Superconducting Field Theory (the Unification Theory)

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Abstract

Unification theory with no extra dimensions. The first part unifies the strong nuclear force with the gravitational force in a mathematical way, the second part unifies the nuclear force with the quantum vacuum in a hypothetical structure.

Keywords: Unified field theory; Quantum vacuum; Strong nuclear force; Dark matter; Cosmic inflation;

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. This system calculates the 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. Due to having an extremely small field of action it has been underestimated in the search for a possible interaction with the gravitational force, but if we turn that field and look for its internal interaction instead of its external, 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 into space.
- The **quantum vacuum** or aether which has been ignored to a certain extent. It could be responsible for the most important interactions over long distances, being perceived as a kind of material medium as demonstrated by 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 or spinors trying to explain spin interactions, and it could be the guilty party for all particles vibrations.

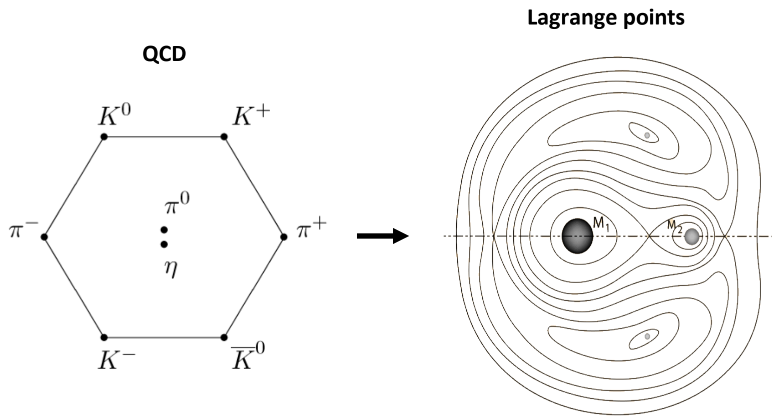


Fig. 1: From quantum dynamics to general relativity.

This physics branch uses the 3 spatial dimensions and time, 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, the strong nuclear force makes quarks to remain together being the strongest of the fundamental interactions, having 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 to separate by a constant force of attraction of maximum 10.000 N (≈ 1.000 Kg).

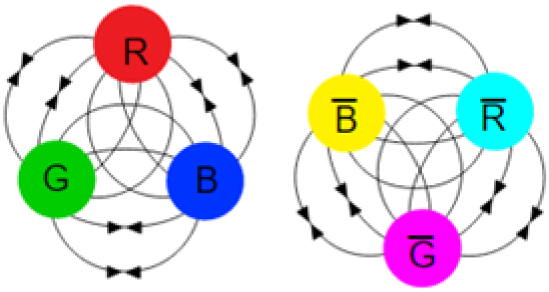


Fig. 2: QCD color charge.

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 constitutes their color charge. The "color charge" of quarks and gluons is not related to the everyday meanings of color and charge, but is related with its hidden internal degree of freedom.

2.2 Quantum vacuum

We can note two important qualities of the quantum vacuum:

- Superconducting particles. Distance to the most distant galaxy detected by the human being is more than 30 billion light years, that means there are photons which are able to travel that distance without decreasing its speed, modifying only its 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 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, tenser than any known structure and under extreme repulsive forces to allow the universe expansion.

This description would deal with a quantum vacuum working as a superfluid with zero viscosity and any loss of kinetic energy. It has a practically infinite particles conductive capacity and extremely dense, remember we are moving into the universe at an estimated speed of 600 km/sc.

Centre for the Subatomic Structure of Matter

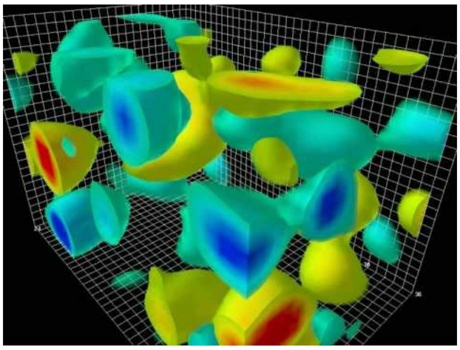


Fig. 3: QCD vacuum.

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 by 2,4 by 3,6 fm. This induces chromo-electric and chromo-magnetic fields in its lowest energy state. The frame rate into the real example is billions of billions of frames per second (FPS).

3. Strong nuclear force unification

3.1 Fundamentals

The new framework consists in a vacuum that superconducts matter (quarks interacting with the strong nuclear force holding matter together, travelling into space without resistance). To interact with each other, we can think about an elastic band (it would simulate the strong force with a size of 10^{-15} meters) that tightens two V-shaped sticks at the most opened side. If sticks are sufficiently slippery and tense, the elastic band will slide to the thinnest side, more elastic bands, more force will be exerted on the sticks to join them; equally, more matter at the end of the sticks causes more attraction at the top.

We are talking about unknown limits, such as infinite conduction or tensions never seen.

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 and a nucleus conformed by a single proton, where its nuclear force is located. A proton is in turn composed of two up-quarks and a down-quark bound by the gluon interaction. With these data about hydrogen, we'll calculate its **average** interaction to create a contraction in the vacuum.

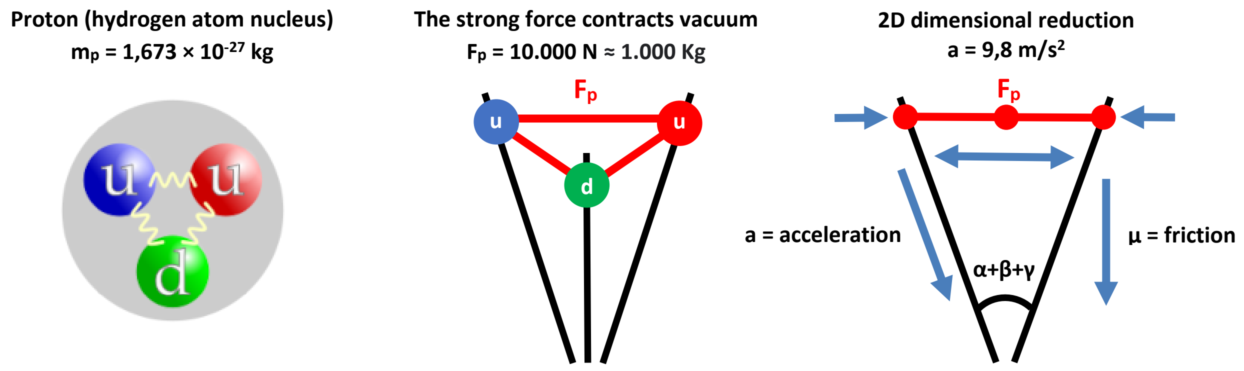


Fig. 4: Involved forces.

It would correspond to what is known as quantum gravity (QG) to describe gravity according to the principles of quantum mechanics, erases gravity as one of the fundamental forces of nature and turns the strong force into its generator affecting each nucleon (protons and neutrons) in isolation.

3.2 Calculations

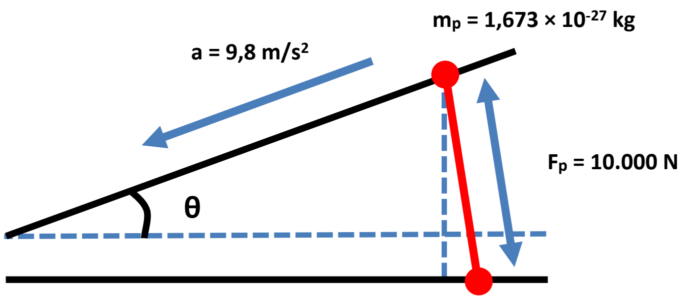
***** Fig. 5** is the most important figure in the document, it must be understood in order to continue. It has been positioned horizontally to be more intuitive.*

The calculation is 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, it has 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 in our planet is matched with the acceleration down the plane, 9,8 m/s² (a).
- Friction is depreciable.

These variables should be the average values collected through classical mechanics, from quantum physics interactions.

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



**** Fig. 5: Inclined plane forces.**

Convert variables to metric system considering a proton.

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

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

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

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

Apply the laws of inclined planes for the previous variables.

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

$$F_p = m \times g = 10.000\ N$$

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

Planet Earth's angle shared by 3 quarks, creating 9,8 m/s^2 acceleration. This deviation occurs at the proton distance.

$$\theta = arcsin(F_1 / F_p) \quad (1.2)$$

$$\theta = arcsin(1{,}6395 \times 10^{-30})$$

$$\theta = 9{,}393 \times 10^{-29}\ ° \quad (1.3)$$

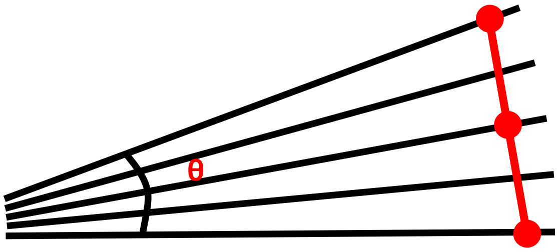


Fig. 6: Quarks scope.

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 × volume, all of them associated to our framework.

3.3 Quantum vacuum density

Dark matter could have its origin due to differences in the quantum vacuum density. An extension between quarks could turn mass (m_p) into tension energy (F_p), so some places at universe can have lower or higher accelerations because of this effect; this means no dark matter in reality, 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.

The force exerted increases with quarks separation

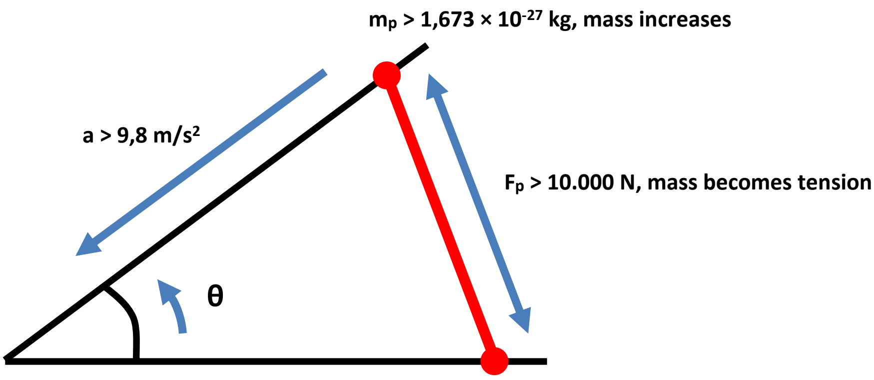


Fig. 7: The strong force behaves like an elastic band.

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.

Variables set.

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

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

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

Calculate the relation between the angle and the acceleration.

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

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

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

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

Bigger angle generates more acceleration.

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

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

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

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

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

The strong force has positive correlation when transforming its force, increasing F_p or m_p implies more acceleration, it acts as a spring to generate different tensions into space. In addition to historical reasons of rivalry between Newton and Hooke, Hooke's law (spring constant) is the best and easiest approach 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.

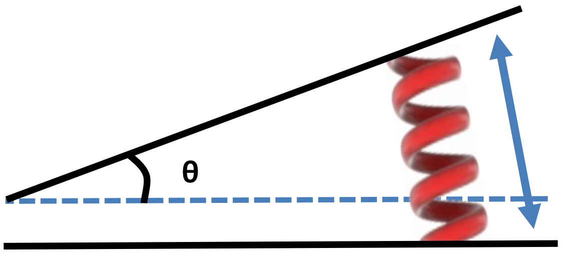


Fig. 8: The strong force becomes the fundamental tensor.

But in reality, the space deforms not proportionally to create more acceleration near the accumulation of matter, 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 at 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 (Ɛ).

$$E = \Delta\sigma / \Delta\varepsilon$$

The force exerted by the angle (θ), increases (Δ) faster than the strong force (F_p) and its relation with mass (m_p).

$$\Delta F\theta > \Delta F_p / \Delta m_p \qquad (4.1)$$

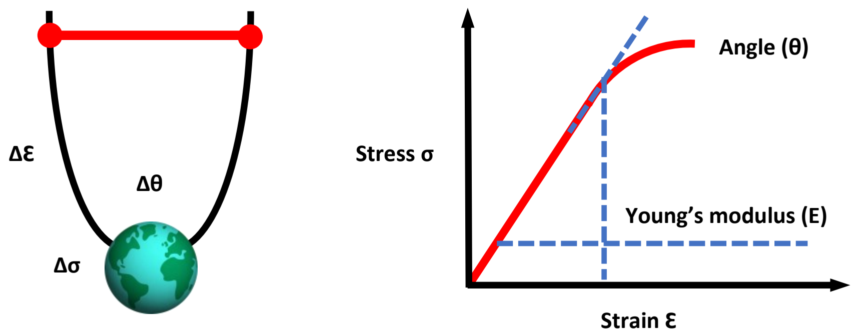


Fig. 9: The angle exerts over large distances.

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 the calculations on the Earth, and it should be associated with actual physics like general relativity (GR) or Einstein field equations (EFE) where matter bends space and are determined by densities and an unknown matter-based tensor. Also, we can find more 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.
- Electromagnetic and 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.

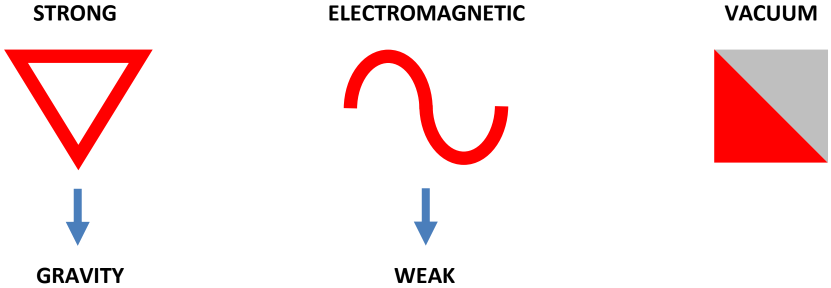


Fig. 10: Fundamental interactions.

4. Quantum vacuum unification

4.1 Structure

We need a quantum vacuum structure to achieve different behaviors like **the constant motion of matter, the electromagnetic field generation and the transportation of subatomic particles** (like photons or neutrinos). The topological model proposed are polarized triplets rotated in a static balance (a symmetric group) in the 3 axes of space.

- Matter is constituted by protons and neutrons (nucleons) which make up the elements of the periodic table, at the same time each nucleon is made up of 3 quarks. This vacuum asymmetry, maintains the speed of nucleons stable because repulsions and attractions from the whole part are equilibrated in the 3 spatial directions (nucleons triplets against vacuum triplets), the average sum of all the forces in the network is 0 for this reason matter is not accelerated.

$$\bar{F}_x + \bar{F}_y + \bar{F}_z = \bar{F}\ net = 0 \qquad (5.1)$$

This asymmetry is the cause of quantum chromodynamics (QCD) colors and anticolors (3 types of each) and their transformations, the nucleon structure doesn’t collapse inward due to this outward repulsion and is the only thing bigger than each one capable to survive it.

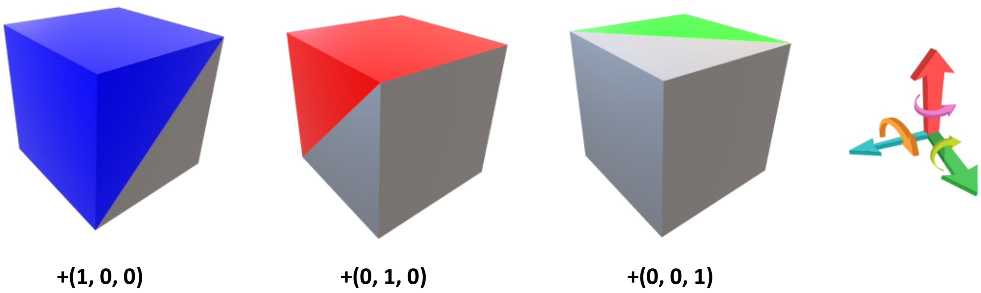
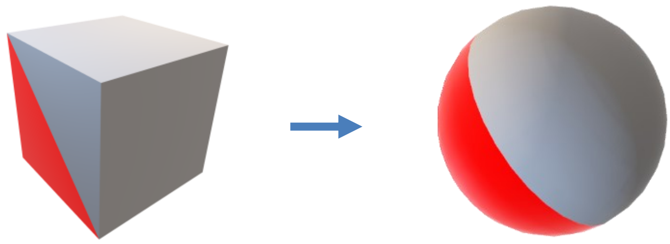


Fig. 11: Motion of matter in equilibrium.

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

All the elements in the periodic table have a mass or nucleon number related with its 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 have an electron). These electromagnetic attractions could affect the gravitational force, but only in a residual way.

Each container should have an internal force trying to expand with a spherical distribution as is theorized for U(1) gauge, so particles can be easily dispersed in all directions like during a space burst.



-(0, 1, 0) -(0, 1, 0)

Fig. 12: Electromagnetic field generation.

- Light has its own inertia, it travels at approximately 300.000 kilometers per second, but it slows down to 225.000 kilometers per second in water (it depends on the electromagnetic properties of the medium it's embedded in), recovering its speed when leaves the water.

  Subatomic particles (photons or neutrinos) are smaller than this basic frame so they can be transported by the vacuum. The infinite amount of inertia accumulated in these particles comes from the energetic vacuum spin, and at the same time, quarks are trying to be accelerated to the speed of light but the symmetrical stability prevents it.

  These basic frames can be seen as the smallest units of time, where other behaviors could be studied such as such as neutrino flavors (electron, muon and tau) as a motion system between triplets (more similar to how matter works) or the photon generation as a monopole interaction.

+(0, -1, 0)

Fig. 13: Subatomic particles transportation.

The particles scape angles are needed to conform the net, taking into account all the containers positions into space:

+(1, 0, 0), +(0, 1, 0), +(0, 0, 1)

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

-(1, 0, 0), -(0, 1, 0), -(0, 0, 1)

-(-1, 0, 0), -(0, -1, 0), -(0, 0, -1)

These structures can help to build the Standard Model internal symmetries, SU(3) × SU(2) × U(1); the Gell-Mann matrices, representation of the SU(3) group, where quarks possess color quantum numbers and form the fundamental triplet; the Pauli matrices, representation of the SU(2) group, which reproduce the electrons spin; and the simplest internal symmetry group as U(1). This solution can **accommodate the main types of motion**, being the first time that a nonlinear structure is theorized to solve the technical problems of renormalization in order to yield sensible answers to the strange behavior of quantum physics. Anyway, this is considered a hypothetical structure because the complete mathematical matrix has not been built, knowing 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 others like the pions are unstable, ice rules in molecules as internal spins with geometric constraints which generate a periodic lattice, emerging patterns like fractals or crystal structures with its repeating arrangement of atoms…

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 the **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, all the necessary energy to provide motion to the whole matter was then created and everything began to interact provided by the "infinite" inertia that the quantum vacuum supplied.

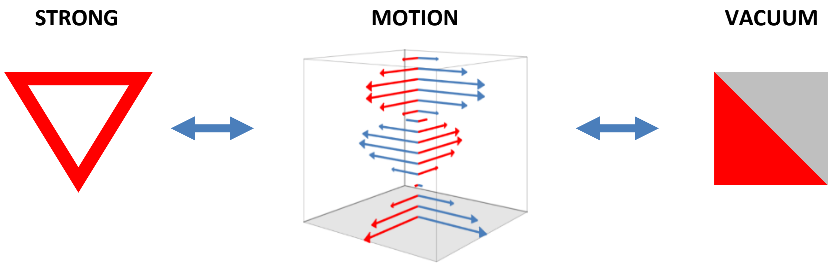


Fig. 14: Theory of Everything scheme.

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

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 exist being all pre-calculated) and overcome resignation thinking how to break it, like, 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 it (the universe needs it). From now on, I only hope I have raised your consciousness level…

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 are better than more complex ones.

This theory can explain:

- 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 the dark matter behavior, at the same time, the cosmic microwave background should be related to these vacuum variations. Universe is anisotropic (is not uniform in all directions).
- Dark energy and cosmic inflation. The unitary containers behavior implies a spin repulsion helping to its expansion, strong enough to avoid to get closer and be able to reestablish its structure after any contraction; this generates the required propagation force over large distances to take place 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, creating an explosion and leading to new internal concentrations (a black hole can vary from a nuclear density inside the Schwarzschild radius of 4×10^{19} kg/m^3, more extreme than our nuclear density of 2.3×10^{17} kg/m^3). Depending on the new field size, photons could be attracted because its field can interact with the vacuum while smaller particles like neutrinos can escape.
- These containers can be seen 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 relationships between space, time and motion; until nowadays with the infinitesimal calculus, where a mathematical curve can be analyzed as if it were constituted of homogeneous separable points.

- Gravitational time dilation. Each container is connected with space and time, a bigger frame implies minor energy concentration and displacements takes less time because of the slowing frame rate.
- Gravitational constant ($G = 6,67408(31) \times 10^{-11}\ m^3kg^{-1}s^{-2}$), vacuum permittivity ($\varepsilon_0 = 8,8541878128(13) \times 10^{-12}$ F·m−1) or vacuum permeability ($\mu_0 = 1,25663706212(19) \times 10^{-6}\ N{\cdot}A^{-2}$) and their problems to measure with high accuracy since they can be related to the density variations.
- Variations in E = mc2 to set the rest energy of matter, for example, it could be $E = AF_p$ where A is the nucleons number; even small modifications expected in the speed of light because of the vacuum density and its related spin, in fact, this speed can be calculated based on the previous variables about vacuum permittivity and permeability using Maxwell's equations, $c=1/\sqrt{(\varepsilon_0\mu_0)}$.
- Schrödinger equation and the wave function, to describe how the quantum state of a quantum system changes with time.
- Particles decay due to the vacuum interaction. It can correspond to the current theories about the false vacuum decay (a vacuum not so stable), even the neutron decay can be seen as a small dominant space polarization which tends to create protons.
- Compatibility with light and matter interaction (QED), as well as electrons cannot occupy the same quantum state.
- Planck length ($\ell_P = 1,616255(38) \times 10^{-35}$ m) and Planck time ($t_P = 5,391247(60) \times 10^{-44}$ s) are theoretically considered to be the quantization of space and time and may point to the vacuum structures by length as well as time. Planck referenced to relativistic values which may not be so accurate, for example, Gamma rays have one of the smallest wavelengths, shorter than 10^{-11} meters.
- Conservation of angular momentum at rotations into space with spherical and circular movements at planets and galaxies. Applying this conservation during the BigBang, antimatter is not needed to create it and could lead to less antimatter than 50% in the universe as expected (a small portion was generated during the explosion).
- The residual strong force (the bond between protons and neutrons) which is much weaker than the (real) strong force, has a correlation quark up/down and quark down/up which can be perfectly electromagnetic as it was considered originally.
- Newton's and Coulomb's law similarities.
- The unidirectional arrow of time…

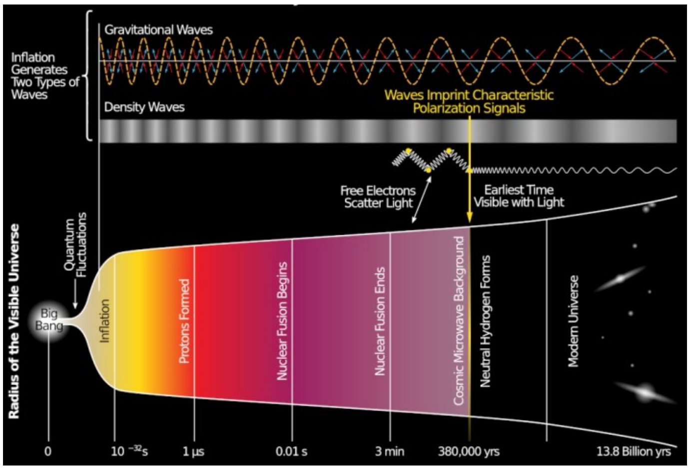


Fig. 15: All these variables help to shape galaxies (like the golden spiral ϕ = 1,6180).

6. Considerations for the study

Gravitomagnetism (GEM) is a term that refers to the kinetic effects of gravity in analogy to the magnetic effects of a moving electric charge. This is just a relation to extract the magnetic moment and check behaviors since there are specific GEM equations.

We can accelerate matter using a chamber with magnetic coils to transform into energy as much matter as possible. We need a material with maximum magnetic permeability on 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, forces 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.

As an example, we'll calculate the energy of one disk in motion, taking a radius of 2 cm and a height of 2 cm, using iron with density ρ = 7,874 gr/cm3.

$$V = \pi \times r^2 \times h = 25{,}1328\ cm^3 \qquad (6.1)$$

$$m = 25{,}1328 \times 7{,}874 = 197{,}89\ gr = 0{,}197\ kg$$

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

$$v = 3 \times 10^7\ m/s \text{ (near the speed of light)} \qquad (6.2)$$

$$E_k = ½mv^2 \qquad E = mc^2$$

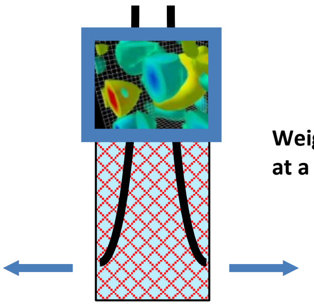
$$E_k = ½ \times 0{,}197 \times 9 \times 10^{14} \qquad E = 0{,}197 \times 9 \times 10^{16}$$

$$E_k = 0{,}8865 \times 10^{14} \qquad E = 1{,}773 \times 10^{16}$$

The energy calculated in 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 output energy can be calculated when a speed is reached in a relativistic approximation.

$$E = ½mv^2 = q^2B^2r^2 / 2m$$

Vacuum density should change in connection with the disk



Weight can be increased about 1/100 at a speed of 3 × 10^7 m/s

Fig. 16: Motion and relativity equivalence.

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 and the vacuum extraction/insertion should be related with a change in the density but we don't really know the proton size variations in space to perform new calculations.

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