Why Only Three Equations Are Enough to Explain the Universe?

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Abstract

The only way to elucidate the mystery of the universal expansion appearance from a gravitational singularity is to discover a theory that would unify the two infinities in the same frame.

The Big-bang, considered as "instant 0", was born from an extrapolation of the equations of general relativity (called in this context Friedmann-Lemaitre's equations), therefore without taking into account the three other forces that are then no longer negligible.

The following six step methodological approach will be applied to solve this problem:

1) Unification of the eight fundamental energy equations instead of unification of the four Fundamental interactions,

2) The unitary position instead of space-time,

3) The quanto-gravitational constant 'b',

4) The convergence of the two infinities at the two values '0' and '1',

5) The pairwise convergence of the energy equations,

6) The mother equation of the two universal phases.

The conclusion I have reached is that the Universe is governed by only three absolute equations:

1) $N = 0$; [1]

2) $\{N = (E\,(x, y, z) / t)\, M\}$; [2]

3) and $\{N^4 = (E\,(x, y, z) / t)^4\, M^4\}$. [3]

Keywords: Absolute Physics; Unifying Theory Without Constant; Universal Mother Equation; Universal Absolute Structure; Two-Phase Universe.

Introduction

At sufficiently large scales, a fundamental principle of the modern model of cosmology [1, 1] postulates that the distribution of matter must be smooth and regular in all directions. This assumption is establishing in many cosmological calculations.
However, this principle is questioning. A study of more than a million galaxies has shown that the distribution of matter may not be the same in all directions, which could upset much of what we understand about the Universe.

Regarding universal expansion, Wendy Freedman of the University of Chicago recently stated that "things fit remarkably well, except the Hubble constant (a measure of the rate of the universal expansion). Indeed, the two main calculation methods - using the old Cosmic Microwave Background (CMB) versus a local measure of the motion of nearby objects - still disagree.

This discrepancy (obtaining contradictory results between the two measurements); can only be explained by a glaring lack of symmetry. This discrepancy may indicate a fundamental error in the standard cosmological model and may force us to change what we think we know about the Big Bang and the moments that followed it. These crucial moments have decisively affected the shape and expansion of the Universe.

A fundamental tenet of the modern model of cosmology is coming into question. One of our most basic assumptions about the Universe may be wrong. This discrepancy led Freedman to say that [there's probably some missing physics somewhere, but nobody has been able to come up with it yet.]

Universe

In the modern sense of the term, these two units (ontological + legislative) define what we call a Universe.

There are at least three distinct definitions of the word "Universe":

The visible Universe represents the totality of observable Universe mass and energy.

The presumed Universe represents the totality of mass and energy, including all that is not visible.

The complete Universe is the sum of matter and energy and space-time itself.

There is no unanimously accepted consensus on these terms, so we must be careful to avoid confusion.

Infinite Universe

[According to the data obtained by the Planck satellite, our Universe is flat (without space curvature).

In this case, for it to be finite, it is necessary to introduce a discontinuity in the curve parameters of the Riemannian metric (at the "edge" of the Universe). But as it is unfortunately impossible in physics, it means that our Universe is indeed infinite.

Be careful; to say that the Universe is infinite today implies that it will be and has always been infinite. In other words, at the time of the Big Bang, our Universe was already infinite. As implausible as this may seem, it is an undeniable physical reality, and that is what makes cosmology so incredible. (Source: Romaric Gravet (Ph.D. in Solar Physics & Astrophysics)]

Primordial Universe and Universal Expansion

What mysterious "energy" endowed the Universe with the forms it has today? It is necessary to distinguish the energy with a big E of the Universe, from the exchanges of energy taking place in the Universe.

"The conservation of energy of a system implies that this system is invariant by translation in time. The Universe is not invariant by time translation (because it expands), so its energy is not conserved."

Even if the laws of physics are the same, what breaks the invariance by time translation is the expansion. Thus, the universal temporal origin, assimilated to the singularity of the Big Bang, can be fixed.

But in fact, the Universe has neither beginning nor end. The words “beginning” and “end” are only consequences of its topological configuration.

The Big Bang Theory is not a theory of the Universe’s origin. Yet it claims to reveal some aspects of the beginning of its expansion phase, the so-called “primordial Universe”. Approaching the problem of a temporal origin would imply that one could invoke a first, prior and explanatory cause.

[An origin (of the Universe) in time must explain the origin of time itself because it is part of entropy: this raises the whole mystery of the nature of time itself. How can time have a start and at the same time serve to date the beginning of a space-time with which it has emerged?] [1, 4]

Remark

[When we talk about universal expansion, we are talking about space-time, and more precisely about space that is expanding at every point.

The notion of proper space translates that any material body forms a couple “mass/volume of space”: for a given body, its space and mass are indistinctly generating in pairs.

“According to the spatial theory, the presence of a material body causes a spatial density which corresponds to energy distributed in space. This density produces an action of space on the bodies. It manifests itself in the form of spatial surface tension.

Let us imagine a Universe whose mass increases constantly. This surplus of mass causes an increase in the volume of space which pushes the bodies towards the outside. This phenomenon could explain, among other things, the expansion of the Universe.” (Source: Khalid Jerrari)] [1, 4 Bis]

Acceleration of the Universe

The energy that contributes up to 68 % of the critical density is called “dark energy”, which means that our Universe has the characteristic of a “flat” Universe (without curvature of space) and “eternal” expansion.

[The so-called “critical” density is three hydrogen atoms per cubic meter.]

[In fact, the Universe is a volume that has three dimensions but is curving in a fourth. A curvature in the fourth spatial dimension is a kind of reversal (of volumes) impossible to visualize for us.]

The acceleration of the Universe could, indeed, be explaining by dark energy. Constant in time and occupying the smallest space, its contribution to the Universe mass would grow with the universal expansion.

The Universe (characterized by various phase transitions) comes directly from the energy known as “primordial”. It would be at the same time the source of all the forces acting in the Universe and the origin of the Big Bang.

As a result, very discreet at the beginning, it would have become the main factor of the destiny of the Universe seven billion years ago as the expansion progressed.

It will be necessary to upset the most fundamental physics concepts to solve both the enigma of the accelerating Universe and that of its content. [1, 5]

Dark Energy

[The Standard Model of particle physics describes a wide variety of particles and antiparticles. And yet, if we add up the total of all of these forms of matter, including photons, neutrinos, and everything that does not compose atoms, we fall far short of what is needed to describe our Universe. Two additional components are necessary: dark matter and dark energy. Assuming that particle is responsible for dark matter, that is not the case for dark energy.

In the 1990s, observations of distant supernovae appeared fainter than our models of the Universe were predicting. As the evidence poured in, bolstered by the CMB and large-scale clustering data, we realized that a wholly novel form of energy, inconsistent with the properties of any form of matter or radiation, must be present.

The Universe marked by a late accelerated expansion does not strictly conserve energy but betrays the presence of dark energy.

What is it, at a fundamental level, that makes up the Universe?

What is remarkable about the evidence for dark energy is how perfectly uniform it is. There is no evidence that dark energy is related to the density, direction, location or, epoch of the Universe.

It appears to be perfectly uniform, homogeneous, and perfectly constant: unchanging throughout space and time. And yet, despite its simplicity, it behaves fundamentally differently from all other known forms of energy.

As the Universe expands, not only does the number of particles remain the same while the volume increases, but the energy of each particle decreases as the Universe expands.

Still, both of these descriptions fall apart for dark energy. As the volume of the Universe increases — as it expands — the energy density does not change; it remains constant.

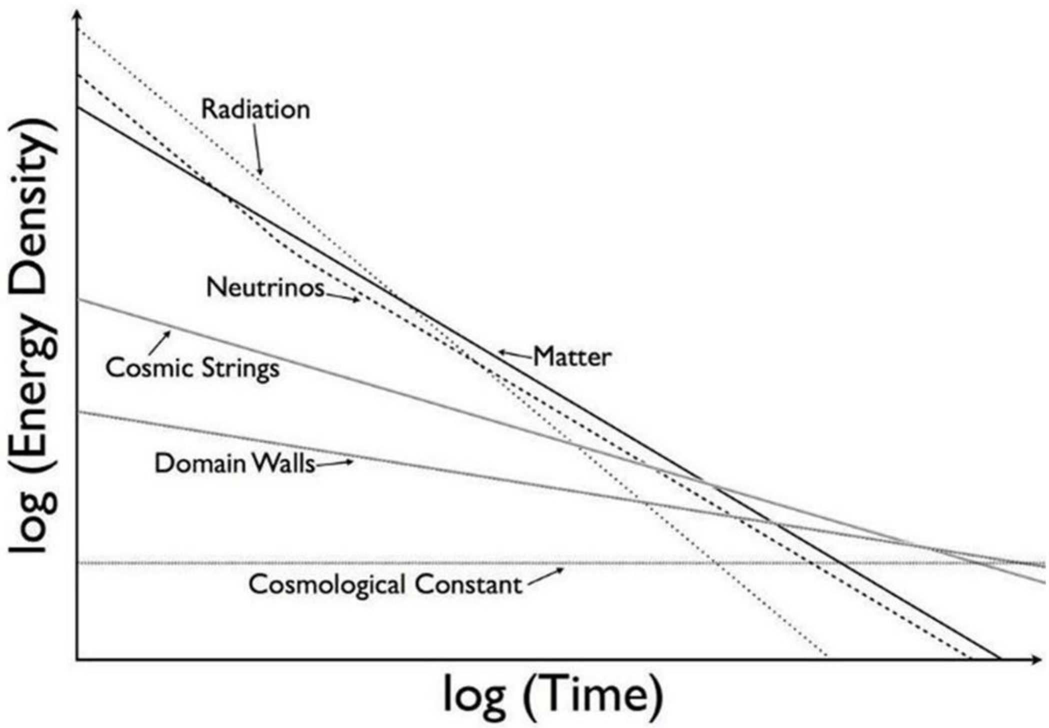

Figure 1: Radiation is dominant over the matter for roughly the first 9,000 years, then matter (that gets less dense as time marches forward) dominates, and finally, a cosmological constant emerges. However, dark energy may not be a cosmological constant, exactly! (Credit: E. Siegel / Beyond the Galaxy)

If dark energy is a particle, then either new particles must constantly be creating to keep the energy density constant, or the behaviour of these particles must evolve with time to keep their effects on the universal constant.

If dark energy is a field that permeates the Universe, then it can evolve either in space, or in time, or both.

Even so, dark energy is the most basic entity imaginable, which behaves neither like a particle nor a field, but rather like a property inherent in space itself.

The dark energy does not seem to be a particle or even evolve. Ethan Siegel: "Dark energy might be neither particle nor field".]

Universe and Quantum computer

Unlike classical physics, where the notions of wave and particle are separate, in the quantum Universe they become two facets of the same phenomenon, a property that, theoretically, can multiply the capabilities of computers.

In the quantum world, the bit is called a qubit. It can take the value 1 or 0 as a bit. But also possess both values 0 & 1. This structure is describing as a "superposition".

Theoretically, this characteristic allows quantum computers to perform several million calculations simultaneously and decrypt codes up to a thousand digits.

But it is interesting to know that creating a qubit (three-dimensional) requires circuits made of materials with superconductivity.

Like their classical counterparts, quantum computers are designing as networks of wires carrying information. Even though the information they circulate are qubits whose states are superposition's of 0 and 1.

Compared to classical bits, the information content is the same. But the interest of the qubit lies in its capacity to be entangled. It allows it to perform all operations simultaneously.

The quantum computer is a set of N qubits, which provides a base of 2N states.

Causal relations with the quantum world

Astonishingly, the quantum computer proves that decohered systems maintain causal relations with the quantum world.

It is now suspecting that the meeting of atoms and molecules of our Universe with quantum particles, emerging randomly from the quantum vacuum, constantly modifies the organization of these atoms and particles. Moreover, entanglement phenomena between quantum particles and atoms or molecules of our world could confer to the latter the computational properties of quantum bits.

All this would lead to a permanent renewal of the architecture and functionality of the material, biological and informational units, even though this would be difficult to observe.

We would thus be in the presence of such a powerful mechanism generating randomness and mutations that would lead to new biological entities and sources of information diffusion, created within our Universe, to enter into Darwinian competition with those that preceded them. Thus, the Universe would adapt much faster than we suspect to the constraints born from its own development.

What is said here about the possible interaction between quantum particles and objects of the macroscopic world should not be limited to what happens on earth. It is a priori the whole macro-cosmos that would evolve in interaction with the quantum fabric of the Universe.

Alternate Realities

[Quantum particles are the fundamental particles of the macroscopical world. Let us assume that the macroscopical world is in a state of superposition. In other words, let us consider the existence of alternative realities in our Universe. Let us admit that the macroscopical world is representing by binary numbers: qubits. Example:

Binary representation: 1 | 0

0 | 1

Representation in qubits:

1&0 | 1&0

1&0 | 1&0

While, in the binary representation, everything is defined and has only one state, the qubit representation identifies 16 states. Only when an observer observes does the wave function collapse and, one of the states is revealing. It could be a perfect representation of how the Universe is.

How can we imagine the world? Why do we not interact with alternate Universes?

Entanglement provides us with an answer to this question. Every time an observation takes place, the Universe undergoes a split to become two alternative realities. Suppose that the quantum phenomenon is entangling in the whole Universe, and the Universe is representing by a wave function. When the observation occurs, the Universe splits into two wave functions representing the two alternative Universes.

To get a clearer picture, let us imagine that the Universe is a superposition of wave functions and that with each observation, these wave functions divide and multiply. These wave functions exist simultaneously but cannot interact with each other. In this Universe's model, the division would mean the passage of time, and the measure of time is the number of alternative Universes that exist simultaneously. In this model, the past is not accessible, nor the future. The only alternative realities exist at a given moment, which cannot interact with each other. Time is used here for convenience. Jyotish Ghosh: "Quantum physics and the nature of the Universe".]

Information, Matter, and Energy

[If you want to find the secrets of the Universe, think in terms of energy, frequency, information, and vibration. Nikola Tesla]

Physics has long considered that the Universe was made up of matter and energy in balance, respecting a universal principle of conservation. We seem to evolve in a world perceived by our senses within four spatiotemporal dimensions in which objects move and transform under the influence of energy.

Quantum physics and research at the confines of matter have led to the assumption of elementary particles without mass, and therefore without tangible existence for our senses, the latter appearing only through the interplay of interactions - coordinating forces - between these particles. Matter, the physical world of which we are a part, turns out to be a game of interactions of different natures at different levels.

For a long time, information theories have focused on communications and calculation, forming a science apart, based on mathematics and, secondarily, on tangible devices (computers, networks), from the field of applied sciences and engineering.

Information appears as the third ingredient in the march of the Universe and becomes a subject of fundamental physics.

Paradoxically, but logically, information is not "visible". It is neither detectable nor observable as such.

Its manifestation as electric currents, magnetic remanence, and electromagnetic waves is only an artificial transmutation. It allows us to exploit it in the material and energetic forms that we perceive.

[Physicists join metaphysicians and philosophers. Common sense begins to accept information as the third fundamental entity constituting the Universe.

When we consider the triplet Matter - Energy - Information, a globally coherent perception of the world emerges. Every object appears as a combination of these three dimensions.

Like energy, information is a notion that escapes direct perception by our senses and, in the same way, seems to lurk in a latent state or to manifest itself in observable phenomena. We can then distinguish:

"kinetic information", information in action, in interactions,

A "potential" information prisoner of matter, that which carries the structure of the crystal or DNA, the biologic memory, the contents of a hard disk.

"Information and the Internal Structure of the Universe: Exploration into Information Physics". Tom Stonier]

Information

Two forms of time could exist at the moment of the Big Bang. First, there is ordinary time that we know, which flows at every moment and which is, of course, closely linked to the notion of energy. And the time that does not flow (non-chronological time unrelated to the movement and energy). What will we find instead? What experts call information (understood as the "inverse" of entropy)! It is why all physical units, without exception, should be replaced by these units called "bits of information" (0 and 1). [Unit of measurement in computing designating the elementary quantity of information.]

The moment zero corresponds to the "initial singularity". At point zero, the entropy of the Universe is zero.

However, since the information is simply the "inverse" of the entropy, at instant zero, the information that characterizes the pre-Universe must be considered at its maximum level. At this instant, there is, therefore, nothing but just information!

Note

Deutsch and Marletto's theory states that the notion of information has a physical basis.

Origin of Information and Theory of Information

The first manifestation of energy created at the beginning of the previous process (known as the Big Bang) behaved like a bit (of information).

In other words, it was:

A particle of energy capable of interacting with those that would follow to form physical material entities;

but also, of a particle endowed with the characteristics of a unit of information. That is to say, roughly, to represent 0s and 1s.

The confluence of physics and information theory stems from a central idea of quantum mechanics. Nature is ultimately discrete (not continuous). A finite number of bits can describe a physical system.

Each particle in the system is like a logical element in a computer. For example, its spin (or magnetic moment) often has only two possible orientations, in which case the spin state is characterizing by a single bit.

A change of orientation of the particle's spin is thus equivalent to a numerical operation on a bit. It results in a transformation from 0 to 1 or vice versa.

The system is also discrete in time: a minimum time is needed for a bit to change. The minimum time t to transform a bit depends on the amount of energy required, E. The higher the energy, the shorter this time can be, an in equation whose formula is:

$t \geq h / (4E)$ [4], where h is Planck's constant.

The Photon

A photon belongs to the family of undetectable objects. It is an object that belongs neither to our space nor to our time. These two concepts are foreign to it. The explanation lies in its frequency. It is so high that:

On the one hand, it generates an infinitely small space and an infinitely short time;

And on the other hand, it generates such a short wavelength that it interacts very weakly. It is the interaction with the surrounding Universe.

Special relativity abolishes the notion of time for the photon. It postulates that the photon moves in the vacuum without changing its parameters. The quantity of photons remains constant. It moves in an immutable way.

The orientation past > future disappears for the photon. The asymmetry, past > future, is the only parameter distinguishing the spatial dimensions from the temporal dimension.

According to the temporalist model, on the contrary, the light vibration is damped while propagating in the vacuum. It was, therefore, proposed a change in the characteristics of the photon emitted. This one supposes the dynamics of its propagation and the absence of external interaction. It means that the time asymmetry is an integral part of the very nature of the photon.

[An experiment has confirmed the asymmetry of time at the level of elementary particles (PLEAR 1998).]

The photon is thus a virtual particle. Particles made up of photons become real as we move up the spatial scale so that, starting from a virtual particle - with absolute qualities -, as we climb on the spatial scale, we end up creating particles and objects - with relative ones - and for which space-time begins to have a direction. The reality, therefore, appeared from a virtual particle!

[There are methods to derive the laws of large objects from the laws of small ones. It is the formalism of the theories of effective fields. It teaches us about the relationship between the behavior of large and small objects and their interactions.]

Note

The "real" particles are structures carried by virtual particles which receive a Higgs boson. When the virtual particle becomes a carrier of mass, it builds around it a space-time field it structures the disordered space- time of the virtual level.

If the only matter can constitute space-time (allowing virtual particles to appear for us), "matter/light" on the other hand, is produced by these virtual elements.

The virtual constantly produces the real and the virtual according to the mechanisms "absorption/emission" of photon and "creation/annihilation" of matter in a vacuum, which are the two main fundamental mechanisms of physics.

[The Higgs boson is a particle predicted by the "standard model" of elementary particle physics. It would explain the origin of the mass of all particles in the Universe (including itself!). By deviating from the model, the Higgs boson could provide clues about new particles. These would only interact with other Standard Model particles, through the Higgs boson, and lead to new scientific discoveries.]

The Birth of the Matter

In general relativity, the energy density takes a geometrical aspect since this quantity is interpreted geometrically as one of the components of a tensor, linked by Einstein's equations to the curvature of space- time. The vacuum energy, defined without any additive constant, has cosmological consequences since it implies that the vacuum behaves as if it had a mass.

In quantum mechanics, no distinction is also possible between space and time. Mass and space-time are on an equal footing, and in a certain sense, particles and vacuum are both made up of the same substance. The inflationary era has seen an intense injection of energy on a universal scale. It is actual energy, which the virtual particles will appropriate to gather in hydrogen nuclei and enter the real world. The end of the inflation marks thus, starting from the vacuum, the birth of the matter that we know.

Energy

Energy is neither fluid nor a substance but rather a physical, numerical quantity, which is not general because it is associated with a concrete situation.

Energy is a concept that goes back to antiquity. The English word "energy" comes from the Vulgar Latin energia, itself derived from the ancient Greek ἐνέργεια / enérgeia. This original Greek word means "force in action".

In physics, energy, measured in joules, is a measure of the capacity of a system to modify a state, to produce work leading to movement, electromagnetic radiation, or heat.

Work is thus an ordered transfer of energy between a system and the external environment, unlike heat which is a disordered transfer of energy between the system studied and the external environment.

Relativity brought several changes of perspective on the concept of energy. Special relativity (1905) forced us to consider, for a point particle, the coordinates of position and time as variables that can combine when we change reference frame; they form the four components of a single entity, a quadrivector. Similarly, energy combines with the three coordinates of the momentum vector (or moment) to form a quadrivector, so that energy and moment are quantities of a similar nature. In parallel with the position-quantity of motion duality, the time-energy duality thus appears in a new light. Moreover, relativity fixes the arbitrary additive constant that could enter the pre-relativistic definition of energy.

In quantum mechanics and analytical mechanics, the dynamics of a system are generating by a Hamiltonian. It is a function of the positions and moments of the elementary constituents. It is equal to the sum of their kinetic and interaction energies (the interaction potential, which appears directly in the Lagrangian or the Hamiltonian, has a more fundamental character than the forces, which are the magnitudes that result from it).

In terms of elementary particles, there is no dissipation, irreversibility, and heat: these notions appear once the transition to the macroscopic scale is achieving.

The advent of quantum mechanics has not changed these principles much, but we must now consider positions, moments, and other dynamic quantities not as variables that switch but as operators. Any physical object described by an operator behaves like a random variable that can fluctuate around its mean value. Then, the energy is interpreting as the mean value of the Hamiltonian Operator H.

Conservation of Energy

All physics is basing on the postulate of conservation of energy. The Universe of our cosmological models is no exception to the rule. All modeling is basing on equivalence relations expressing invariances.

In a broad sense, energy allows us to establish equivalence relations between different classes of phenomena taking place in the Universe.

The global energy of the Universe has necessarily had a different meaning from the energy of phenomena occurring in the Universe.

Scientific research shows that no natural event is fortuitous or independent of other phenomena and attests to the consistency of the same laws throughout the Universe.

Noether's theorem establishes a link between the conservation of some quantities and the invariance of physical laws:

Energy is conserved if, and only if, the physical laws are invariant in time (no absolute time);

The impulse ("momentum") is conserved if, and only if, the physical laws are invariant by translation in space (no absolute spatial position);

The angular momentum is conserved if, and only if, the physical laws are invariant by rotation in space (no absolute orientation).

These three conservation laws have never failed.

The metric of Friedman-Lemaitre-Robertson-Walker (FLRW), used in the standard model of cosmology, combines space and time by introducing a scale factor. This scale factor is necessary to have a Universe in expansion or contraction.

Its breaks the invariance by translation in time, and energy is no longer a quantity of interest. Conservation is doing on a slightly more complicating object, the energy-impulse tensor.

[The energy-impulse tensor gives only the energy of a body or a non-gravitational field at a point, without taking into account the gravitational field's energy at this point. This tensor does not represent the energy of gravitational waves, and its zero covariant derivative does not also represent the global conservation of energy.]

Conversely, energy is conserved in classical mechanics (Euclidean metric) or special relativity (Minkowski metric).

In quantum theory, the law of conservation of energy can be briefly unapplied.

The vacuum can indeed "lend" energy to a collision of particles, provided that this energy is immediately returning. Without going into complex considerations, Heisenberg's principle of indeterminacy authorizes this "violation".

Many physicists do not seem to postulate in favor of the conservation of the energy of the Universe. Two solutions are then possible in the case of an increase:

Either there is a creation of energy in the Universe;

Or the energy comes from the "outside".

Force and Energy

You can't talk about force without talking about energy. Energy is what characterizes the forces of interaction. Although related, force and energy are not equivalent. One, force, is the derivative of the other, energy. The link between the two is: work - the work of a force - that is, its circulation - is energy - we can therefore see a force as a factor in the transfer of one form of energy to another form of energy.

The theory of fields at all scales states that: [a force creates energy which produces a force field.]

Fundamental Interactions

Current theories show that our Universe is governing by four fundamental (absolutely conservative) interactions. These four forces are at the origin of the stability of matter and radiation as we know them today.

The characteristic intensities of the four fundamental interactions must meet at an energy close to 1019 GeV.

[The four fundamental forces govern how all the objects and particles in the Universe interact with each other. But recently, physicists say they have found possible signs of a fifth fundamental force of nature.

Professor Mark Lancaster said that "we have discovered that the interaction of muons is not in agreement with the standard model." He added that "it's exciting because it potentially points to a future with new laws of physics, new particles, and a new force that we haven't seen to date."]

Unification of Theories

Physics has an aesthetic dimension, so theorists almost systematically seek to simplify, unify and symmetrize theories. It is done by reducing the number of fundamental constants (and sometimes by deleting them) and bringing together previously distinct conceptual frameworks.

The difficulty in fundamental physics lies in the unification of the four fundamental forces of interaction (gravity with the three other interactions (strong nuclear, weak nuclear, and electromagnetic)) which seems impossible.

They are four possible interactions between particles and carried by what are called bosons.

→ Electromagnetic interaction (boson = photon)

→ Weak interaction (bosons = W+, W-, Z0)

→ Strong interaction (bosons = gluons)

→ Gravitation (boson = graviton)

These four interactions intervene at different stages of Universe life, the three first act at a short distance and the fourth at a very long distance.

[The graviton is highly hypothetical because the quantum theory is incompatible with gravitation which is modelled on a large scale by General Relativity.] [1, 19]

Note

Top-down approaches (which assume the invention of a new theory based on principles we cherish and then deduce what we expect from particle colliders) postulate that the fundamental forces are unifying or that the Universe has extra symmetries, or that the parameters of the theory are "natural". But none of these assumptions are necessary. They are just assumptions.

Invariance by temporal translation symmetry

The Lagrangian of general relativity is not systematically invariant by time translation. It is not invariant by time translation in an expanding Universe, so no conservation of energy in this case.

[But Noether's theorem also formulates, or renews, an even more striking truth: time can only be defined if energy is conserved.]

Globally, the Universe is a closed system where energy is conserved!

Attesting the invariance by symmetry in time on the universal plane supposes the study of several Universes in evolution.

Thus, what would allow us to model universal energy and know what is invariant for a given Universe, is to study what varies from one Universe to another and what remains constant. We would then have a chance to link this invariance to the other invariances observed from the interior of the Universe...

We would then have a universal Theory of energy, integrating energy from the external and the internal point of view. Unfortunately, for any observer inside the Universe, some events of our history remain singular and thus without any point of comparison that would allow us to model them. The inflationary period of the Universe can be qualified neither as invariant nor as non-invariant. Indeed, we do not know to which type of symmetry this invariance or non-invariance could refer.

The large-scale structure of the Universe is composed of voids and filaments. In publishing his theory of general relativity, Einstein demonstrated that this structure depends on the potential influence of all energy sources on the total density. Symmetry theories, which happily manipulate quantum physics, allow the

vacuum to have a non-zero energy density - one of the many paradoxes of quantum physics. These are the quantum fluctuations that are functions of the Higgs fields.

Andrei Sakharov defined a cosmological constant making it possible to calculate this "energy of the vacuum". But of the value that one allots to him depends the geometrical structure of the Universe. For this very reason, its determination is the subject of particular attention. The Big Bang theories allow us to arrive at a solution, but the values they propose for this constant are far from being in line with the observation. In the eyes of physicists, it means that the world of elementary particles is far from having delivered all its secrets. Many problems remain unsolved.

[In classical field theory, for example, an electromagnetic field can be both suppressed and canceled. The vacuum is the absence of a field. In quantum theory, on the contrary, a field is irremovable. One cannot get rid of it. The vacuum can, therefore, only be a state of the field. And if the field thus acquires an ontological status, the particles, on the other hand, lose theirs: they appear, disappear, transform themselves. The reason for these strange behaviors is that the particles are the emanation of the field. They have lost their situation of "fundamentals of the Universe" to become only the manifestation of fluctuations or excitations of the quantum field.

A quantum field remains a quantum field, possibly without any particle if it is in its empty state except in rare cases of spontaneously broken symmetries. The appearance of particles reveals the transition from this vacuum to excited states of the quantum field. The main thing to remember is that the particles tell us about the force fields of the excited state. It is these excitations that we could call particles. They are the ones that carry energy. Note that the quantum fields do not move in space. The quantum fields being motionless.] [1, 20]

Supersymmetry

Supersymmetry is a complex mathematical framework based on the theory of group transformations. The idea of supersymmetry comes from the fact that by extending the symmetries of space-time, it becomes possible to consider bosons and fermions, and thus, in certain sense matter particles and boson interaction vectors, as two states of the same super particle.

Supersymmetry more than doubles the number of particles in the standard model. In supersymmetric theories, each particle has a previously undiscovered "superpartner" with many similar properties. Fermions and bosons go together.

[The association of a bosonic particle with a fermion of the same mass provides several advantages. This method eliminates, in particular, the problems of infinities appearing in the calculations].

By introducing a kind of super isospin as in the nuclear force theory and more remarkably, if we insert a supersymmetry group and "gauge" it, gravitation appears automatically. This local supersymmetry is called supergravity.

[Supersymmetry is initially a global symmetry of space-time (involving the Poincaré group). Supergravity" has become its local formulation. The "M theory" has recently revived another generalization of Einstein's theory]. [1, 21]

The simplest supersymmetric theories (those that best explain the Higgs boson) predict a zoo of new particles with masses comparable to the W and Z bosons.

They lead, at least, to double the number of (complex) Higgs doublets and imply relations between the different masses of the particles.

However, it seems increasingly unlikely that supersymmetry could include all three features: an explanation of the mass of the Higgs boson, a dark matter particle, and the unification of forces.

For technical reasons, adding supersymmetry to a theory is an effective way to "get rid" of a possible tachyon. Thus, in 1981, the American physicist Michael Green and his compatriot Schwarz developed a new string theory, or rather "superstring" theory, based on the idea of Scherk and Schwarz, but in which no tachyon remains because of the use of supersymmetries.

In a quantum framework, the superstring theory can be a possible way to unify all interactions. Indeed, superstrings are, at the same time, the elementary brick for matter, fundamental interactions, and space- time.

Entropy and Arrow of Time

[In physics, we explain things not only by laws but also by initial states. A system starts in an initial state and then evolves in time according to law. The second law of thermodynamics says that systems evolve from a less probable to a more probable state. The arrow of time is that process of evolving to more probable states. Lee Smolin]

[Thermalization is a natural and irreversible phenomenon that occurs when two systems come into contact, as both tend to what experts call thermal equilibrium.

This seemingly innocuous phenomenon introduces a fundamental asymmetry in physics: it defines a time arrow. From our daily experience, it always flows from the past to the future.

Sean Carroll explains that: "the fundamental laws of physics make no distinction between the past and the future". According to Carlo Rovelli, physics ignores the problem: "it describes how things evolve in their times, not how they evolve in time."

In this sense, the equations are symmetrical in all disciplines: from mechanics to quantum theory via electromagnetism.

The second law of thermodynamics states that natural processes demonstrate an increase in the universal entropy and, never the other way around. Clausius thus defined the meaning of the time arrow.

We can now define entropy as a measure of the disorder in nature. Entropy tends to increase as order becomes more likely. It was Boltzmann's major contribution, and it was the one that led to the problem of the arrow of time: the future differs from the past simply because the entropy of the Universe has increased.

If we study cosmological evolution and the big bang theory, the Universe must have been in a very low entropy - that is, a very ordered state - when it was born.

And it is not sound very convincing that something so well-organized could emerge from a massive explosion.

Note that the Universe is not a thermodynamic system because it is governing by an external force: gravity.

Why did the Universe, which arose immediately after the big bang, did so in a highly improbable state of order?

Without a way to describe how the Universe came to be, we cannot explain why it had low entropy and, thus, understand the arrow of time. And the relevant question is: what is a high-entropy state like when gravity becomes an essential component of the system?

According to Rovelli and his collaborator, Marina Cortês, the Universe is a succession of unique events that never repeat. Because every series of events can only influence the next, the arrow of time appears naturally.

Penrose, meanwhile, proposes the hypothesis of Weyl's curvature. It stipulates the existence of a natural law that distinguishes past and future spatiotemporal singularities. And it endows the Universe with an arrow of time.

When did time begin to flow?

Thomas Gasenzer and Jürgen Berges, physicists from the University of Heidelberg (Germany), published, at the end of 2019, research entitled: "How did the arrow of time appear if we start far from equilibrium like this happened at the birth of the Universe? ".

According to Gasenzer, the Universe was a vast "far from balanced" ocean of quantum energy.

If we could observe that ocean of primordial energy over time and at different scales, we would see that everything remained the same, as frozen, in a state of no change, no time.

A slight disturbance ended that non-time state governed by fractal dynamics, resulting in a dense soup of quarks (protons and neutron bricks) and gluons (particles that hold the quarks together).

The Universe then became subject to the second law, and the entropy increased in an active process of several billion years.

In summary, the Universe was born from an initial singularity following the massive explosion and cosmic inflation. In an insignificant fraction of a second, it multiplied its size by 1026. This primitive energy could have remained immutable indefinitely, without past, neither present nor future. Then, suddenly, a tiny change occurred that imposed a sense of flow on the energy that bathed primordial space, an arrow of time. Gerardo Franco: "Have we finally figured out where time came from?"]

Cosmic Time

The time of our clocks does not have the same meaning as cosmic time. The clocks' time allows us to compare phenomena taking place in the Universe. cosmic time is a conceptual time. It indicates the great stages of universal evolution positioned at different "moments" of its history.

All the equations of physics are symmetrical by reversal of time. Its means that between one moment and another, something is conserved.

But for the Universe, it is not the time of the clocks that we have to consider, but the cosmic time which acts on the scale factor by the expansion.

The Friedman-Lemaître equation is also symmetrical by reversal of cosmological Time. We can play the film backward to converge towards the initial singularity. Its means that the energy (which is the law of invariance per unity of cosmic Time) is also conserved.

Does space differ from time?

The flat space-time is necessary to define the matter. Distinctions between space and time are only possible at the low energies of everyday life.

In general relativity, we assume that we live in a (pseudo-Riemannian) space-time of variable curvature. Note that curvature is an observable related to the distribution and motion of matter and energy in the way described by the field equations.

In general relativity, the invariance by diffeomorphism makes the distinction between space and time impossible.

More explicitly, we cannot uniquely identify the coordinate x0 with the physical time t. This identification is only possible in special relativity. In this one, the invariance under the Lorentz transformation of space and time differentiates energy, momentum, and angular momentum as fundamental observables. The properties of matter are always defined using space-time descriptions of special relativity.

No distinction is also possible between space and time in quantum mechanics. Mass and space-time are on an equal footing, and in a certain sense, particles and vacuum have for origin the same substance.

Remarks

[In mathematics, a diffeomorphism is an isomorphism in the category of differential varieties. It is a differentiable bijection of one variety in another (whose reciprocal bijection is also differentiable).]

[Talking about quantum mechanics forces us to change our references. We can no longer place ourselves in time, by evoking chains of causality staggered in a chronology of time, because the quantum world is dimensionless, neither temporal nor spatial.]

In quantum mechanics [where everything is a question of the probabilistic nature (of physical phenomena) without being ever of cause and effect], it is possible to conceive unique situations in which an event can be both the cause and the consequence of another one. This possibility, allowed by the theory, has determining implications for the foundations of quantum physics, quantum gravity, and quantum computing.

Time in Relativity

The theory of relativity has challenged the usual properties of time. It is no longer possible to consider time as a universal and independent entity.

Albert Einstein showed that the flow of time is relative. Why?

"Simply" because motion in space affects its flow. Einstein thus revealed the fundamental link between space and time, implying in passing that past, present, and future exist in the same way and without distinction!

However, to consider that "relativity has definitively condemned most of the properties of time and the notions related to it" is to take a quick shortcut and bury time itself. If relativity has called into question the notions of simultaneity and chronology, it is by conferring on time the rather rigorous status of dimension in Minkowski space.

Finally, relativity tells us that seeing far away means 'see in a past time'! But to want to find an origin to the Universe as space-time is a futile exercise. The extrapolation which allows us to arrive at the zero instant is abusive because it is an instant through which the Universe (as described by the current physical laws) could never pass!

But should we resign ourselves to the fact that if the time 't = 0' is inaccessible, it means that the quest for origins leads straight ahead to a dead end?

Notes

Because of the principle of generalized covariance - which manifests the indifference of the theory to the choice of coordinates - Einstein's theory does not have variables that can get along with time. It contradicts the quantum theory since the latter is basing on a very particular figure of the time, in this case, the Newtonian time. In other words, the variable 't' which appears in the Schrödinger equation is in flagrant contradiction with the covariance of general relativity.

The coordinates have no physical meaning, i.e. they do not identify particular points in space or space- time. It only is when, equipped with a metric, that the distances between points make sense.

The Space Time

The space-time is constituting by the set of possible values of the quadruplet: (x,y,z,t). It is defining in all possible coordinate systems as well as their transformations.

The speed of light is part of the definition of space-time. Indeed, the existence of a maximum speed in nature obliges introducing a variety of space-time (i.e. continuous sets of points) for its description. In the theory of special relativity, such a space-time is called Minkowski space-time.

Minkowski space-time and Galilean space-time are both flat varieties, i.e. free of any curvature. Time then becomes an observer-dependent concept.

In space-time, motion does not exist. It exists only in space. For each point particle, space-time contains a line of the Universe. Space-time is, consequently, squared by lines of the Universe. It is why we use the usual expression of "frame" or "texture" of space-time.

Since the speed of light is constant, we deduce that the energy impulse dictates the space-time to curve. Concretely, the curvature of time is translating by the slowing down of a local clock. The curvature of space, as for it, is translated by non-linear trajectories.

The space-time of Einstein's relativity is continuous and curved (the flat case not being excluded a priori) and differentiable. This type of space cannot account for the quantum properties of matter.

In general relativity, the structure of space-time becomes dynamic: it is no longer fixed a priori but becomes dependent on the different physical processes. This interdependence between the metric and the material content of the Universe makes the distinction made in classical physics between kinematics and dynamics untenable. We speak then of "background independence" or the absence of background. This characteristic of general relativity is, for many, much more fundamental than the revolution brought by special relativity that depends on a non-dynamical framework and which determines a priori the space-time localization.

[During the last decades, our conception of space and space-time has been considerably enriched on the conceptual level.

It has undergone profound changes thanks to the employment of several new non-point, non-linear and non-commutative mathematical structures.

These structures form today what is called quantum geometry, a geometry with very different properties compared to the properties that characterize Euclidean geometry but also Riemannian geometry.

These structures are at the heart of non-abelian gauge theories, which have succeeded in unifying particles, fields, space-time geometry, and dynamics of physical phenomena.

The tour de force lies in the mapping of the description and explanation of fundamental interactions at the quantum scale to the structure of certain transformation groups (compact Lie groups) and their representations (Lie algebras).

The extended construction of the standard model includes, in a unitary model, the electroweak interaction and the strong interaction. It exploits the idea of the group and asymmetric space. The latter is a fibered space which is a more general concept than that of a variety. It has a connection (a geometrical object that generalizes the Riemannian metric) on which it acts.

This connection can also have a curvature and a torsion, which will have considerable consequences on the behavior of the physical phenomena considered.

The standard model of particles physics has succeeded in giving a deep and coherent description of the physical interactions emanating from the three fundamental forces acting in the subatomic world. The standard model attempts to explain all phenomena of particles, except gravity. It is then unable to explain the behavior of the gravitational force and, consequently, to include general relativity in a global unitary framework.

The theory of superstrings and non-commutative geometry are among the most significant. Not only in terms of new and fine mathematical structures (which they were allowed to discover) but also in terms of new epistemological concepts. These new concepts are necessary to be able to think about a complex and interwoven physical reality.

A fundamental philosophical idea underlying these theories is to extend the four-dimensional space-time model of general relativity to higher dimensions.

Recent attempts to arrive at a non-perturbative quantum field theory embracing, inherently, gravitation are based on the idea that space-time at the quantum scale must have an essentially fuzzy structure (resulting from a mixture of continuous and discrete properties). Such a structure includes topological singularities of some type. They are non-linear solutions to the equations (monopoles, solitons, etc.).

It is indeed possible to show, based on both mathematical and physical reasoning, that for phenomena existing at the Planck 10-33 cm scale, the effects of quantum fluctuations on the curvature of space-time are large enough to produce decisive modifications in its topology. It suggests the idea of a kind of non-linear superposition of different topologies. A "smooth" (or continuously differentiable) variety would bear little resemblance to this superposition.

More precisely, at the quantum scale, we can hypothesize that the structure of space6time is not that of a differentiable variety C∞. But presumably the equivalent of a topological, non-classical space constructed from a compact and complex Riemann surface with edges.

Several topological and algebraic invariants, namely: lace invariants, knots, braids, etc., are defined on these edges.

The values of these invariants would correspond to the dynamical states of the physical theory that concerns us.

The theory of superstrings has remarkably developed this idea both on the mathematical and physical levels.

One of the consequences of this hypothesis, in particular in quantum field theory, is that the global topological properties of the variety M. (Lorentzian or pseudo-Riemannian) play a fundamental role and, consequently, several quantum physical effects come from the global geometrical structure and topology of

M. (Source: Luciano Boi, lecturer; Mathematical Structures and Philosophical Concepts of Space-Time in Contemporary Physics).]

Motion in special relativity

Although limited in speed, special relativity shows that motion is at the same time relative, defined by the propagation of light, conserved, reversible, and deterministic.

To explain the relativistic motion of a free particle in terms of an extremal principle requires the definition of action. Now the physical action is a measure of the change that takes place in a system. For a free particle or a particle in inertial motion, the only transformation is that of time. Therefore, the action of a free particle will be proportional to the elapsed proper time. The expression of the action for a free particle is:

S = - mc2 ∫dζ, [5] where ζ is the proper time along the trajectory.

The proper time is maximal when the difference between the kinetic energy and the potential energy is minimal. Special relativity shows that nature minimizes the change by maximizing the proper time.

The reference frame in relativity

The central idea of relativity is that we cannot talk about quantities such as speed or acceleration without choosing first a frame of reference. Any motion, any event is then described in relation to the observer's frame of reference.

Relativity and coordinate system

In general relativity (and this reflection also applies more generally to the framework of curved space geometry), we can use any coordinate system to describe a given space-time. But we need to be careful when looking for physical information about that space-time.

Generally speaking, only the "geometric" space-time object has a "physical reality" and not all the information contained in the coordinate systems. However, we can use them to describe it. Let us note, in passing, that in some particular coordinate systems, phenomena seem to occur without any concrete existence.

Unitary Constant

Planck length PL = (ħG/c3)1/2 ~ 10-35 m [6] and Planck time PT = (ħG/c5)1/2 ~ 10-43 s [7] are the two most fundamental physical constants and are intrinsically quanto-gravitational.

The relativistic constant c = (PL / PT) [8] is not the only structure constant of space-time.

There is another structure constant of space-time (of the same physical importance as c): the product (PL.PT), noted b = ħG/ c4 = 8.71360(88).10-78 m.s [9] and named "unitary constant" (inheriting the quanto- gravitational character of PL and PT).

Precise spatiotemporal location

In order to locate accurately in three-dimensional physical space, one must not only measure the three coordinates of the vector r = (x,y,z) but also measure a pulse q, an inverse scalar of a time. And to locate in a precise one-dimensional time manner, not only the scalar duration t must be measured, but also a waveform s, an inverse vector of a length.

More realistic conceptions of the spatial and temporal position than r and t are (bq; r) and (bs; t). The scalar impulse q and the vector ripple s are, like the vector r and the scalar t, coordinates (non-local variables), called "wave coordinates" (the heart of the problem here).

On the one hand, the scalar q and the vector r and on the other hand the vector s and the scalar t are, strictly speaking, inseparable: r is only one syllable of the word (q; r), and t is only one syllable of the word (s ; t).

Saying or writing "r" without "q", or saying or writing "t" without "s", is equivalent to approximating

b = 0. However, b is infinitely small but not equal to zero. Any theory containing an "r" not associated with a "q" or a "t" not associated with an "s" is, strictly speaking, erroneous.

The physical space is three-dimensional but to locate without ambiguity in this three-dimensional physical space, the three coordinates r are not enough. Likewise, the single scalar t is not enough to spot unambiguously in time, even though it is a one-dimensional space. Spatiotemporal tracking requires more coordinates than space-time has dimensions!

Remark

Two thousand five hundred years ago, Plato had already sensed that if man reasons in conditions where his perception is limited in dimensions, the deep understanding of phenomena escapes him.

What is a unitary position?

The hypothesis of unitary location states that a definition of the spatiotemporal position more in line with reality than (r ; ct) is ((bq ; r); c (bs ; t)), named "unitary position" and that defining the position by (r ; ct) is equivalent to making the double approximation

PL (Planck length) → 0 and, PT (Planck time) → 0.

This hypothesis explains why we have so far ignored the need for wave coordinates for precise localization in physical space and time.

The transparency of the double approximation PL → 0 and PT → 0 in the definition (r ; ct) can be explaining by a theoretical-experimental conjuncture. It also demonstrates that, under current experimental conditions, the experimental detection of this double approximation can only be indirect. It is elucidating by the above analysis of physical constants. On the one hand, experimentally, we have observed lengths and durations that are respectively much greater than PL and PT. And on the other hand, theoretically, we use the constant c, the ratio of PL and PT, which, unlike the product b, is not necessarily affected by this double approximation:

PL → 0 and PT → 0 => b = PL*PT → 0 and c = PL/PT → c => ((r ; bq); c (t ; bs)) → (r ; ct)

It also demonstrates that, under current experimental conditions, the experimental detection of this double approximation can only be indirect. It is explaining by the above analysis of the physical constants.

In summary, the hypothesis of unitary detection demonstrates the possibility and affirms the existence, at the very origin of current physics, of an involuntary approximation - i.e., an error.

Is a unitary position both vectorial and scalar?

The unitary spotting hypothesis considers the coordinates r and t as proper to the 'spotted' and the coordinates q and s as specific to the 'spotter'.

If q is a pulse and s is a ripple, then q is a true scalar and, s is a true vector.

Now, via the constant b, this scalar q is associated with the vector r and this vector is associated with the scalar t: [bq] = [r], [bs] = [t]. One interpretation of this association is that there is (at least) another association with another quantity "j" so that jq is vectorial as r and js scalar as t.

Furthermore, if: jq and js are specific to the locator ("the observer"), then they should be non-observable that is, mathematically speaking, a pseudovector and a pseudoscalar.

The quantity j would thus be a pseudovector so that jq is a pseudovector and js a pseudoscalar.

Thus, the definitions of the spatial and temporal position would be respectively vectorial (r ; bjq) and scalar (t ; bjs) where: j is a pseudo vectorial and dimensionless (and presumably imaginary, the number i being pseudo vectorial) quantity.

According to this interpretation, the "unitary position" is written as follows:

(r ; bjq); c (t ; bjs)] where the "spatial position" (r ; bjq) is vectorial with r true vector (tensor of rank 1) and bjq pseudo vector (tensor of rank 2), and where the "temporal position" (t ; bjs) is scalar with t true scalar (tensor of rank 0) and bjs pseudo scalar (tensor of rank 3).

Note

The number of components of the vector product, tensor of rank two, is exceptionally equal to the number of dimensions of the space in which it takes place when this space is three-dimensional - thus when it is physical space. It is then appropriate to represent this tensor of rank two by a vector, which we call "pseudo" or "axial", and to call the tensor of rank one "true vector" or "polar vector".

A similar convention also exists for some tensors of rank three that have only one component and which are called "pseudo scalars" to distinguish them from the "real" scalars (zero-rank tensors).

Is the unitary position homogeneous to energy?

Yes. [(ħq, Fr), c (ħs, Ft)] is a form of the unitary position homogeneous to the energy where:

F = c4/G ~ 1044 Newtons [10], ħs/F being a form of the unitary constant.

[So, the distinction between space-time and matter is not clear since quantons - in other words, matter - are considered not as something “in space-time” but as space-time in itself. (Source: Jean Marie LABOPIN, theoretical physicist)]

Vacuum Energy

The vacuum, as we imagine, is not empty at all. It contains a form of energy in the form of fluctuating quantum fields. These cannot have a mean value of zero due to Heisenberg’s indeterminacy principle.

According to quantum theory, our Universe was born from a fluctuation in quantum vacuum energy (or zero-point energy). One could say in a pictorial way that this term of energy of the vacuum designates a Universe underlying ours. It is devoid of time, space and mass. Its entropy is maximum (infinite?) Insofar as it is impossible to give any information about what is there.

Special conformal transformations

The vacuum is conformally invariant and also invariant by dilation. It is the other way of expressing that the absolute vacuum alone cannot define lengths since it does not set a scale factor. The matter is necessary for that. Conformal (special) transformations are not representative symmetries of situations containing matter. Only empty space is conformally invariant (cosmos as a whole is not).

Conformal invariance implies reversal symmetry, i.e. that the large and small scales of empty space are connected. It suggests that the constancy of the speed of light is associated with a reversal symmetry.

Note

Transformations are named conformal when they do not change the angles for (infinitesimally) small shapes. They, therefore, leave the morphology (of infinitesimally small objects) intact. They are named ‘special’ when the whole conformal group contains the dilations and the non-homogeneous LORENTZ transformations.

Remark

Since dilations do not permute with translations in time; there is no conserved quantity associated with this symmetry. On the contrary, rotations and translations in space permute with translations in time and thus lead to conserved quantities.

The infinitely small and the infinitely large

[World reality is far from being continuous, derivable, and integrable. It is especially unable to give a physical meaning to the infinitely large and small.

In physics, there is no factual existence of the infinite, neither large nor small. Physicists did not invent infinity: they started to use this mathematical concept by necessity. Indeed, for mathematicians, infinities, both large and small, are defined as a process of crossing the limit.

In no field of physics, and not only in quantum physics, one cannot progress quantitatively without reaching a qualitative leap which leads us into another physics, towards a field where other laws apply.

There are thresholds everywhere, whether they are lower or higher. They are tipping points that ensure the transition between quantitative progression and qualitative change. The matter thus passes from one hierarchical level of structure to another. During the qualitative leap, it is not only the same parameters that continue to evolve, but the laws themselves change.

Planck’s constant is an action minimum. It implies minima of time, space, mass, or energy below which no one can go. The Heisenberg inequalities are another manifestation of this impossibility.

Such well-matched parameters mean that an increase in one leads to a decrease in the other. The parameters can neither be arbitrarily small nor arbitrarily large. It is the uncertainties in the measurements of the coupled parameters that indicate their degree of accuracy. It means that the agitation around a position can be neither as intense as expected nor as weak. One can neither arbitrarily mitigate the agitation of particles nor arbitrarily increase it. All this comes from the fact that the quantum is indivisible, irreducible, and unsurpassable. Therefore, the jump is inevitable in quantum physics. Nothing exists below the quantum, and nothing either between one and two quanta or between two and three quanta, etc. No access to continuity has been possible in a physical phenomenon! (Source: How physics solves the thorny question of infinities? by Robert Paris)]

Note

Due to the weakness of our senses, the phenomena seem mysterious and contradictory to us. Indeed, they can reach neither the infinitely large (characterized by a flexible, dynamic and, continuous space-time which interacts with the matter it contains) nor the infinitely small (determined by a flat, static and discrete space- time).

Two notions of infinity

Mathematicians distinguish between two notions, of which only the first one can make sense. What are the notions of infinity?

The potential infinity

The first notion of infinity is potential infinity. When we say that the set of integers (1, 2, 3, etc.) is infinite, we use this notion: any number can be exceeding. If I ask you to give me a large number, I can always find a larger one: by adding 1 to it, for example. In ancient times, mathematicians only admitted this notion of infinity. Physicists can also easily accept it.

The actual infinity

The for-real infinity, the one that physicists refuse, is called the actual infinity. The word "actual", must be taken here in the sense of "effective".

To consider it in some of the calculations is interesting in mathematics, where the consideration of infinitely small quantities makes it possible to solve some problems. This notion also allows us to consider infinite sums such as: S = 1/2 + 1/4 + 1/8 + 1/16 + etc. [11]

Giving them meaning is a more delicate matter. In this case, a small drawing helps to do it:

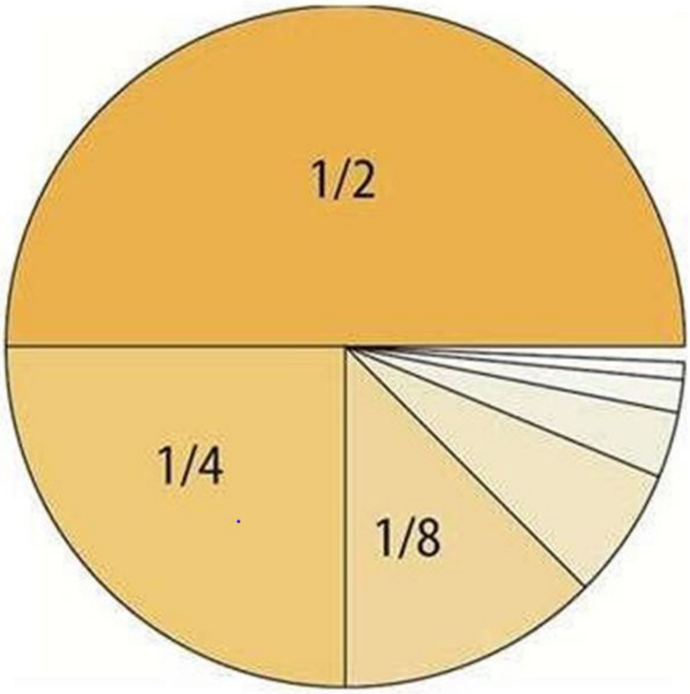

Figure 2: Divide a pie by cutting it in half, then the rest in half, ..., ad infinitum. © Hervé LEHNING

This geometrical division shows that: S = 1. However, this division can only be achieved in the ideal because, very quickly, the pieces are only crumbs.

Remark

If we ask ourselves the question about the existence of infinity, the answer depends on the meaning given to the verb "to exist".

Therefore, the answer is undoubtedly no if it is an existence linked to material reality. On the other hand, it is positive if it refers to a mathematical concept.

[Hervé LEHNING is a graduate of the 'Ecole Normale Supérieure' and has taught mathematics for over forty years. Crazy about cryptography, a member of the Association of Cryptography and Information Security Reservists, he has in particular unlocked the secrets of Henri II's encryption box.]

Relationship between the two absolute bounds (0 and 1) and the two infinities

Let's pose: ∞ = X;

Which is equivalent to writing: ∞ + 1 = X + 1; Now, since ∞ + 1 = ∞, then ∞ = X + 1;

Let's raise both limbs to the power of 0, which gives us:

∞0 = (X + 1)0 → 1 = (X + 1)0;

X = 0 is a solution since 10 = 1; So, we get: ∞ = 0.

- Let's pose the same: ∞ = Y;

Which is equivalent to writing: ∞ - 1 = Y - 1; Now, since ∞ - 1 = ∞, then ∞ = Y - 1;

Let's raise both members to the power of 0, which gives us:

∞0 = (Y - 1)0 → 1 = (Y - 1)0 ;

Y = 1 is a solution since 00 = 1; So, we get: ∞ = 1.

- Therefore:

0 = ∞ = 1 [12]

If I put: ∞ = 1 → (1 / ∞) = (1 / 1) → 0 = 1;

If I pose: ∞ = 0 → (∞ - 0) = (0 - 0) → (∞ - 0)0 = 00 = 1;

∞ = 1 is a solution since 10 = 1 → 0 = 1.

- By setting: (0 = 1);

I pose: (∞ / ∞) which is indeterminate but in fact (∞ / ∞) = 1 by definition.

I pose on the other hand: (0 / 0) which is indeterminate but in fact (0 / 0) = 1 by definition. So, I get (∞ / ∞) = 1 = (0 / 0), which implies: (0 / ∞) = 1 = (0 / ∞) = 0.

But like (0 = 1) → 0 = (1 / ∞) = 1 [13].

[12] & [13] → ∞ = 0 = (1 / ∞) [14] & ∞ = 1 = (1 / ∞) [15].

The two infinities (the infinitely small and the infinitely large) join the two absolute limits that are the '0' and the '1'.

Leibniz and the binary representation of the creation of the world

[No life without number. The world is creating when God calculates. From nothingness, from zero, God creates 1. The '0' and the '1' order the world. These two numbers are the foundation of all that is on earth as in heaven. In the beginning, was the number, and the number was in God." (Gottfried Wilhelm Leibnitz)]

The two numbers "0" and "1" must imperatively be taken into account in any physical theory without constants. The world owes its existence and its order only to them!

The universal language is indeed binary that allows the most complex calculations.

[Leibniz worked on the binary system as a substitute for the decimal system. He linked it logically to the creation of the world. Leibniz designates the creative unity by the unity (1), whose highest expression is God, and the nothingness of the formless chaos by the zero (0).

According to him, Nothingness (0) and God (1) are the basis of all creation.

In the whole binary arithmetic, there would be only two characters, 1 & 0. God (1) and nothing (0) are the origins of all things. God (1) created everything from nothing (0) and still does, conservation being only a continuous creation. This origin of things from God (1) and nothing (0) presents a great analogy with the emergence of all numbers from unity (1) and zero (0). Indeed, all numbers can and even must be expressed most scientifically by the couple 1 and 0, and consequently, by a unique and continuous relation to these two first elements of numbers. The evolution and the secret of the Universe are therefore taking place through these two numbers (0) and (1).

Leibniz defended the idea that a world created out of nothing by God could only be confirmed with the help of mathematics.

According to him, God is a perfectly wise creator who, conceiving the world, materializes the numbers and acts as the ideal mathematician. Thus, numbers and their bases represent the foundation of the world.

The binary system of Leibniz (with the base symbols 0 and 1) is the model par excellence of creation. The possibility of representing Genesis using the binary system serves as a definite confirmation of Leibniz's accuracy in a mathematizing global reality.

Finally, as symbolic writing born from the variation of the symbols 0 and 1, we think that the binary system is an attempt by Leibniz to create a universal language.

This system in base-2 could very well describe the whole creation so that it does not differ much from the mathematical formula.

Note that the symbolic image of Genesis and the binary world is the undisputed proof of the correctness of his choice! (Aleksandar Nikolic)]

Major problems facing contemporary physics

The three theories of relativity, quantum mechanics, and statistics have changed our daily life. But they are not sufficient to explain the current state and the evolution of our observable Universe.

Continuity and Quantization

Einstein's General Relativity deals with space-time and gravitation and assumes that space and time are continuous. Quantum mechanics describes the behavior of particles and has introduced the concept of quantization which imposes, for example, that the range of energy available to a particle covers a discontinuous spectrum and is limited to discrete values.

However, the quantization of gravitation poses almost insurmountable conceptual difficulties since it implies the quantization of space-time itself. The gravitational force is indeed directly linked to the metric.

It is the heart of the problem: how to reconcile continuity and quantization?

Infinitely small and infinitely large

The existence of a form of energy belonging to the vacuum is attesting by two approaches (from two radically different theories). Although its source is still unknown, it is logical to think that it is the same form. Moreover, most physicists consider vacuum energy through a single concept, i.e. independently of the theory to which it is supposed to belong. However, there is a big problem when the two values overlap. Indeed:

When cosmologists calculate the energy density of the vacuum (quantity of energy per unit volume), they

obtain a density ρcosmology = 10-8J.m-3 [16];

When quantum mechanical physicists do their calculation on their side, they get a density

ρquantic = 10113J.m-3 [17].

The difference is unheard of; a factor of 10120 exists between the two calculations of the vacuum energy density. Proof that the current physics is in the dead-end!

Quantum mechanics and gravity

Quantum mechanics works perfectly well with the three forces (electromagnetic, weak, and strong) but fails with the force of gravity. The reason is that the assumption of zero-dimensional entities leads to absurdities such as infinite densities, infinite energies, and infinite deformation of the space-time continuum.

Gravitation and renormalization

One of the most fundamental notions in quantum physics is that of "unitarity". It briefly describes the fact that the sum of the probabilities of an event (conserved in time) must always be equal to 1.

General relativity also explains that the notion of time cannot be absolute. Indeed, for a given observer, that only appears to be time can be conceived differently for another and be interpreted as a subtle mixture of space and time. This nuance complicates the unitary theory development that is compatible with the "basic principles" of relativity.

Moreover, another decisive element of quantum physics is the notion of "indeterminacy" (of Heisenberg) of the result of a measurement, which is at odds with the determinism of general relativity. Let us note that these problems only appear when one seeks to quantify the gravitational field itself. It is not the case when one tries to describe the quantum field in a fixed curved space-time. These two theories do not disagree on everything. The difficulties lie in the way the structure of space-time is modeling.

Nevertheless, if we naively apply quantum principles to the notion of dynamic space-time, it appears that at small scales, this notion must probably take the form of a kind of "incessant bubbling". Indeed, smooth and calm at large scales, the "fabric of space-time" is characterized by quantum fluctuations at small scales.

A major theoretical problem is a probable appearance of "holes" during space-time fluctuations. It is translated in mathematical language by "topology changes".

From a technical point of view, these typical changes at small scales have their origin in one of the difficulties of the quantization of gravitation. This difficulty comes from its behavior concerning a mathematical procedure usually used in research for the quantum formulation of the interaction: the "renormalization".

Roughly speaking, this procedure consists in undertaking calculations at a given scale even if one cannot do them with a single formula valid at all scales. Concerning gravitation, it implies the appearance of infinite terms more and more numerous as one advances in the calculation.

Fundamental Contradictions

The following contradictions have to be solved:

The photon and the energy

How to reconcile the fact that:

[Photons are particles with a frequency ν of light and carrying an energy E (Wikipedia);]

The photon is not energy and, that matter is made solely and exclusively of motion which is the basis of space-time which itself condenses into photons (according to the authors of the unitary theory);

The photon is an object that belongs neither to our space nor to our time since these two concepts (taken separately) are foreign to it (according to the unitary theory).

Particles and space-time

How to reconcile also the following assertions of the physicists:

Matter is not necessary for space-time to exist. According to the unitary theory's authors, the matter only exists as a consequence of the preliminary existence of space-time;

The fundamental particles do not exist in space and time. These are space and time that combine as a function of them (according to Banesh Hoffman and Michel Paty in "L'étrange histoire des quanta");

The differentiation between space-time and matter is immediately blurring since quantons - in other words, matter - are not considered as something "in space-time" but as space-time in itself (according to Jean Marie Labopin).

Wave-corpuscle duality

The theory of quantum mechanics is incoherent because, on the one hand, it affirms the wave-corpuscle duality and, on the other hand, it denies it, hence the problems of interpretation that it always poses.

Mass of the Universe

How to reconcile the contradictory theories concerning the mass of the Universe:

The quantity of matter is constant in the Universe and that, consequently, its expansion does not produce an increase of that one. The amount of energy that has been available at its birth and that gave the present Universe is always constant. By virtue of this, we can affirm that in the sense of Einstein, the Universe's mass always remains constant;

If the Universe is expanding, then the space of the Universe is also doing. It necessarily implies that the associated mass must also be because the increase of the Universe's mass follows naturally from the notion of Eigen space that associates a volume of space with a mass (according to the author of the space theory).

About Time

The variable 't' which appears in the Schrödinger equation is in flagrant contradiction with the covariance of general relativity.

Conservation of energy

Energy expresses the belief of physicists that the laws of physics are invariant by translation in time. Worded in another way, it boils down to: first in the form of a principle of invariance by translation in time, then in an energy conservation law (which is the basis of the definition of time).

The statement that energy is conserved would only be correct for a Universe in which space does not change with time. But in our Universe space is expanding. This expansion leads to a violation of the energy conservation law. But if energy is not conserved, time is no longer defined!

Unified theory without any constant

The idea of the unifying 'Theory of Everything' should ideally reduce the fundamental constants to zero. The goal of physicists is precisely to find a theory that would not need to set the values of the fundamental constants!

Note

The constants are objects of the language of physics. They exist (objectively, naturally) while being only idealities (subjective, produced by a formalism). It is not a very comfortable ontological status, but this caution is necessary.

The constants are only the reflection of our incomprehension of the Universe that surrounds us.

The unified theory based on absolute physics, proposed here, reduces the fundamental constants to zero. It is basing on eight (08) key principles, namely:

1. Spatiotemporal location requires more coordinates than space-time has dimensions;

2. Accuracy leads to the unitary position that is homogeneous to energy;

3. The duality "information - energy" established contemporary physics. Wanting to penetrate the secret of the Universe requires not only questioning the problematic of information but also how it circulates, in other words, energy;

4. All aspects of the Universe are energetically and entropically connected;

5. The energy N from which the Universe originates has a different meaning than the energy E of phenomena occurring in the Universe.

Reasoning in terms of energy E is to make the following eight equations converge two by two (convergence by pairs):

$E_U = K\Lambda.c^4.V / G$ (cosmological scale vacuum energy) [16],

$E = ½ \hbar\omega$ (vacuum energy at the quantum scale) [17],

$E = k_B T$ (thermal energy) (18], $E = mc^2$ (nuclear energy) [19], $E = h\nu$ (radiant energy) [20],

$E = [h^2 / 8ma^2] (n^2_x + n^2_y + n^2_z)$ (energy of an atom of mass m in a cubic box of edge 'a') [21], $E = S_{BH} .T = [¼ k_B (c^3/ \hbar G) A].[\hbar c^3 / 8 \pi k_B G M]$ (black hole radiation energy) [22] and $E_{gw} = (G / c^5) s^2 w^6 M^2 R^4 t$ (gravitational radiation energy) [23].

6. The energy is not invariant by translation in time. The universal expansion causes spatial dimensions to change over time. It leads to a violation of the principle of conservation of energy. The laws of physics are therefore bound to change!

7. The infinitely large and the infinitely small meet at the two absolute boundaries '0' and '1'. Note that equality (0 = 1) is the basis of all creation. The numerical convergence of the equations (taken two by two) is thus made possible;

8. Time, Space, Mass, and Energy are physical quantities independent of each other (evolving in relation to themselves).

Conditions to unify the physical theories

To unify the physical theories, it is necessary:

1) Let the infinitely large and the infinitely small meet;

2) To reason in the absolute;

3) To do away with the cosmological Standard Model and the Standard Model of particle physics;

4) Stop reasoning in terms of position, momentum, spin ...;

5) Ignore the notions of elementary particles, forces (fundamental interactions), fields, and energy;

6) To admit the fact that there is no more object, observable, observer, and reference frame;

7) To know that the mathematical representation of a system has no more sense (in quantum mechanics, the state of a system is representing by a vector in a Hilbertian vector space),

8) Forget the fundamental constants and the International System of measurements;

9) Overlooking the continuum versus discrete dialectic;

10) Link physics and information.

Global convergence and paradigm shift

Physical reality must be subject to the constraints imposed by the experimental process and to physical laws. It is entirely determining by the mathematics that underlies it. Our Universe is structuring by physical laws. A good theory explains the world as simply, economically, and globally as possible. In the perspective of global convergence, the laws of relativity and quantum and statistical mechanics must lead to a single fundamental law. The different domains (the infinitely small and the infinitely large) must imperatively be able to meet to form a continuous explanation at all scales of the world.

This unification requires a precise location which supposes taking into account the unitary constant 'b'. But as the unitary position is homogeneous to the energy, this one must qualitatively mutate towards a radically new form designated by N.

This qualitative change entails, in its wake, profound upheavals in the very nature of time, space, and mass. Thus, the precision brought to the tracking is at the base of a change of paradigm. The new physics that unites the two infinities in a single framework is neither quantum nor relativistic, but absolute!

Methodology leading to the unification of energy equations: basics of absolute physics

This methodology consists of the following steps:

1) Establish the two absolute reference frames:

The absolute axis A (1): product of a unitary one-dimensional time by a unitary one-dimensional space;

The absolute axis A (0): product of a one-dimensional zero time by a one-dimensional zero space.

2) Remove all the constants (even the most fundamental ones, i.e. G, c, h, and kB) by multiplying the two members of the eight energy equations by the unitary constant b.

3) Denote by N the product of the energy E by the product of a one-dimensional time and a one-dimensional space.

4) Take two by two the eight equations thus obtained: the number of possible combinations is giving by the formula C82 = [8! / ((8 - 2)! 2!)] = 28.

5) Perform numerical convergence as follows:

Let αi be a non-zero rational number with i a natural number such that $1 \leq i \leq 28$;

Let βj be a natural number with j a natural number such that $1 \leq j \leq 28$;

Then αi 10βj = 1 = αi 10- βj at the A (1) axis and αi 10βj = 0 = αi 10-βj at axis A (0);

[βj being considered as the convergence step of the chosen pair of energy equations.]

There is an additional "junction point" which is the "point" common to all 28 junctions and corresponds to (10-0 = 0 = 100) and (10-0 = 1 = 100).

6) Converge the different pairs of energy equations to the unifying equation

{N = (E (x, y, z) / t) M} [2] at their own step (with E (x, y, z) absolute space, t absolute time and M absolute mass).

The Good Equation

[The great quest in all of science is the search for an equation, perhaps no more than one-inch-long, which can unify all the laws of the Universe, and perhaps allow us to "read the Mind of God," in the words of Albert Einstein. It will be the crowning achievement of science." Michio Kaku, professor of theoretical physics.] [1, 46]

The leading candidate today is a unified theory based on absolute physics.

Absolute universal structure

The universal expansion (which is now accelerated) takes place along a double axes structure (universal absolute reference) that are:

The zero universal axis defined as follows:

A (0) = (zero one-dimensional time) * (zero one-dimensional space);

And the unitary universal axis defined as follows:

A (1) = (unitary one-dimensional time) * (unitary one-dimensional space).

Each axis is doubly graduated, that is to say, on two scales (infinitely large and infinitely small).

This structure is doubly closed in the expansion phase but opens at only one end (ultimate point of expansion) in the creation phase.

Application of the methodology to one pair of equations taken as an example: nuclear energy and radiation energy

The convergence on the two planes (dimensional and numerical) is explaining as follows:

Convergence on the dimensional plane

The equivalence equation in relativistic physics is the following:

E = mc2 (where c = 299 792 458 m/s) [19].

By multiplying (or dividing) the two terms of this equation by the unit constant

b = ħG/c4 = 8.71360(88).10-78 m.s, [9] we obtain the following equation: {E.R = (E(x, y, z) / t) M} (Where E(x, y, z): three-dimensional space, t: one-dimensional time, M: mass and R: product of one-dimensional space by one-dimensional time).

By convention, we will call N: the product (E.R). We thus obtain the equation:

{N = (E(x, y, z) / t) M} [2].

Attention, the absolute mass 'M' differs radically from the mass 'm' in E = mc2. The emission and absorption energy exchange equation is as follows:

E = hν (the relativistic invariant is the action quantum h = 6.626068 x 10-34 m2 kg s-1 and

ν: a wave frequency) [20].

By multiplying (or dividing) the two members of this equation by the unitary constant

b = ħG/c4 = 8.71360(88).10-78 m.s, we obtain the following equation:

{E.R = (E(x, y, z) / t) M}

(Where E(x, y, z): three-dimensional space, t: one-dimensional time, M: mass and R: product of one-dimensional space by one-dimensional time).

We obtain in the same way (with the same conventions) the equation {N = (E(x, y, z) / t) M} [2].

Convergence in the numerical plane

To fulfil the sufficient conditions for unification, the constant (h / c2) and its inverse (c2 / h) must take the numerical values '0' and '1'.

In other words: (299 792 458)2 / 6.626068 x 10-34 = 1 or 1.36 1050 = 1;

and numerical value of the ratio (h / c2) = 1 that is - to - say 6.626068 x 10-34 / (299 792 458)2 = 1 or 0.74 10-50 = 1.

We then obtain the following double equality: 1.36 1050 = 1 = 0.74 10-50 [15]

And numerical value of the ratio (c2 / h) = 0 that is to say (299 792 458)2 / 6.626068 x 10-34 = 0 or 1.36 1050 = 0;

and numerical value of the ratio (h / c2) = 0 that is - to say 6.626068 x 10-34 / (299 792 458)2 = 0 or 0.74 10-50 = 0.

We obtain then the following double equality: 1.36 1050 = 0 = 0.74 10-50 [14]

When we divide [14] by [15] we get: 1 = 0 = 1 or 100 = 0 = 10-0.

When we divide [15] by [14] we get: 'indeterminacy' = 1(division by '0' is therefore possible).

(1 = 0) when (100 = 10-0) and when (1.36 1050 = 0.74 10-50).

The unifying equation thus takes two forms:

{N = (E(x, y, z) / t) M} [2] when 1.36 1050 = 1 = 0.74 10-50

And {N = 0}[1] when 1.36 1050 = 0 = 0.74 10-50

[(E(x, y, z) / t) M] can thus take the value '1' or '0'.

The Two Universal Phases

The design of a two-phase Universe results in the following two equations:

[(-) (dt / t) / (dE(x, y, z) / E(x, y, z)) / (dM / M) / (-) (dE/ E)] = 1 [24] (for the 'expansion – evolution' phase);

[(dt / t) / (-) (dE(x, y, z) / E(x, y, z))] / [(-) (dM / M) / (dE/ E)] = 1 [25] (for the 'contraction - creation' phase).

The mother equation of the eight energy equations is obtaining by equality between the succession of ratios of the variations of the physical quantities concerning themselves (in a precise order) and the unity taking into account the signs. This equation becomes in both cases:

E = (E(x, y, z) / t) M (dE / dM) (dt / dE(x, y, z)) [26] Since the four physical quantities belong to the following intervals:

0 ≤ t ≤ 1; 0 ≤ E(x, y, z)) ≤ 1; 0 ≤ M ≤ 1; 0 ≤ E ≤ 1, their elementary variation in the form dx must be integrated

from 0 to 1 so as to have:

(∫1 dM)(∭ 1 dE(x, y, z)) **E** = *(E(x, y, z) / t) M (∫1 d***E***)(∫1 dt)* [27]

0 0 0 0

This leads to {N = (E(x, y, z) / t) M}[2].

Note

The equation {N = (E(x, y, z) / t) M} can only be considered true if [dx / x = 1]. But this condition is not met since [dx / x = 1] apparently has no solution. In fact, it does have one! This will be the subject of a future publication.

Explanation in Geometric Terms

The methodology consists of building a regular octagon where each vertex represents an energy equation. Then consider each of the eight sides and the twenty diagonals as one of the levels where the two infinities meet. For numerical convergence to occur, all twenty-eight levels must match all pairs of equations.

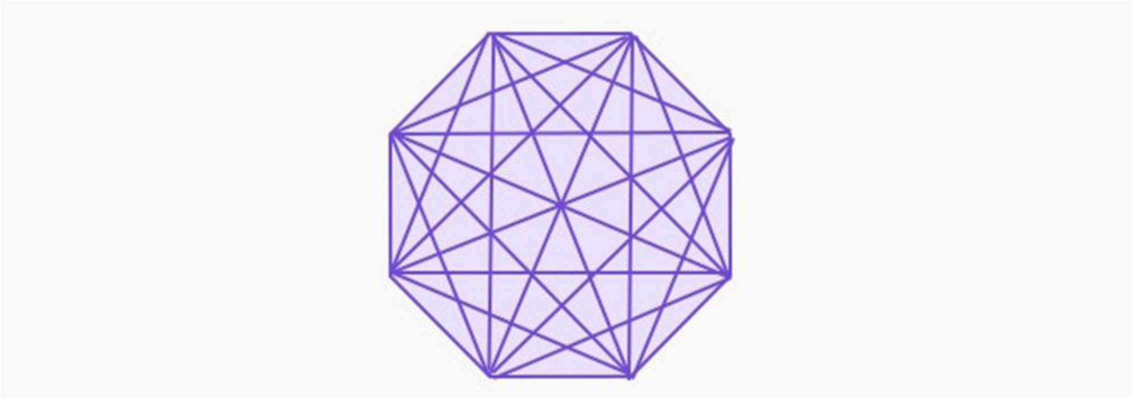

Figure 3: Different levels of convergence of the energetic octagon

Conclusion

Our Universe would be 95% filled with dark matter and dark energy, the emergence, and nature of which no one has yet been able to explain.

No instrument or experiment has observed the slightest cosmic structure or particle that could assume the role of this invisible mass.

This 95 % is composed on the one hand of dark matter, made up of particles that are unknown today

(25 %), and on the other hand of the dark energy (repulsive and antigravitational) at the origin of the expansion of the Universe (70 %). The latter two do not emit or absorb light, so they are invisible.

This dark energy has a negative pressure; it acts as a kind of antigravity that feeds cosmic expansion, while the gravity of matter slows it down. While baryonic matter and dark matter dilute with the augmentation of space, the density of dark energy remains almost constant.

By accepting this curious composition, cosmologists were able to develop the standard cosmological model. A model which, while - remaining compatible with general relativity and observations, - strives to coherently describe the history of the Universe from the Big Bang to the present day.

But there is something wrong with the Universe that this model describes. Dark matter can only relate to as yet unknown physics.

Theorists have shown that the existence of negative masses is perfectly compatible with general relativity. However, the movements that these masses could have with each other would be unusual. It boils down to aggregation between positive masses, and a distancing and repulsion between negative masses!

Within the framework of absolute physics, the notions of object, observable, and observer's referential are absent. Time, space, mass, and energy are affected by signs, sometimes positive, sometimes negative.

Absolute physics does not conceive reality as discrete and does not represent it as a continuum. It escapes completely from the international system of units. However, it offers keys for the following enigmas:

(-) (dt / t): the acceleration of time,

(dE(x, y, z) / E(x, y, z)): the acceleration of the universal expansion,

(-) (dE(x, y, z) / E(x, y, z)): the spatial contraction during the phase change, (-) (dM / M): the nature of dark matter,

(-) (dE/ E): the nature of dark energy.

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