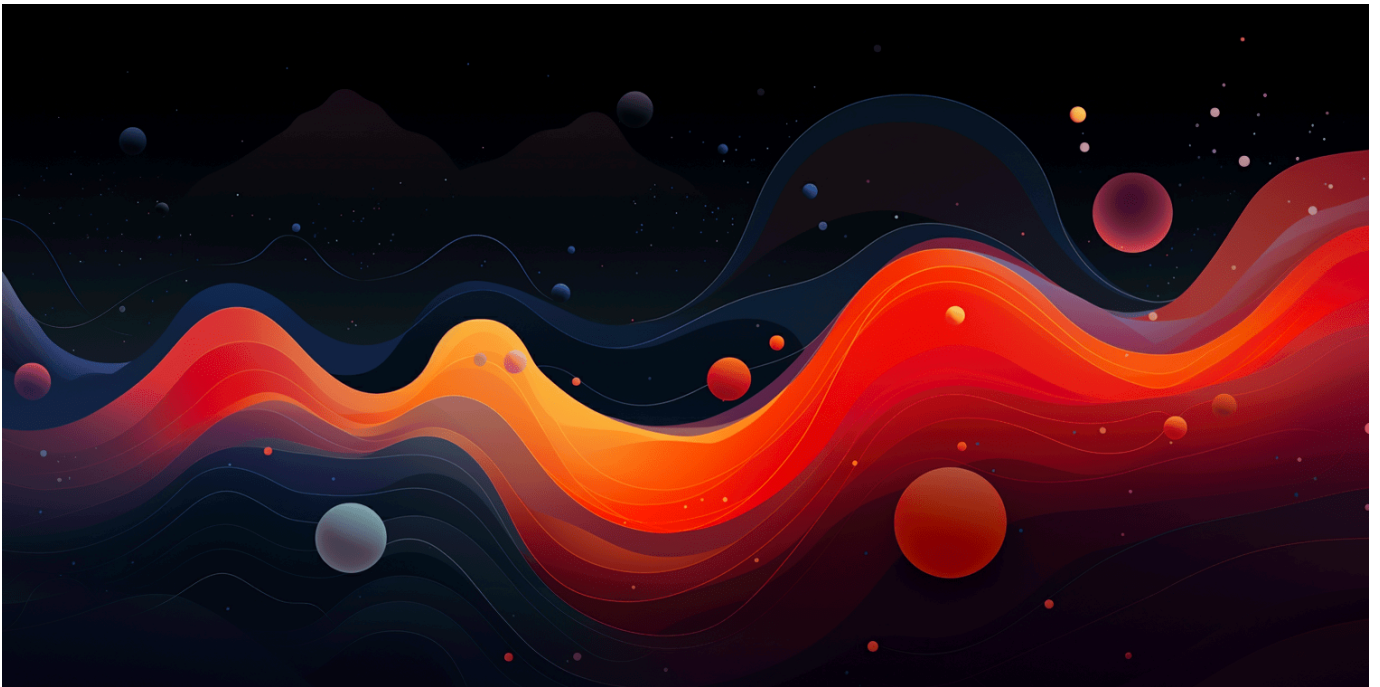




Superconducting Field Theory (The Unification Theory)

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Superconducting Field Theory (The Unification Theory)

Unification theory with no extra dimensions. The first part unifies the strong nuclear force with the gravitational force in a mathematical way; the quantum vacuum is treated as a deformable system by the strong nuclear force. The second part unifies the strong nuclear force with the quantum vacuum in a hypothetical structure; the quantum vacuum is treated as a supersymmetric and metastable system with properties related to the different types of particles' motion.

Keywords: Unified field theory; Quantum gravity; Quantum vacuum; Strong nuclear force; Dark matter; Dark energy.

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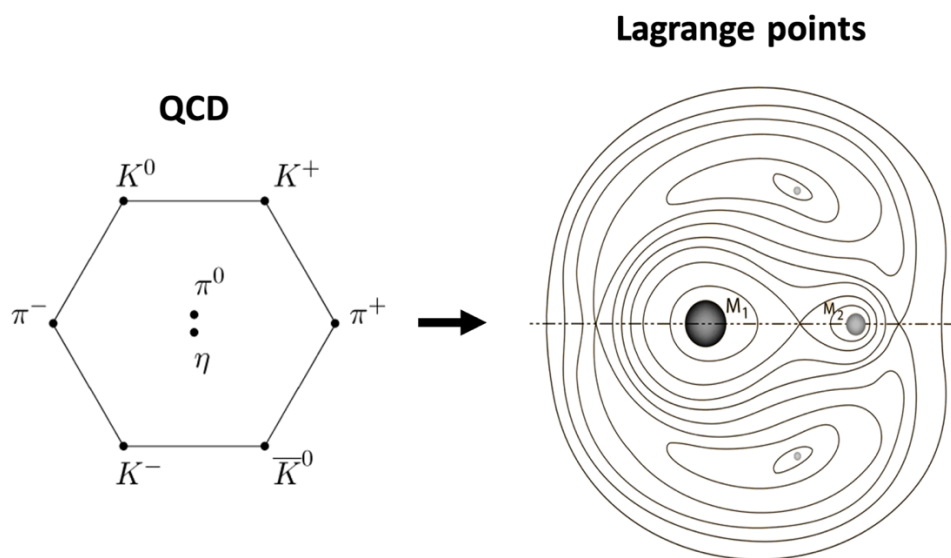
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1. Introduction

A Grand Unified Theory is any model of physics that explains and connects all fundamental forces ([strong force](#), electromagnetism, [weak force](#), and gravity) into a single force. The framework described here calculates **the exact point** at which quantum dynamics transforms into classical physics.

The basic concepts we'll use are:

- The **strong nuclear force**, which has always been a controversial force, has been underestimated due to its extremely small field of action in the search for a possible interaction with the gravitational force, but if we turn our attention to its internal interaction instead of its external one, we can create a basic piece for a somewhat more complex and extremely important model. It was responsible for the origin of string theory with the S-matrix, a physical system in which the point-like particles are replaced by [one-dimensional](#) objects called [strings](#), although it later drifted towards any type of vibration in space.
- The **quantum vacuum** or aether, which has been ignored to a certain extent, could be responsible for the most important interactions over long distances, being perceived as a kind of material medium as demonstrated by the Michelson-Morley experiment attempting to probe the transmission of light in a vacuum, or as an energetic field as demonstrated by the Casimir effect as well as the Lamb shift. Its topology has been another source of discussion, developing branches like twistor theory, spinors, or knots, in an attempt to explain spin interactions, and it could be the guilty party for all vibrational states of particles.



This physics branch only uses the 3 spatial dimensions and time, with the strong nuclear force as two-dimensional strings and the quantum vacuum as a multistable motion system, being compatible with the Standard Model.

2. Principles

2.1. Strong nuclear force

The atomic nucleus is the fundamental constituent of matter at the center of an [atom](#), consisting of [protons](#) and [neutrons](#), each one conformed by 3 quarks. These **quarks remain bound together due to the strong nuclear force**, which is the strongest of the fundamental forces with a scope not greater than 10^{-15} meters. It has been determined that more than 99% of the proton mass is concentrated in the atomic nucleus, and less than 1% comes from residual forces.

[Gluons](#) act as the exchange particle for the strong force between quarks, preventing them from separating by a constant force of attraction with a **theoretical maximum of 10.000 N (\approx 1.000 Kg)**.

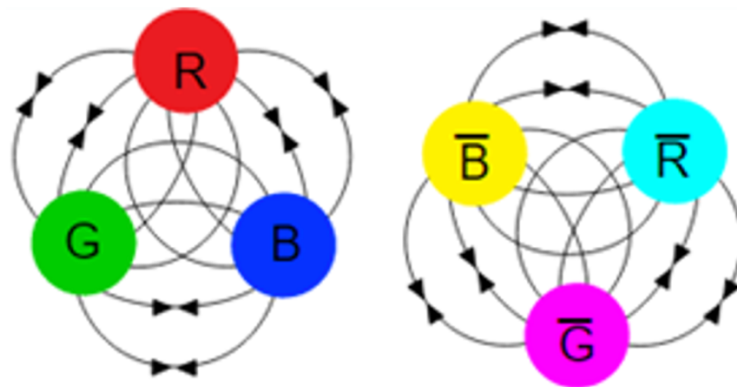


Fig.2. Color charge (QCD).

In quantum chromodynamics (QCD), a quark's color can take one of three values or charges: red, green, and blue. An antiquark can take one of three anticolors, called antired, antigreen, and antiblue. Gluons are mixtures of two colors, such as red and antigreen, which constitute their color charge. The "color charge" of quarks and gluons is not related to the everyday meanings of [color](#) and [charge](#), but is related to its hidden internal degree of freedom.

2.2. Quantum vacuum

We can note two important qualities of the quantum vacuum:

- Particles superconductor. The distance to the most distant galaxy detected by human beings is more than [30 billion light years](#), which means there are photons that are able to travel that distance without decreasing their speed, modifying only their wavelength. Like light, an object can move into space for a practically unlimited period as long as it doesn't find a force to stop it, so we can determine that the vacuum has a resistance equivalent to 0.
- A tension. In order to allow waves, it's easier into a strongly linked structure. Gravitational waves could behave like ocean waves, which are similar to an uptight net, these tensions can be decomposed as a unitary set of points tensor than any known structure and under extreme repulsive forces to allow the universe expansion.

These qualities would treat the quantum vacuum as a **superfluid** with zero [viscosity](#) and any loss of [kinetic energy](#), having a practically infinite conductive capacity for particles and being extremely dense. Remember, we are moving through the universe at an estimated speed of 600 km/s.

Centre for the Subatomic Structure of Matter

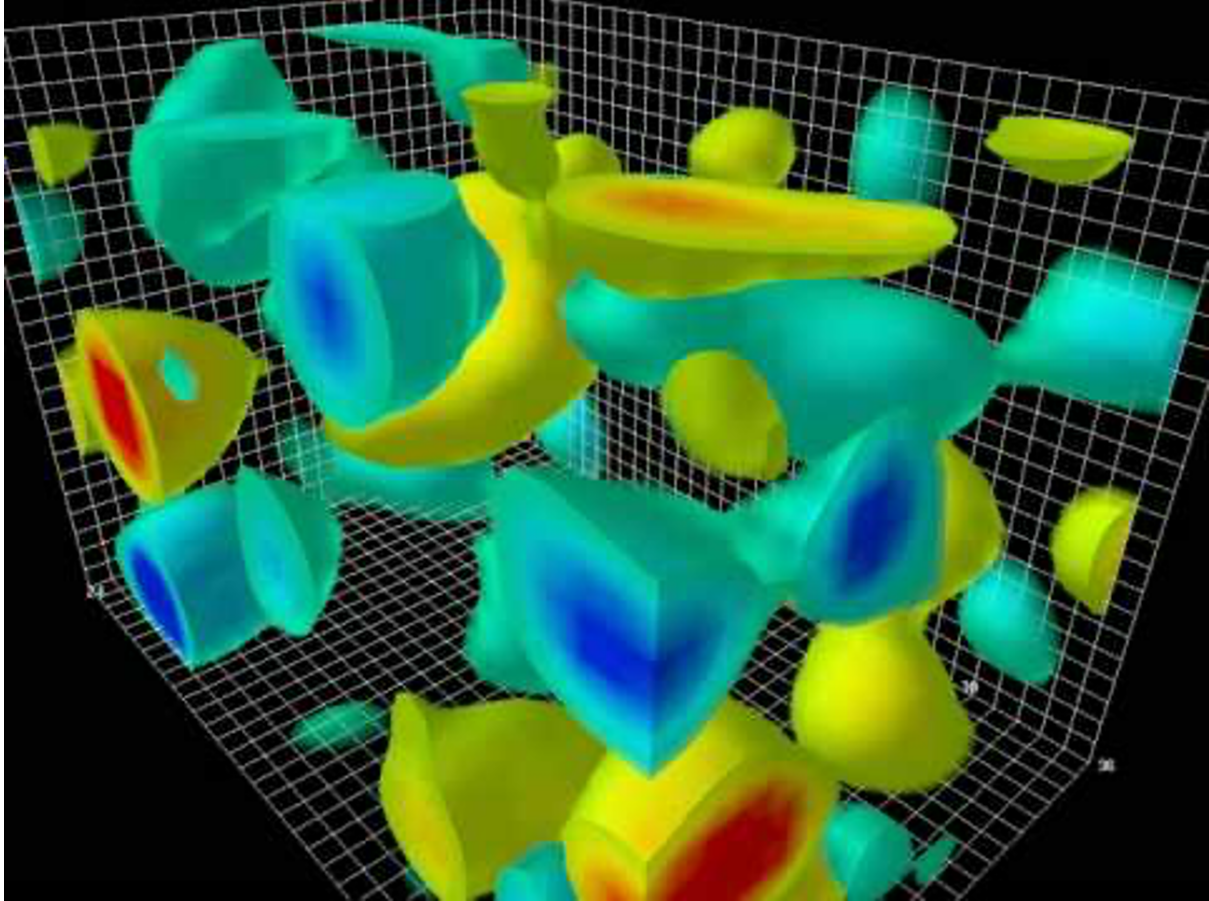


Fig.3. QCD vacuum.

This real picture illustrates the three-dimensional structure of gluon-field configurations, describing the vacuum properties where quarks are popping in and out constantly. The volume of the box is $2.4 \times 2.4 \times 3.6$ fm, inducing chromo-electric and chromo-magnetic fields in their lowest energy state. The frame rate in this real example is billions of billions of frames per second (FPS).

3. Strong nuclear force unification

3.1. Fundamentals

This new framework consists of a quantum vacuum helping to transport matter without any friction (quarks joined and interacting through the strong nuclear force holding matter together, traveling into space as if it were a superconductor).

As an example, I've chosen the smallest and most abundant chemical element in the universe, the hydrogen atom, with an estimated **mass of $1,673 \times 10^{-27}$ kg**, which contains a single electron and a single nucleus. This nucleus consists of a single proton (the basic constituent of matter), where it exerts its nuclear force, which is in turn composed of two up-quarks and a down-quark bound by the gluon interaction.

With these data about **the hydrogen nucleus**, we'll calculate its **average interaction** to create a **contraction** force in the vacuum. For this purpose, we can think about an elastic band (it would simulate the proton strong force with a size of 10^{-15} meters) compressing two V-shaped sticks on its broadest side; if the sticks are sufficiently slippery and tense, the elastic band will slide to the narrower side. The more elastic bands, the more force will be exerted on the sticks to join them; equally, the more matter at the narrow end of the sticks, the more attraction at the top. We talk about unknown limits, such as infinite conduction or tensions never seen.

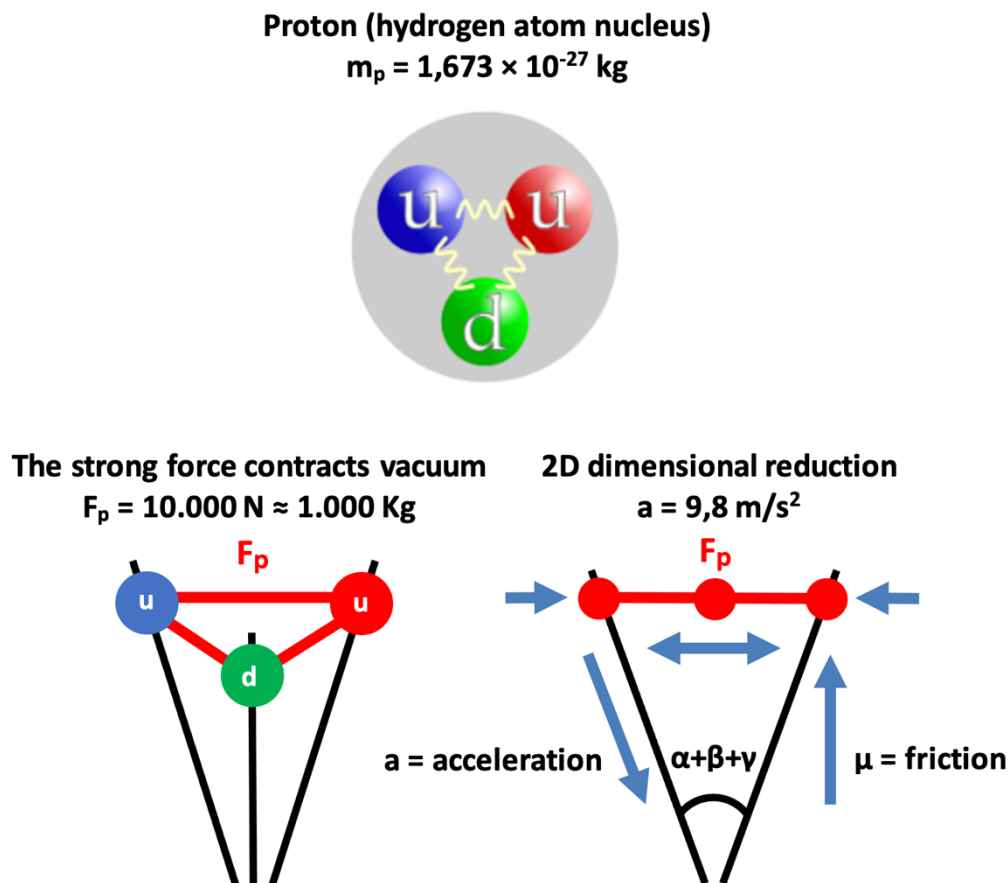


Fig.4. Involved forces.

This scheme would correspond to what is known as quantum gravity (QG), which aims to describe gravity according to the principles of [quantum mechanics](#), erasing gravity as one of the fundamental forces of nature and turning the strong force into its generator, affecting each nucleon (protons and neutrons) in isolation.

3.2. Strong force contraction

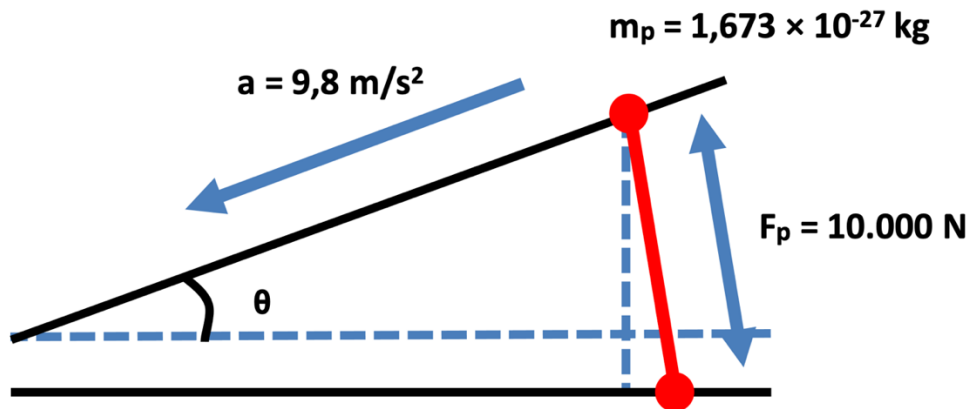
**** Fig. 5 is the most important figure in the document; it must be understood in order to continue. It has been positioned horizontally to be more intuitive.**

The calculation corresponds to the **angle** generated at one point on the Earth's surface to create its gravitational acceleration (the space deformation), applying the formulas from inclined planes (Newton's second law) with the following values:

- The proton strong force is matched with the vertical force, having an estimated strength of 10,000 N (F_p).
- The proton mass has an estimated value of $1,673 \times 10^{-27}$ kg (m_p).
- The gravitational acceleration on our planet is matched with the acceleration down the plane, 9.8 m/s^2 (a).
- The friction is zero, 0.

These variables are the average values from quantum dynamics interactions collected through classical physics.

The strong force (F_p) creates the vertical attraction (a)



**** Fig. 5. Equivalences in the inclined plane.**

1. Variables set considering a proton.

$$m_p = 1,673 \times 10^{-27} \text{ kg}$$

$$a = 9,8 \text{ m/s}^2$$

$$F_1 = m_p \times a = 1,673 \times 10^{-27} \times 9,8 = 1,6395 \times 10^{-26} \text{ N}$$

$$F_1 / F_p = 1,6395 \times 10^{-30} \text{ N}$$

2. Apply the laws of inclined planes to the previous variables.

$$m \times g \times \sin(\theta) = m_p \times a \quad (1.1)$$

$$F_p = m \times g = 10.000 \text{ N}$$

$$F_p \times \sin(\theta) = m_p \times a = F_1$$

$$\theta = \arcsin(F_1 / F_p)$$

3. Planet Earth's angle is shared by 3 quarks, creating $9,8 \text{ m/s}^2$ acceleration. This deviation occurs at the proton size.

$$\theta = 9,393 \times 10^{-29}^\circ \quad (1.2)$$

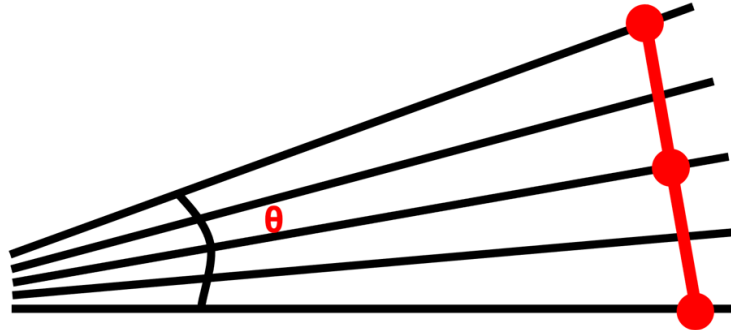


Fig. 6. Quarks scope.

The definition of mass says that it is a quantity that represents the amount of matter in a particle or an object. Its calculation has many variations, like weight / acceleration (due to gravity); force / acceleration; or density \times volume, all of these associated with our framework.

3.3. Quantum vacuum density

Dark matter could have its origins due to **variations in the quantum vacuum density**. An extension between quarks could turn mass (m_p) into tension energy (F_p), so some places in the universe can have lower or higher accelerations because of this effect; this means that dark matter doesn't really exist, which is estimated at 27% of the [mass](#) in the [observable universe](#).

The most important related discovery might be the **asymptotic freedom**, which is a property of quantum chromodynamics (QCD) where interactions between quarks become weaker as the energy scale increases and the corresponding length scale decreases. The fact that couplings depend on the momentum (or length) scale is the central idea behind the [renormalization group](#).

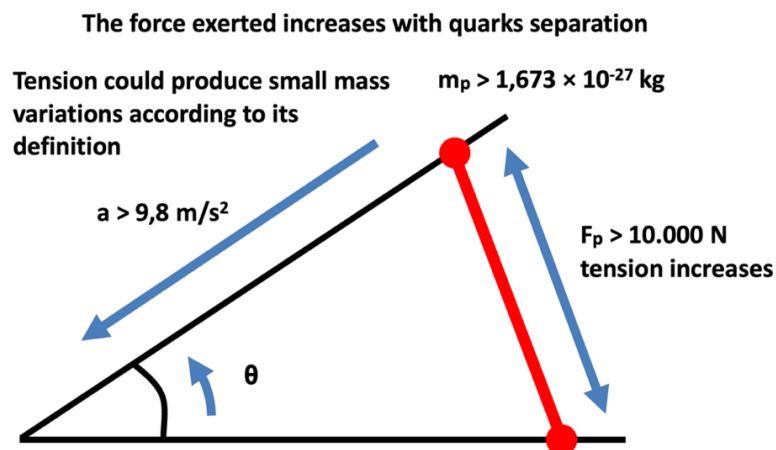


Fig. 7. The strong force behaves like an elastic band.

We don't really know the relation between the vacuum density and the strong nuclear force, so this is just an estimation, but it's expected that more vacuum concentration could expand quarks and modify all the relations.

1. Variables set.

$$m_p = 1,673 \times 10^{-27} \text{ kg}$$

$$F_1 = m_p \times a = 1,673 \times 10^{-27} \times a$$

$$F_1 / F_p = (1,673 \times 10^{-27} \times a) / 10.000 = (1,673 \times 10^{-31} \times a)$$

2. Calculate the relation between the angle and the acceleration.

$$F_p \times \sin(\theta) = m_p \times a = F_1 \quad (2.1)$$

$$\theta = \arcsin(F_1 / F_p)$$

$$\theta = \arcsin(1,673 \times 10^{-31} \times a)$$

3. A bigger angle generates more acceleration.

$$a \approx (\theta / 1,673 \times 10^{-31}) \text{ m/s}^2 \quad (2.2)$$

Another example can be created using a smaller force, like $F_p = 7.000\text{N}$

$$a = F_p \times \sin(\theta) / m_p \quad (3.1)$$

$$a = 7.000 \times \sin(1,6395 \times 10^{-30}) / 1,673 \times 10^{-27}$$

$$a = 6,85 \text{ m/s}^2$$

The strong force has a positive correlation when transforming its force; increasing F_p or m_p implies more acceleration. It acts as a spring to generate different tensions in space. In addition to historical reasons of rivalry between Newton and Hooke, Hooke's law (elasticity constant) is the best and easiest approach to explain it, since this calculation is just at **one point in space**. The force (F_p) is proportional to the distance needed to extend or compress the spring.

k = Tension (proportional constant at one point)

ΔL = Displacement between quarks

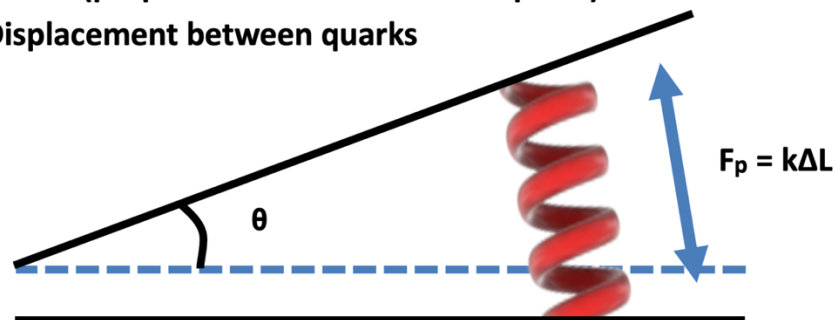


Fig.8. The strong force becomes the fundamental tensor.

But in reality, the space deforms not proportionally, creating more acceleration near the accumulation of matter and behaving like an elastic material. This behavior can be quantified by the [elastic modulus](#) or Young's modulus, which represents the factor of proportionality

in [Hooke's law](#) in [non-linear](#) systems. The Young's modulus (E) depends on the force exerted by matter (σ) and the deformation at each point of the resulting vector (ϵ).

$$E = \Delta\sigma / \Delta\epsilon$$

The force exerted by the angle (θ) increases (Δ) faster than the strong force (F_p) and its relation to mass (m_p); the greater the distance, the weaker the force.

$$\Delta F_\theta > \Delta F_p / \Delta m_p \quad (4.1)$$

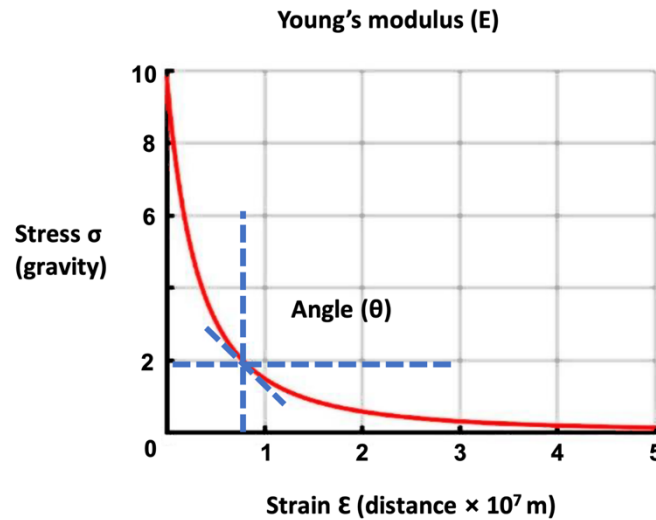


Fig.9. The angle exerts force over large distances.

This relation between the strong force and the quantum vacuum modifies the space density since it induces their approach because of the electromagnetic extraction and its dispersion; therefore, we can speak of the existence of a bulk modulus (K), which depends on the pressure changes (p) and volume (V).

$$K = -V (\Delta p / \Delta V)$$

We only know this relation for Earth calculations, but it must be associated with actual physics like general relativity (GR) or Einstein field equations (EFE), where matter bends space using an unknown tensor, determining the geometry of space depending on the distribution of matter over intricate energy density fields. Also, we can find other physics connections, like the Modified Newtonian Dynamics (MOND) hypothesis, which proposes a modification of Newton's law of universal gravitation to account for observed properties of galaxies, having multiple observational evidences.

Other properties such as volume viscosity, also called bulk viscosity, can be applied.

3.4. Fundamental forces

This is the new fundamental forces grouping:

- The strong force and gravity have been unified.

- Electromagnetism and the weak force are actually unified by the electroweak interaction.
- The quantum vacuum is a new fundamental force because of its strength and the fact that it isn't reducible to more basic forces.

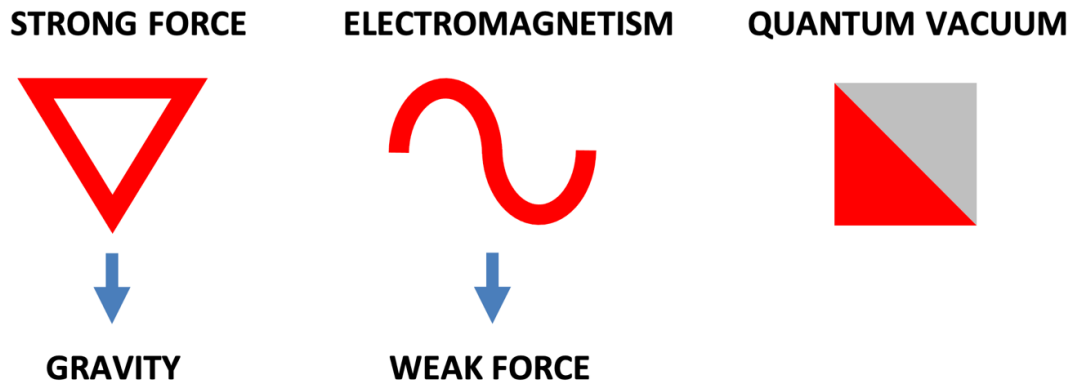


Fig.10. Fundamental interactions.

4. Quantum vacuum unification

4.1. Structure

We need a quantum vacuum structure that allows us to unify the different types of quantum fields and their different behaviors, like the constant motion of **matter**, the travel of **subatomic particles**, and the **electromagnetic** field generation. One solution would be a metastable system with different balances; the topological models proposed are polarized triplets rotated in a static balance (a symmetric group), differentiated in the 3 spatial axes, where each element is in continuous repulsion.

- Matter is composed of protons and neutrons (nucleons), which make up each element of the periodic table; at the same time, each nucleon is made up of 3 quarks. The vacuum asymmetry maintains the speed of nucleons stable because repulsions and attractions from the whole part are equilibrated in the 3 spatial directions (quarks triplets against vacuum triplets), and the average sum of all vector velocity forces (\vec{V}_F) in each spatial direction is 0; for this reason, matter is not accelerated to the speed of light (the asymmetrical multistability prevents it).

$$\vec{V}_{FX} + \vec{V}_{FY} + \vec{V}_{FZ} = \vec{V}_F \text{ net} = 0 \quad (5.1)$$

This asymmetry is the cause of quantum chromodynamics (QCD) colors and anticolors (3 types of each) and their transformations, where the nucleon structure doesn't collapse inward due to the outward vacuum forces, being the only thing bigger than each individual frame capable of surviving it. Even the different types or flavors of neutrinos (electron, muon, and tau) can be studied as a motion system between triplets, more similar to how matter works.

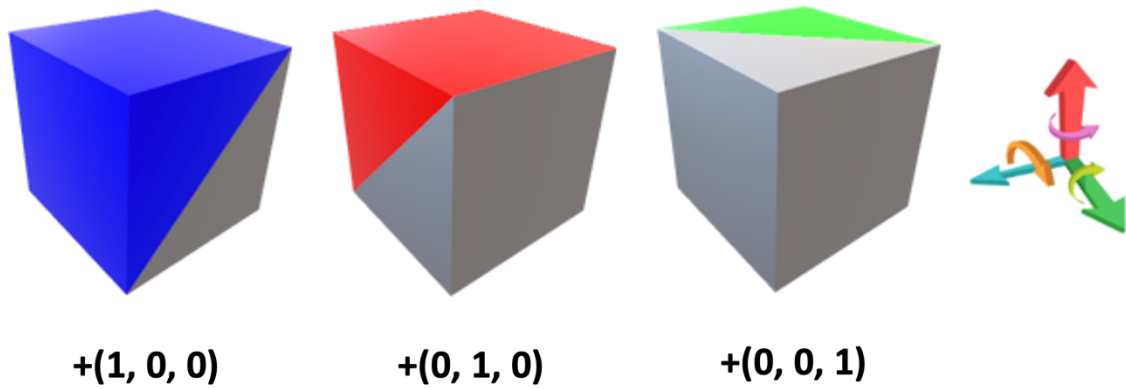


Fig.11. Motion of matter in equilibrium.

- Its $\pm\frac{1}{2}$ polarization shapes fermions, having an internal force trying to expand with a spherical distribution as is theorized for U(1) gauge, so particles smaller than this frame can be easily dispersed in all directions.

$$|\uparrow\rangle \equiv \left|+\frac{1}{2}\right\rangle \quad |\downarrow\rangle \equiv \left|-\frac{1}{2}\right\rangle \quad (5.2)$$

Both the vacuum permeability and permittivity are originated from the quantum vacuum magnetization and polarization in order to create virtual electrons, having as their greatest quality the ability to emit or absorb energy. The collective alignment of each magnetic moment creates magnetic domains, where temperature and atomic structure play crucial roles.

All the elements in the periodic table have a mass or nucleon number related to their number of electrons, so nucleons should be able to extract and recover this energy as electromagnetism from each polarized container, helping to create electromagnetic bonds like the hydrogen bond to conform the chemical compounds (under normal conditions, it is impossible for a proton not to possess an electron). These electromagnetic attractions could affect the gravitational force, but only in a residual way.

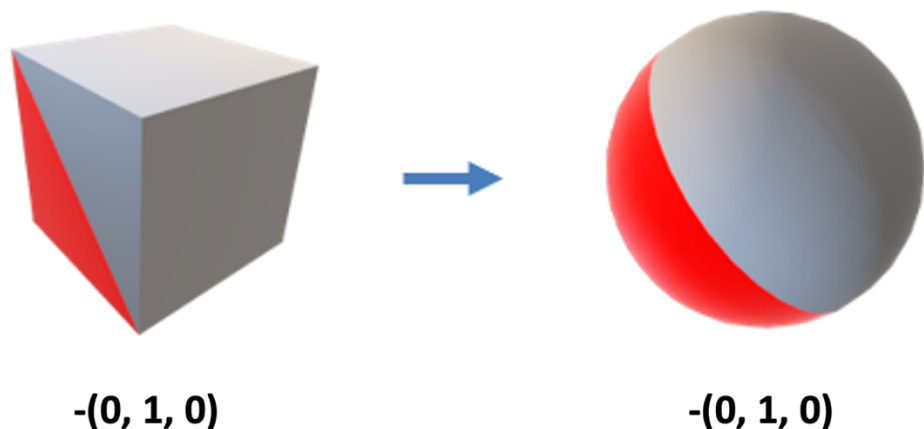


Fig.12. Electromagnetic field extraction.

- Light has its own inertia; it travels at approximately 300,000 kilometers per second, but it slows down to about 225,000 kilometers per second in water (it depends on the electromagnetic properties of the medium it's embedded in), recovering its speed when leaving it.
Subatomic particles (photons or neutrinos) are smaller than this basic frame, so they can be transported by the vacuum; their infinite amount of accumulated inertia comes from the spin speed (SF) of this energetic vacuum, where quarks are trying to be accelerated, but its stability prevents it.

$$\bar{S}_{F1} = c \quad (5.3)$$

These basic frames can be seen as the smallest units of time, where other behaviors can be studied, such as the photon generation through a monopole interaction.



$$+(0, -1, 0)$$

Fig.13. Subatomic particles transportation.

The particles' escape angles are needed to conform the net, taking into account all the different containers' positions in space (two different positions on each axis and its conjugates). Thus, we have the following groups per axis conformed by their unitary vectors (U):

$$U_x = \{+(1, 0, 0), +(-1, 0, 0), -(1, 0, 0), -(-1, 0, 0)\} \quad (6.1)$$

$$U_y = \{+(0, 1, 0), +(0, -1, 0), -(0, 1, 0), -(0, -1, 0)\}$$

$$U_z = \{+(0, 0, 1), +(0, 0, -1), -(0, 0, 1), -(0, 0, -1)\}$$

These structures can help to build the Standard Model [internal symmetries](#), $SU(3) \times SU(2) \times U(1)$; the Gell-Mann matrices, a representation of the $SU(3)$ group, where quarks possess color quantum numbers and form the fundamental triplets; the Pauli matrices, a representation of the $SU(2)$ group, which reproduce the electron's spin; and the simplest internal symmetry group, $U(1)$. This solution can **accommodate the main types of motion**, being the first time that a nonlinear structure is theorized, solving the technical problems of [renormalization](#) in order to yield sensible answers to the strange behavior of quantum physics, such as the production of shapes related to the 4 dimensions (mainly tesseract shapes or hypercubes). Anyway, this is considered a hypothetical structure because the complete mathematical matrix has not been built, taking into account that any real section can be reconstructed in a stand-alone way.

It's compatible with behaviors like the Lorentz transformation and Minkowski diagram to explain the spacetime deformations (via rhomboidal deformations); supersymmetry to explain the symmetry between bosons and fermions (via symmetry groups); photons' creation due to the Dynamical Casimir effect; antimatter survival while other structures like the pions are unstable; ice rules in molecules with internal spins and geometric constraints that generate a periodic lattice; emerging patterns like fractals or crystal structures based on parallelepiped shapes with a repetitive arrangement of atoms in unit cells...

4.2. Fundamental forces (Theory of Everything)

Considering the electromagnetic field as a flux extracted from the vacuum, it's easy to guess that the final component between the strong force and the quantum vacuum is **motion**.

The resulting scheme can be reduced to matter and energy in perpetual motion. The Big Bang event produced the initial state of high density and temperature, creating all the energy necessary to provide motion to the whole matter, and everything begins to interact, provided by the "infinite" inertia that the quantum vacuum supplied.

Its properties, also determined by thermal radiation and pressure, could create the first conditions for life by helping to compact structures like the double helix in the chromosomes, considered to be the origin of biological homochirality (probably gained by the quantum superposition), giving rise to more complex structures like worms, with which we can share up to 70% of our DNA, being considered the evolutionary forerunner of most animals. Within this quantum vacuum structure, we even have some mathematical curiosities, such as having 5 faces per prism ($5 + 5$, decimal handedness).

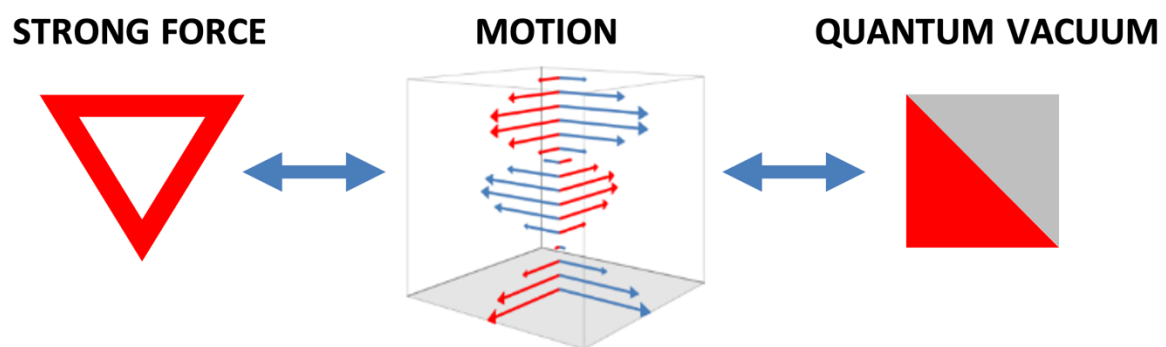


Fig.14. Theory of Everything scheme.

But wondering about the future, if the scientific method is based on determinism and hidden variables don't exist, we could consider an absolute determinism (neither chaos nor free will exists, all pre-calculated) and overcome the resulting frustration by thinking of ways to break it, such as through overmuch information in the universe (all the photons from all the stars can't be predetermined); this is the first cycle in the universe (so we start from a blank canvas); God (if we are an expression from the vacuum, there is something that can feel inside it); or we are a tool capable of breaking such determinism (the universe needs it). From now on, I only hope I have raised your consciousness level, offering you a better understanding of your environment...

5. Conclusions

In [philosophy](#), **Occam's razor** (also known as the principle of parsimony) is the problem-solving principle that recommends searching for simpler explanations constructed with the smallest possible set of elements or fundamental concepts because they provide better results than more complex ones.

This theory can explain behaviors such as:

- Unification theory between the strong nuclear force and gravity, quarks motion, and the electromagnetic field generation, until obtaining a unified field theory.
- Dark matter due to quantum vacuum densities. Recent studies have associated the cosmic microwave background (CMB) with dark matter behavior; thus, the cosmic microwave background should be related to the quantum vacuum and its density. The universe is anisotropic (is not uniform in all [directions](#)).
- Dark energy and cosmic inflation. The behavior of each individual container implies a spin-based repulsion helping to its expansion, strong enough to avoid getting closer and be able to reestablish its structure after any contraction; this generates the required propagation force over large distances to allow the expansion of the universe.
- Black holes as a density break. The vacuum concentration becomes so strong that its repulsion can break the strong force bonds, generating their rupture and explosion, and leading to new internal concentrations (a black hole can vary from a nuclear density inside the [Schwarzschild radius](#) of $4 \times 10^{19} \text{ kg/m}^3$, more extreme than our nuclear density of $2.3 \times 10^{17} \text{ kg/m}^3$). Photons, depending on the new container size, could be attracted because their field can interact with the vacuum. Neutrinos, regardless of whether it is a black hole, can escape if the container size is bigger than itself.
- Particles decay due to the vacuum interaction. It can correspond to the current theories about the false vacuum decay (a not so stable vacuum); also, the neutron decay can be seen as a small dominant space polarization that tends to create protons.
- Gravitational time dilation. Each container is connected with spacetime; a bigger frame implies minor energy concentration, and the displacements in space imply less frames to pass through, which means less time.
- These frames can be considered as the smallest units of time. This size has been attempted to be explained since Zenon's paradoxes (430 BC), dedicated mainly to the problem of the continuum and the relations between space, time, and motion, until nowadays with infinitesimal calculus, where a mathematical curve can be analyzed as if it were constituted by homogeneous separable points.
- Conservation of angular momentum at bodies' rotations in space with spherical and circular movements at planets and galaxies. Applying this conservation during the Big Bang, antimatter is not necessary to create it and could lead to less antimatter than 50% in the universe as expected (a small portion could have been generated during the explosion).
- The gravitational constant ($G = 6,67408(31) \times 10^{-11} \text{ m}^3\text{kg}^{-1}\text{s}^{-2}$), vacuum permittivity ($\epsilon_0 = 8,8541878128(13) \times 10^{-12} \text{ F}\cdot\text{m}^{-1}$), or vacuum permeability

($\mu_0 = 1,25663706212(19) \times 10^{-6} \text{ N}\cdot\text{A}^{-2}$) and the problems to measure with high accuracy since they can be affected by density variations. Even small modifications in the speed of light can be expected due to the vacuum-related spin; in fact, the speed of light can be calculated based on the previous variables about vacuum permittivity and permeability using Maxwell's equations, $c=1/\sqrt{\epsilon_0\mu_0}$.

- Variations in $E = mc^2$ to set the rest energy of matter, for example, we could obtain $E = AF_p$ where A is the nucleons number.
- Compatibility with light and matter interaction (QED), and the fact that electrons cannot occupy the same quantum state or light refraction; as well as the wave function and Schrödinger and Dirac equations, describing how the [state](#) of a [quantum system](#) changes with time.
- Planck length ($\ell_p = 1,616255(38) \times 10^{-35} \text{ m}$) and Planck time ($t_p = 5,391247(60) \times 10^{-44} \text{ s}$) are theoretically considered the quantization of space and time and may point to the vacuum structures by length as well as time. Planck referred to relativistic values, which may not be so accurate; for example, gamma rays have one of the smallest wavelengths, shorter than 10^{-11} meters.
- The residual strong force (the bond between protons and neutrons), which is much weaker than the (real) strong force, has a correlation between quarks up and down that can be perfectly electromagnetic, as it was originally considered.
- Similarities between Newton's and Coulomb's law or Einstein's relativity and Maxwell's equations for the electric field.
- The unidirectional arrow of time...

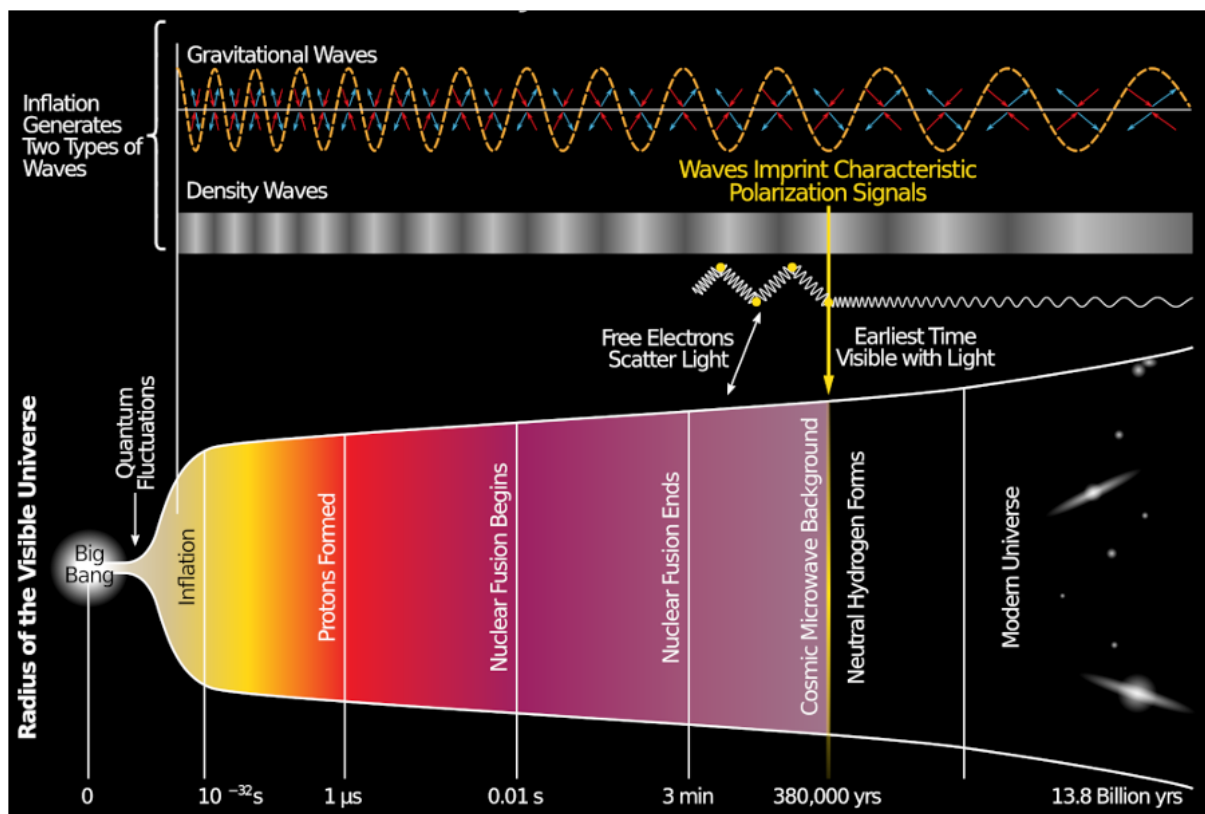


Fig.15. These variables help to shape galaxies (like the golden spiral $\phi = 1,6180$).

6. Considerations

Gravitomagnetism (GEM) is a term that refers to the kinetic effects of gravity in analogy to the magnetic effects of a moving electric charge. Here we will create a relativistic relation to extract the magnetic moment and check its behavior, independently of GEM equations.

We can accelerate matter using a chamber with magnetic coils to transform as much matter as possible into energy. We need a material with as much permeability in high magnetic fields as possible; pure iron can be a good reference, but we can consider some other materials with high permeability. The centripetal force will force matter outwards, so we need a magnetic field to keep its dimensions. We need sufficient width and height to concentrate internal energy and study how the vacuum is bent; it's complex to concentrate kinetic energy at one point to obtain its potential energy.

As an example, we'll calculate the energy of one disk in motion, taking the radius and a height of 50 cm, using iron with density $\rho = 7,874 \text{ gr/cm}^3$, with the following mass:

$$V = \pi \times r^2 \times h = 392.700 \text{ cm}^3 \quad (7.1)$$

$$m = 392.700 \times 7,874 = 197,89 \text{ gr} = 0,197 \text{ kg}$$

Considering a maximum speed reached, we'll compare its kinetic energy with the maximum energy that could be generated using a relativistic approximation.

$$v = 3 \times 10^7 \text{ m/s (near the speed of light)} \quad (7.2)$$

$$E_k = \frac{1}{2}mv^2 \quad E = mc^2$$

$$E_k = \frac{1}{2} \times 3.092,119 \times 9 \times 10^{14} \quad E = 3.092,119 \times 9 \times 10^{16}$$

$$E_k = 13.914,535 \times 10^{14} \quad E = 27.829,071 \times 10^{16}$$

Vacuum density should change in connection with the disk

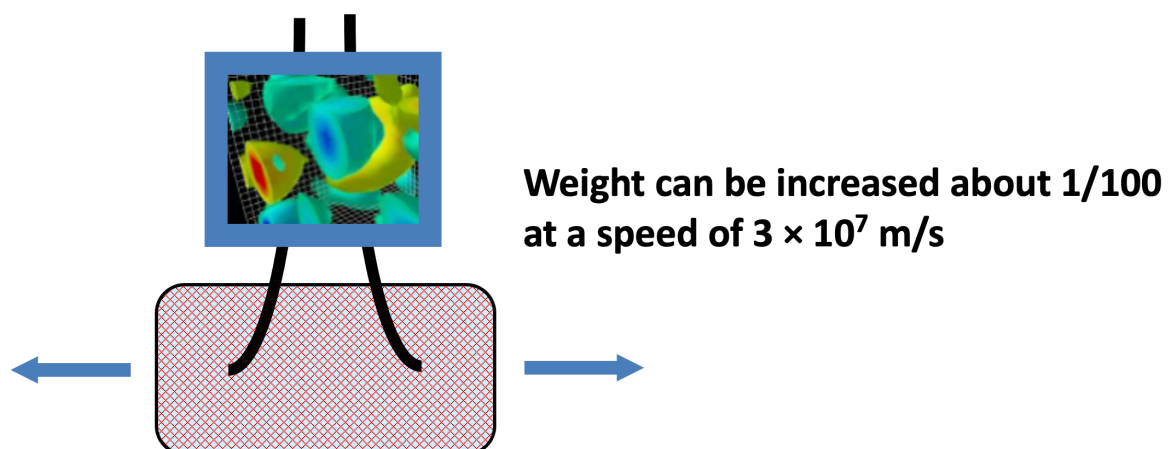


Fig.16. Motion and relativity equivalence.

The energy calculated at the disk periphery can have a magnetic relation with its motion. Its charge (q) and magnetic field (B) are linked with its velocity, where $v = qBr / m$, so the energy generated can be calculated when a speed is reached in a relativistic approximation.

$$E = \frac{1}{2}mv^2 = \frac{q^2 B^2 r^2}{2m}$$

Other variations at QCD have been observed, like at baryon resonances.

Anyway, more studies are needed to check the real correlation between the quantum vacuum and the strong nuclear force. The motion, together with the vacuum contraction / extraction / insertion, should be related to a change in density, but we don't know the possible proton size variations in space to perform new calculations (we are dealing with very complex dynamic scales). It can be considered a highly problematic system.

Declarations

Ethics approval and consent to participate

There are codes of conduct regarding the nuclear force.

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