *Über irreversible Strahlungsvorgänge*, Annalen der Physik 306, 69–122 (1900). → Introduction of natural units.
5. G. Amelino-Camelia, *Quantum-gravity phenomenology*, Living Reviews in Relativity 16, 5 (2013). → Modern interpretation of Planck metric limits.
6. C. Rovelli, *Quantum Gravity*, Cambridge University Press (2004). → Discussion on granularity of space without absolute rigidity.

**Photon, mass, propagation — QED and relativity**

7. P. A. M. Dirac, *The Quantum Theory of the Electron*, Proc. Royal Society A 117, 610–624 (1928). → Fundamental link between geometry, spin and massive states.
8. R. P. Feynman, *QED: The Strange Theory of Light and Matter*, Princeton (1985). → Massless nature of photon and structure of interactions.
9. S. Weinberg, *The Quantum Theory of Fields*, Vol. I, Cambridge (1995). → Formal framework of massless and massive states.

**Inertia — resistance to change of state**

10. E. Mach, *Die Mechanik in ihrer Entwicklung*, Brockhaus (1883). → Conceptual origin of inertia as relational property.
11. A. Einstein, *The Meaning of Relativity*, Princeton (1922). → Discussion on inertia and space-time structure.
12. J. Barbour, *The End of Time*, Oxford (1999). → Geometric and structural approach to inertia.

**Atoms, apparent dimensions, internal structure**

13. N. Bohr, *On the Constitution of Atoms and Molecules*, Philosophical Magazine 26, 1–25 (1913). → First distinction between internal structure and apparent measurement.
14. R. P. Feynman, *The Character of Physical Law*, MIT Press (1965). → Limits of naive interpretation of physical dimensions.

**Cosmology — observed metric and real structure**

15. A. Friedmann, *Über die Krümmung des Raumes*, Zeitschrift für Physik 10, 377–386 (1922). → Global metric models.
16. G. F. R. Ellis, *Relativistic Cosmology*, Proc. Int. School of Physics Enrico Fermi (1971). → Distinction between local, global metric and physical interpretation.
17. R. Penrose, *The Road to Reality*, Jonathan Cape (2004). → Limits of purely metric descriptions, compressed structures.

**Principle of parsimony and epistemological framework**

18. W. V. O. Quine, *On What There Is*, Review of Metaphysics (1948). → Ontological economy.
19. K. Popper, *The Logic of Scientific Discovery*, Routledge (1959). → Structural hypotheses and refutability.

**How to use these references (important)**

- None is "cited by authority".
- They serve to show that:
  - nothing in Ethon-Space breaks with established physics,
  - the mobilized concepts already exist, but reorganized.

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# Ethon-Space — Correspondence notes (integrated version)

**Note 1 — General relativity**

The description of gravitation as metric curvature follows from Einstein's equations, where the geometry of space-time responds to the energy-momentum tensor [1–3]. Ethon-Space does not alter this framework; it proposes a structural interpretation upstream, where curvature is the macroscopic manifestation of local compression of space.

## Note 2 — Planck scale and metric bounds

The introduction of natural units by Planck fixes a minimal scale beyond which continuous descriptions lose their meaning [4]. Modern approaches to quantum gravity confirm the existence of metric bounds without imposing absolute rigidity of space [5,6]. Ethon-Space fits within this framework by postulating strictly bounded variability above the minimal scale.

## Note 3 — Photon and massless states

In quantum electrodynamics, the photon is a massless state propagating at velocity c [8,9]. Ethon-Space recovers this result by associating the absence of mass with weakly constrained spatial geometry, without modification of established propagation laws.

## Note 4 — Massive states and geometric structure

The relationship between spin, mass and internal structure of particles is already suggested in the relativistic formulation of the electron [7]. Ethon-Space extends this idea by interpreting massive states as stable geometric configurations of compressed space, without introducing additional parameters.

## Note 5 — Inertia

The principle of inertia, historically discussed by Mach and Einstein, can be interpreted as a relational property rather than as an isolated axiom [10,11]. Modern approaches propose a geometric reading of this resistance to change of state [12]. Ethon-Space fits within this continuity by relating inertia and structural stability of space.

## Note 6 — Atomic dimensions and metric appearance

Early atomic models already distinguished internal structure from measured quantities [13]. Modern physics recognizes that atomic "radii" are operational constructs dependent on experimental context [14]. Ethon-Space formalizes this distinction in terms of local relaxed metric versus compressed regions.

## Note 7 — Cosmology and metric volume

Standard cosmological models describe the expansion of an average metric [15]. More refined analyses emphasize the distinction between observed metric and real structure of space-time [16,17]. Ethon-Space takes up this distinction by emphasizing that strongly compressed regions may contain real space not metrically accounted for.

## Note 8 — Theoretical parsimony

The principle of ontological economy recommends not multiplying fundamental entities without necessity [18]. Ethon-Space respects this principle by adding neither new fields nor free constants, but by reorganizing existing notions in a coherent structural framework, conforming to the requirements of scientific refutability [19].

**Associated references**

(numbering identical to the bibliography provided previously)


[1] Einstein 1916 — GR
[2] Wheeler 1962 — Geometrodynamics
[3] Misner, Thorne & Wheeler 1973
[4] Planck 1900
[5] Amelino-Camelia 2013
[6] Rovelli 2004
[7] Dirac 1928
[8] Feynman 1985
[9] Weinberg 1995
[10] Mach 1883
[11] Einstein 1922
[12] Barbour 1999
[13] Bohr 1913
[14] Feynman 1965
[15] Friedmann 1922
[16] Ellis 1971
[17] Penrose 2004
[18] Quine 1948
[19] Popper 1959