

The gravitational field and space-time have the same identity

A gravitational field is space-time that loses its local symmetry due to the presence of mass.

Mass determines a gravitational field in space-time because it deforms it: It makes it asymmetric.

So the gravitational field is just a property that space-time acquires when it is deformed.

The concept of field "seen" as dynamic quantized geometry

The known dynamic at the quantum level is the **zitterbewegung**, which we could define as the **"quantum entropy" of space-time**.

In quantum electrodynamics (QED) the negative-energy states are replaced by positron states, and the zitterbewegung is understood as the result of interaction of the electron with spontaneously forming and annihilating electron-positron pairs.

(Wikipedia)

It represents the quantum background teeming.

*A **quantum fluctuation** (also known as a **vacuum state fluctuation** or **vacuum fluctuation**) is the temporary random change in the amount of energy in a point in space.*

(Wikipedia)

A quantized harmonic motion of the wave/particle that continuously reorients itself in every direction at the speed "c" of light:

The basic dynamics of space-time geometry is therefore a symmetric quantized electromagnetic field.

It is shown that the well-known zitterbewegung can be considered as a circular motion around the spin direction of the electron, with a radius equal to the Compton wavelength (divided by 2π) of the electron.

It is further shown that the **intrinsic spin of the electron can be considered as the "orbital angular momentum" of this motion**. The current produced by the zitterbewegung gives rise to the **intrinsic magnetic moment of the electron**.

American Journal of Physics 20, 479–484 (1952)

How I see space-time and the gravitational effect

Key clue: All bodies "fall" at the same speed !

All bodies intimately traverse space-time in the same way, inducing the same type of interaction.

All bodies pass through space-time in the same way, that is, a quantized electromagnetic field: In **zitterbewegung**, in which there is **no preferential orientation**.

- The body/space-time interaction occurs only at the basic quantum level. Space-time "sees" only its most intimate quantum structure of the immersed body. **Not** its complexity.

The geometry of the emerging gravitational field therefore "sees" all bodies in the same way: **that they all "fall" at the same speed.** (falling process speed)

- All bodies see that one possible geometry in a necessarily dynamic way. (zitterbewegung). They are an integral part of it and are dynamically involved at a basic quantum level.

The gravitational field is the space-time that incorporates bodies.

Deformation of the gravitational field = deformation of the basic geometric structure of space-time.

Unwarped space-time, without gravitational gradient

The basic geometric structure of space-time, in the absence of bodies, is regular and without preferential orientation. Its dynamics is limited to zitterbewegung.

Space-time with gravitational gradient

All bodies, dynamically and necessarily, **reside in the state of zitterbewegung**, in which there is no local preferential orientation.

Zitterbewegung means the result of the interaction of the electron with electron-positron pairs that form spontaneously and annihilate.

"The zitterbewegung is understood as the result of interaction of the electron with spontaneously forming and annihilating electron-positron pairs."

When a body resides in space-time it means that **all the electrons/positrons contained in the body immersed** in space-time **are shared by both** the body and the space-time structure and interact in the same way as the spontaneous formation and annihilation of electron/positron pairs (*zitterbewegung*). *Wikipedia*

In other words, the electron-positrons trapped in the specific (non-random) geometric structure of the body have a specific orientation, but since they must also belong to space-time they modify, locally, the geometry from random (*zitterbewegung*) to the specific orientation. **It is the interaction, at the quantum level, body/space-time.** It is the condition of a "still" body (in the classical sense) with respect to space-time. We can say that electron-positrons represent the minimum common quantum.

Spacetime tells matter how to move; matter tells spacetime how to curve.
John Archibald Wheeler

All bodies, of all types, pass through space-time in the same way (because they "fall" at the same speed), **but how?**

- **What is the moving process?**

- **What is their frame of reference?**

- **How do bodies travel through space-time?**

All bodies **pass through space-time in the same way** because they are composed of minimal common elements, the quantum, which are dynamically permutable with the adjacent quantum of the space-time structure.

Therefore the bodies that "fall", in the classical sense, all recombine, quantumly, with the same process speed.

So, including antimatter:

It was tested at CERN that the antihydrogen atom falls like the hydrogen atom. There is NO gravitational repulsion!

So antihydrogen atoms also traverse space-time, quantumly, in the same way as hydrogen atoms. Because they too contain electrons/positrons or (in any case) positrons/electrons to share in the space-time structure that they pass through by substitution and with the same zitterbewegung process, **but with the local spin orientations specific to the body.**

What is the process of moving bodies?

They move by substitution (dynamic exchange between electron-positron pairs) as in a domino effect where the piece, the "quantum" that geometrizes the space-time cell structure is a **quantum fluctuation**, (a forming/annihilating) in the direction of propagation of the body.

A more massive body deforms the geometry of the space-time in which it is immersed and of which it is an integral part, because more quantum space-time is affected. A greater gravitational field gradient is created, **but quantum-quantum scrolling always and only concerns electron-positrons, indistinguishable from each other. It is the scrolling rhythm that determines the unique speed of the fall and not their number. The speed of fall therefore becomes a constant for any body, as constant as the speed "c" of light.**

What is their frame of reference?

The body recomposes itself step by step in the direction of propagation, thus crossing the background and reference space-time cells. **Space-time constitutes the frame of reference.** Obviously, a body cannot exist outside of space-time. Space-time is the infinite underlying constituent of the Universe.

What are the components that make up a single space-time cell in the absence of bodies?

They are electron-positron waves/particles in quantum fluctuation: An **exciton**, electrically neutral quasiparticle.

The Compton wavelength of the electron is $2.42631023867(73) \times 10^{-12}$ m.

A LISA-like instrument should be able to measure relative displacements with a resolution of 20 picometres.

What could be the most basic and simple geometry of the space-time cell "frame", ideally taken, composed of excitons?

Ideally deprived of the zitterbewegung, of the dynamics, (obviously it does not exist in reality) **the geometry of the "frame" space-time cell must, plausibly, be:**

- in 3D (time is ideally frozen)
- simple.
- symmetrical and regular in 3 dimensions.
- As compact as possible.

- synergistic when represented in reality in 4D, in zitterbewegung.

A quantized geometry that leaves no "empty" spaces (misleading ideological void) and can be defined as quantumly contiguous in 4D.

The only geometry that meets these essential (non-reducible) requirements is **tetragonal geometry**.



The sides of the tetragonal cell are the excitons (electron/positron).

The tetragonal cell is in basic conditions (absence of particles and/or bodies) subjected to the dynamics of zitterbewegung.

This dynamics means the continuous statistical reorientation of the tetragon (cell) induced by its sides, by the spin of the excitons (the sides). The spin/antispin of the excitons, electrons/positrons maintain their angular momentum balanced.

Since the sides of the tetragons of adjacent cells are common (common excitons), the continuous statistically uniform activity of annihilation/recreation of pairs involves an equally statistical and uniform revolution of the tetragonal orientation of the cells. As well as mutual dynamic uniformity.

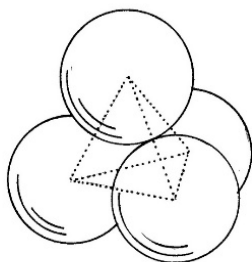
The activity of annihilation/recreation, their rhythm marks the speed "c". Step by step.

"c" is the clock, the quantized time related to the space defined by each tetragonal cell. Thus 4D quantum space-time takes place.

This is the uniformity and symmetry of basic space-time. Condition of total absence of gravity. What is called quantum vacuum it's a quantum plenum.

In accordance with the "Single Field Theory",

The space-time stitch model: One sphere is the photon/electron, The counter-rotating sphere is the antiphoton/positron. **Both are the neutrino. The side of the spheres that one intends to observe defines the neutrino/antineutrino aspect.**



3D vision of **two neutrinos: the pixel of the image space-time.**

The **space-time stitch** is composed of **two neutrinos** geometrically organized not to lose any space among the spheres. The space is fully quantized. A fully quantized space that, paradoxically, we call quantum vacuum.

The lines **connecting the Centrum of the 4 spheres** (the two neutrinos, 2 pairs of $(\gamma^+ - e^- / \gamma^- - e^+)$ **design** the geometric picture of a **tetrahedron**.

<https://physicsworld.com/a/symmetry-breaking-in-galactic-tetrahedrons-linked-to-parity-violation/>

Symmetry breaking in "galactic tetrahedra" linked to parity violation.

Scale factor?

Considered and premised that:

- Any body is composed, in its most intimate features, of a set of electrons/positrons aggregated to form other sub-particles, atoms, molecules etc.

Bodies are not "in" space-time per se, but are an integral part of space-time.
Einstein

Their structure, whether simple or complex, is updated (relocated) in the space-time structure at the rhythm of zitterbewegung.

This is a body perceived as "still" in space-time, but which in fact exchanges all of itself at speed "c" at the electronic level with the electrons/positrons of space-time of which it is an integral part.

The body constitutes a quantum deformation of regular space-time. A characterization that **belongs both to the body and to the local space-time that is created.** The two things are essential and identical: They are **a local structured quantized field.**

The body replaces itself step by step at the constant speed "c" in every part of it (in its quantum structure) in all the cells making up the **shared space-time at the rhythm of the zitterbewegung.**

The neighboring deformation, produced by the body in space-time, characterizes a deformed space-time which determines the gravitational effect perceived by another body in proximity.

The gravitational interaction between two bodies (mutual attraction) is the **combination of space-time deformations introduced by the respective more complex structures of the bodies themselves compared to the underlying regular space-time structure** (the tetrahedral one).

Gravitational action is always attractive because bodies tend to uniform, align together to restore that regularity and symmetry of tetrahedral space-time (without bodies). So far we have described a body that appears stationary in the classical sense.

A body "moving" in a specific direction involves a Doppler effect of the particle-waves (of which it is composed), more specifically, **the interaction of the angular momentum of its electrons/positrons shared in following space-time cells.** A dynamic component in that direction of propagation is determined with respect to the entropic zitterbewegung.

This involves a scrolling of the body in space-time manifesting 5 effects:

1. INERTIA = A preferential spin polarization/orientation (of the electron-positron pair) in the direction of motion **that overlaps with the entropic zitterbewegung** in the relocation/reconstruction of the body in the next space-time position.

With consequent manifestation of directivity as a prevalence of motion: therefore the body tends towards a rectilinear direction*, even if it had previously been forced to curve.

* (By rectilinear direction we mean following a geodesic which, on a small scale and in the absence of strong gravity fields, approximates our image of a Euclidean straight line.)

2. Gyroscopic effect. It is a particular inertial phenomenon. The continuous rotation of the body in the next space-time position determines a continuous reorientation of

spin in the direction of the angular movement that converges on the rotation axis. The cumulative effect on the rotation axis is called gyroscopic precession.

Gyroscopic precession constitutes a preferential orientation in space-time.

Being an inertial effect, it can only be referred to space-time.

Can gyroscopic precession, a preferential orientation in space-time due to preferential spin angular orientation, **interact with a preferential magnetic field**, a permanent magnet, which is determined only by a preferential spin orientation?

- Magnetic levitation occurs in superconductors (Dirac electrons).

- **A rotating magnet can levitate another magnet in mid-air!** Behind the **new levitation** there appears to be a unique mechanism, **demonstrated for the first time in 2021** by Hamdi Ucar

See article: A new type of magnetic levitation makes its debut

https://physicsworld.com/a/new-type-of-magnetic-levitation-makes-its-debut/?Campaign+Owner=Laura+Gillham&utm_campaign=14290-56704&utm_content=Title%3A%20New%20type%20of%20magnetic%20levitation%20makes%20its%20debut%20-%20Editors_pick&utm_term=&utm_medium=email&utm_source=iop

- **The gyroscopic effect is a gravitational phenomenon** whose interaction process occurs through the magnetic field produced by the electronic spin in space-time.

3. Contraction of the length of the body in the specific direction of motion proportional to the **reduction in wavelength due to the Doppler effect**. Greater body speed, greater Doppler effect, greater contraction. **Lorentz-FitzGerald** contraction.

4. All bodies “fall” at the same speed.

Because: All bodies pass through space-time in the same way, quantumly.

Because: *“Bodies are not “in” space-time per se, but are an integral part of space-time.”*

(Einstein)

5. Increase in energy of the moving mass.

Shorter wavelength means more energy ($E = hv$) that the body acquires. Mass at rest that increases in mass in motion.

If the wave-particles or part of them that make up the body (due to induced external causes) are oriented in the spin, a state of **entanglement** of these wave-particles with other wave-particles positioned in the same direction occurs. The electron/positron wave-particle can be in a state of **entanglement**, but also other types of particles, atoms, molecules, etc. Entanglement of groups.

In analogy to bodies in the Bose-Einstein state that lose their **entropy**, **zitterbewegung**, and can easily assume preferential spin orientations. **Coherence, entanglement.**

Coherence-entanglement as opposed to decoherence-zitterbewegung

Particular bodies in the almost **two-dimensional** (2D) state, such as **graphene**, have the electronic spin oriented in the direction of the missing third dimension. Consequent properties emerge from this, including superconductivity (Dirac electrons) similar to the 3D body in the Bose-Einstein state.

The usual state of the body integrated in space-time is the **entropic one**, at the "high" temperatures compatible with life. In such conditions of high entropy the manifestations of **entanglement** do not emerge.

*The discovery of quantum theory posed a new task to science:
That of finding a new conceptual basis for all physics*

Einstein

References:

Neutrinos could hold the key to proving the quantization of space-time

Nature Astronomy **7**, 898–899 (2023) Giovanni Amelino-Camelia
<https://www.nature.com/articles/s41550-023-01994-y>

The quantization of space-time could be revealed indirectly through its imprint on the propagation of particles.

*An analysis combining data from the IceCube Neutrino Observatory and the Fermi Gamma-ray Space Telescope shows preliminary **statistical evidence of such a quantum-space-time effect.***

Could quantum gravity slow down neutrinos?

<https://www.nature.com/articles/s41550-023-01993-z>

Nature Astronomy **7**, 996–1001 (2023) Giovanni Amelino-Camelia. Dipartimento di Fisica Ettore Pancini, Università di Napoli 'Federico II'

The hunt for neutrinos originating from gamma-ray bursts could also be significant in quantum-gravity research, as they are excellent probes of the microscopic fabric of space-time. Some previous studies based on neutrinos observed by the IceCube observatory found intriguing preliminary evidence that some of them might be gamma-ray burst neutrinos whose travel times are affected by quantum properties of space-time that would slow down some of the neutrinos while speeding up others. The IceCube collaboration recently significantly revised the estimates of the direction of observation of their neutrinos, and we here investigate how the corrected directional information affects the results of the previous quantum space-time inspired analyses. We find that there is now little evidence for neutrinos being sped up by quantum space-time properties, whereas the evidence for neutrinos being slowed down by quantum space-time is even stronger than previously determined. Our most conservative estimates find a false-alarm probability of less than 1% for these 'slow neutrinos', providing motivation for future studies on larger data samples.

Energy reconstruction methods in the IceCube neutrino telescope

<https://iopscience.iop.org/article/10.1088/1748-0221/9/03/P03009/pdf>

The fundamental observable in such detectors is the Cherenkov light produced by the transit through a medium of charged particles created in neutrino interactions. The amount of light emitted is proportional to the deposited energy, which is approximately equal to the neutrino energy for V_e and V_μ charged-current interactions and can be used to set a lower bound on neutrino energies and to measure neutrino spectra statistically in other channels.

On the Zitterbewegung of the Dirac Electron

[Kerson Huang](#) NOVEMBER 01 1952

American Journal of Physics 20, 479–484 (1952)

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The detailed motion of a free Dirac electron is investigated by examining the expectation values of the position \vec{r} and of $\vec{r} \times \dot{\vec{r}}$ in a wave packet.

It is shown that the well-known zitterbewegung may be looked up on as a circular motion about the direction of the electron spin, with a radius equal to the Compton wavelength (divided by 2π) of the electron.

It is further shown that **the intrinsic spin of the electron may be looked up on as the “orbital angular momentum” of this motion.**

The current produced by the zitterbewegung is seen to give rise to the intrinsic magnetic moment of the electron.

<https://pubs.aip.org/aapt/ajp/article-abstract/20/8/479/1034779/On-the-Zitterbewegung-of-the-Dirac-Electron?redirectedFrom=fulltext>

<https://doi.org/10.1119/1.1933296>

Generating mass without Higgs fields [Kerson Huang](#)

AIP Conference Proceedings 72, 528–533 (1981)

<https://doi.org/10.1063/1.32981>

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In the Weinberg-Salam model, as in the various grand unification, models, Higgs fields were introduced to endow particles with mass in a gauge-invariant way. These Higgs fields seem to be undesirable features of the theory, for they bring with them a large number of arbitrary parameters. Most likely, they are phenomenological order parameters not unlike the Ginsberg-Landau order parameter in superconductivity.

I shall describe some work done, in collaboration with my graduate student Roberto Mendel that attempts to generate masses spontaneously, without Higgs fields. (AIP)