Two Absolute Zeros: In Search of the Third

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This essay proposes a philosophical framework rather than a physical classification. Its aim is to ask whether different domains of physics — matter, electromagnetism, gravity — have structural limits of analogous kinds. The conceptual anchors used here ("silence of matter", "boundary of geometry") are not meant as precise physical descriptions, but as starting points for inquiry. The framework may serve as a heuristic tool for further research into the ontological structure of physical limits.

If we place on one boundary the absolute zero of temperature (0 K) — the state in which all thermal activity ceases — and on the other boundary the speed of light c as the absolute zero for electromagnetic waves (since it implies zero rest mass, zero spacetime interval, and zero proper time), then what is the analogous "absolute zero" for gravity? Is it also c (because gravitational waves travel at the speed of light), or rather the event horizon (where time stops), the Planck length (where continuous spacetime loses meaning), or zero curvature (flat space)? And is the question itself well-posed?

1 First zero: the silence of matter

Absolute zero temperature — 0 Kelvin, $-273.15\,^{\circ}\mathrm{C}$ — is one of the most fundamental concepts in physics. The third law of thermodynamics states that it cannot be reached in a finite number of steps. It is a limit, not a state. At 0 K all thermal vibrations cease and mechanical waves fall silent — though quantum mechanics requires a residual zero-point energy, so motion never stops entirely. It is a zero of thermal disorder, not of all motion. Matter does not so much "die" as reach the end of its thermal activity.

It is a zero in the energetic sense: the end of vibration, the end of disorder, the end of all thermal information encoded in molecular motion. Used here as a conceptual anchor, I call it the **zero of content** — the state in which matter falls thermally silent.

2 Second zero: the boundary of geometry

The speed of light c is commonly understood as the "speed of photons" — but that is an incomplete description. In a deeper sense, c is the structure of spacetime itself. For an object moving at that speed, the spacetime interval becomes zero, rest mass must be zero, and proper time ceases completely. It is not a zero of energy — a photon carries energy — but a zero of temporal experience, a zero of causal distance.

Gravitational waves are perturbations of the spacetime metric itself, while electromagnetic waves propagate *on* that metric background — both governed by the same underlying geometric structure, but in ontologically different ways. Gravitational waves also travel at c — not because they "borrow" speed from electromagnetism, but because both are governed by the same geometric structure of spacetime.

A crucial distinction: c is not a zero in the same sense as 0 K. For *massless* objects, c is a **constitutive boundary** — they always move at c, it is not a limit they approach. For *massive* objects, c is an **asymptotic limit** — it can be approached but never reached, much like 0 K. This dual character of c is not a weakness in the analogy; it is part of what makes it structurally rich. Used here as a conceptual anchor, I call it the **zero of geometry** — the boundary at which causal structure reaches its geometric limit.

3 Searching for the third zero — and its non-existence?

The natural question follows: since matter has its structural limit at 0 K and electromagnetic waves have their limit at c, does gravity have an analogous structural limit? Candidates include: the event horizon, where time locally stops; the Planck length, where continuous spacetime loses meaning (though both the graviton and the Planck length as a physical boundary remain speculative and not empirically confirmed); zero curvature, i.e. flat space without gravitational field.

Each of these candidates has a serious flaw. The event horizon is local and conditional — it depends on the mass of a specific object and is not absolute. Zero curvature is more of a "ground state" than a limit — flat spacetime is not the "silence" of space, it is space in its lowest state, still fully present. The Planck length is the most universal candidate — but it is not a "gravitational zero" in the sense that 0 K is a thermal zero. It is rather a zero of physics itself: the point where the very distinction between "geometry" and "content" ceases to be meaningful.

Here a deeper intuition emerges: it is possible that there is no third gravitational zero — not because we have not searched carefully enough, but because gravity does not belong to the same ontological category as matter or electromagnetic fields. In general relativity, gravity is not a field propagating through space — it is described by the law relating the curvature of spacetime to energy and momentum. The gravitational wave and its medium are so deeply entangled that searching for the "zero of gravity" would be like searching for the "zero of the stage" — the stage is the condition of possibility for all zeros, not one of the things that can be zeroed.

4 What makes a zero a zero?

The discussion above reveals a deeper problem: the original analogy lacked a single consistent criterion. If the criterion is "unreachability", then c fails for massless objects — they always move at c. If the criterion is "zero numerical value", then zero curvature qualifies equally with 0 K. A more precise question is needed.

A better criterion: a zero is a state in which the **symmetry of physical interaction reaches an extremum**. At 0 K, thermal symmetry is maximal — all directions equivalent, no preferred motion, disorder ceases. At c, directional asymmetry of the spacetime structure becomes total — the interval collapses, proper time ceases, causal structure reaches its geometric boundary.

Under this criterion, zero curvature does not qualify as a zero — it is the state of maximum symmetry of the gravitational field, not its extremum in the sense of a boundary. It is the background, not the limit. This is precisely why gravity has no separate third zero within general relativity: its apparent "zero" coincides with the ground state, which is not a zero at all.

This criterion is proposed as a heuristic tool. Whether it can be made precise enough to constitute a stable physical classification remains an open question — and that is part of what makes it a starting point for further research.

5 The TSV perspective: when time ceases to be a stage

The above argument makes a hidden assumption: that time and space are the stage, and matter is the actor. In general relativity this is justified — gravity is geometry, not a process within geometry. But what if that assumption is too hasty?

The Multipolar Time Hypothesis (TSV) proposes a different picture. Time is not a geometric dimension of spacetime — it is a *stream of elementary impulses of possibility* flowing toward the observer from all spatial directions. A clock does not measure the flow of absolute time, but counts the number of absorbed impulses. Time dilation, interpreted in GR as "slower passage of time", is in TSV a geometric redistribution of the density of this stream — without any change in an absolute "tempo".

In this picture, gravity as the curvature of spacetime becomes the curvature of the *time stream*. It is no longer a neutral stage — it is a dynamic field influencing how matter absorbs impulses of possibility. In other words, gravity ceases to be exclusively geometry and becomes a relation between geometry and the stream.

The criterion of Section 4 now takes on new meaning. Near a black hole event horizon, where the anisotropy function $f(\theta, \beta)$ of the stream tends to ∞ in the direction of motion and to 0 in the opposite direction, we find a natural "TSV zero" — not as an end of energy or geometry, but as an end of symmetry of absorption. This is the point where the time stream ceases to be isotropic and becomes completely directed. Not a zero of content, not a zero of geometry — but a **zero of symmetry**.

6 An asymmetry that reflects something deep

We have two absolute zeros — not three. 0 K concerns what exists *in* space: matter, energy, thermal motion. c concerns what space *is*: geometry, causality, the structure of the interval. Gravity, described by the law relating energy to curvature, does not need a separate zero because it lies on the same side as c — it is the description of geometry, not a thing within it.

The asymmetry between the two zeros therefore reflects a genuine ontological division: between content (matter, energy, fields — things that can cease) and container (geometry, spacetime — the condition for the possibility of ceasing). The first kind has zeros; the second does not.

Whether this conclusion is final depends on what gravity ultimately turns out to be: the stage on which physics plays out, or another actor in the same play. Within general relativity, the answer points toward the former. But the question remains open.

> *There are two kinds of absolute zeros — one for matter (0 K), one for geometry (c). Their asymmetry is not a gap in our knowledge. It reflects something deep about the structure of physical reality: only what exists within space can fall silent. The description of space itself cannot — unless time turns out to be something more than geometry.*

Note. Section V refers to the Multipolar Time Hypothesis (TSV) developed by the author in a series of articles: *A Different Perspective on Time and Space: Multipolar Time — Ontology, Axiomatics* (Zenodo, 2026, doi:10.5281/zenodo.19056553) and *Momentum Conservation in the Multipolar Time Hypothesis* (Zenodo, 2026). The result concerning stream anisotropy near the event horizon is derived in: *Anisotropic Hawking Radiation in the Multipolar Time Hypothesis* (Zenodo, 2026, doi:10.5281/zenodo.19862513). Full version with appendix: `https://zenodo.org/records/20517271`

Appendix: Space, Gravity, and the Structure of Zeros

I. The question reformulated

The main essay asked: what is the absolute zero of gravity? Candidates — event horizon, Planck length, zero curvature — each proved defective. In this appendix I propose a different approach: instead of asking for the zero of a gravitational "wave", ask for the zero of its "medium".

For mechanical waves the medium is **matter**; its zero is 0 K — the disappearance of thermal activity. For electromagnetic waves the medium is the **metric / vacuum**; its zero is c — the constitutive boundary of geometry. For gravitational waves the medium is **space itself**. And space cannot disappear from itself. There is no meta-space in which space could "vanish".

This is not merely an absence of a candidate. It is a structural answer: the question "what is the zero of gravity" is ill-posed for the same reason as "what is the zero of the stage" — the stage is the condition of possibility for all zeros, not one of the things that can be zeroed.

II. Table of waves and their media

Wave	**Medium of propagation**	**Absolute zero**	**Character of zero**
Mechanical	Matter (solid, gas, liquid)	0 K	Disappearance of thermal activity
Electromagnetic	Metric / vacuum	c	Constitutive boundary of geometry
Gravitational	Space / spacetime	—	Medium = wave; no external zero possi
TSV time impulse	*None (pre-geometric)*	—	*Prior to the stage itself*

Table 1: Waves, their media, and the structure of their absolute zeros. The last row marks the position of TSV time impulses. They are not waves — they are the ontological condition under which any wave can exist at all.

III. Why gravity has no separate zero

In general relativity, gravity is not a field "in" space — it is described by the law relating the curvature of spacetime to energy and momentum. A gravitational wave is a perturbation of the metric, propagating through the metric. The law and its medium are ontologically entangled in a way that has no parallel in electromagnetism.

This entanglement precisely removes the possibility of a "zero" in the thermodynamic sense. 0 K is a zero because matter can, in principle, approach thermal silence. But spacetime cannot "become still" with respect to itself. Flat spacetime (zero curvature) is not the "silence" of space — it is simply space in its ground state, still fully present.

The asymmetry between the two zeros therefore reflects a genuine ontological division: between **content** (matter, energy, fields — things that can cease) and **container** (geometry, spacetime — the condition for the possibility of ceasing). The first kind has zeros; the second does not.

IV. The TSV level: deeper than the stage

If space is the stage on which physics is performed, then TSV time impulses are prior even to the stage. According to the axioms of the Multipolar Time Hypothesis, a time impulse (δT) is:

- elementary and indivisible — the smallest unit of event-possibility;
- local — realised exclusively at the observer's world-point;
- directionless in itself — carries no spatial information;

- non-wave — has no frequency, phase, or energy;
- potential — becomes an event only upon absorption by matter.

None of these properties require space as a medium. An impulse does not propagate "through" space — it arrives at a point. Space is not its carrier; it may be its consequence.

Axiom 3 of TSV states that impulses form a stream flowing toward the observer "with characteristic speed c". There is an alternative interpretation currently under consideration: whether c should be understood as a structural constant describing the *rate of availability* of impulses to the observer, rather than a propagation speed through space. If that were the case, impulses would be fully pre-geometric. This question remains open.

V. A hierarchy of levels

Level	What exists	Relation to c	Can have a zero?
0	TSV impulses (δT)	c as structural constant (open question)	No — prior to physics
1	Geometry / spacetime	c as constitutive boundary	No — medium = wave
2	Fields (EM, gravitational)	c as propagation speed	Yes — c is the zero of EM
3	Matter / energy	c as energy boundary	Yes — 0 K is the zero

Table 2: Four-level hierarchy. Only levels 2 and 3 have absolute zeros in the thermodynamic sense.

The same constant c appears at every level — but plays a structurally different role at each. This recurrence invites further inquiry: is c a single physical constant that wears different masks, or are its appearances at different levels genuinely distinct?

VI. What remains open

The absence of a third absolute zero is not a gap in our knowledge — it is, I believe, a structural feature of reality, at least within general relativity.

Whether TSV changes this picture depends on the resolution of the open question concerning Axiom 3. If time impulses are genuinely pre-geometric, then the above hierarchy is complete and consistent. If not, then impulses too require space, and the boundary between levels 0 and 1 dissolves.

Either way, the central distinction stands: there are two kinds of absolute zero — one for content (0 K), one for geometry (c) — and their asymmetry reflects something deep about the structure of physical reality.

> *Space is the medium of gravitational waves — and for that reason, it cannot have a zero in the way matter can. Whether TSV time impulses are prior even to space, or whether space is their silent precondition, is the next open question.*

Note on sources. The TSV axioms cited here follow: *Time Stream in the Multipolar Time Hypothesis: Detailed Description plus Axioms* (www.multipolartime.com) and *The Elementary Time Impulse (δT): Nature, Operational Definition, and Answers to Key Questions* (2026).