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The most ancient and moving history of thought

Nothing engages the human mind more than space, that intriguing essence of everything that is outside us and within us. The immensely large and the immensely small excite and puzzle us.

But what is space? What is this entity that we are a part of, this entity that, in perfect harmony with our eye-brain system, thanks to light, has given us knowledge of space and of ourselves?

It has always seemed extremely familiar to us, so much so that the centuries-old foundations of science were set on the few certainties and axioms that describe it.

I am referring, of course, to three-dimensional space, which the great Euclid described 2300 years ago in ancient Greece

The Euclidean structure has governed space for many centuries, even though it is unclear what it actually is. It emerged in conformity with experience, and experience is the only certainty that science has.

But space, its physical essence, has been one of the most toiled over ideas in the world of knowledge, because it is undeniably difficult to understand what space actually is, especially in the absence of matter. As a reminder, let’s go back along the path of history to the sixth century before the birth of Christ.

The idea of the Pythagoreans is perhaps the most immediate, the most intuitive. Space is an empty container in which material objects find a place. According to the atomists, it is this void that permits atoms and their aggregates to move around.

Aristotle’s idea is different and more profound. It is not empty space that accommodates material objects, but the objects that determine space, which is not a single entity like Pythagorean space, therefore, but the sum of spaces due to objects.

However, in the 6th century AD this idea is called into question by Philoponus, who revisits the atomists’ and Pythagoreans’ conception of empty space. For Philoponus, space occupied by an object is διαστεμα□□that is, the volume of the object, a void that persists even in the absence of the object.

On the contrary, the Neoplatonist Damascius revisits the thinking of Aristotle, claiming that space is the measure of the positional relation of the different parts of an object and of one object in relation to others. This relation is inseparable from the objects, seeing as it is due to the relationship between the objects themselves.

What we see, therefore, is an alternating between the idea of a single empty space, independent of material objects, and the idea of space derived from the presence of material objects. But human efforts to understand continue to plot a trail on the stone of knowledge.

Moving forward, we arrive at an interesting turning point, to the Renaissance and B. Telesio, who rejects Aristotle's conception, arguing for a single homogeneous space, in which similar and dissimilar objects are respectively attracted and repelled by reciprocal forces. Telesio's space is similar to the space of G. Bruno, namely empty and infinite.

Then we come to the great Galileo, whose idea anticipates today's scientific thinking. For the scientist, space is not homogenous at all, nor is it isotropic. It is space that governs natural motion.

One more step forward for mankind was accomplished thanks to another genius, R. Descartes, who highlights the geometrical configuration of space, considering matter to be only pure extension in three dimensions, in this way cancelling out the existence of a void.

We mustn't forget the conception of space of H. More, who belonged to the Cambridge School. For him, spiritual substances also extend in space.

However, the prevailing idea is that space is immaterial, infinite, uniform, inseparable, an immobile container of everything.

Also for Newton, space is absolute, infinite, homogenous and isotropic.

J. Locke, G. Berkeley, D. Hume and G.W. Leibniz actually counter the idea that space really exists, proposing that the conception of space is the result of a subjective ideal elaboration, drawn from visual and tactile sensations.

Kant refutes the reality of Newton's absolute space, but also the reality of space intended as abstraction of sensorial data. For Kant, space is the intuition of objects outwith us, an intuition that does not allow us to appraise the reality of relationships between the objects themselves.

This brings us to the thinking of C.F. Gauss, who persists with the empirical knowledge of the properties of space, that is, on geometrical knowledge based on ancient Greek thinking.

It would appear that after many centuries of inertia, geometry, which had trailed behind with respect to the progress made by physics, is heading towards a rebirth, keeping the original premise of adherence to experience.

In fact, Euclid's axioms are again a topic of discussion. The fifth in particular, which had already been debated in the seventeenth century, arouses concern again, becoming the object of study once more. Clarification is sought, demonstrating validity using the *reductio ad absurdum* technique, refuting, that is, the content.

The unexpected failure leads to the thought that we may have geometries that are independent of the hypothesis of parallel lines, and thus the rebirth of a geometry that is a faithful representation of the experience of space is brought to a standstill.

With the work of J. Bolyai and Gauss, we begin to see a distinction being made between geometrical space and physical space.

For B. Riemann also, geometrical space is three dimensional like Euclidian space, but not the only space possible.

In the middle of the nineteenth century, the distinction between geometrical space and physical space leads to studies by H.L. von Helmholtz and M. Faraday. Electromagnetic forces can act without the existence of ether, a very tenuous, elastic and weightless means, present all over the universe, and assumed to explain the propagation of light, polarization and other phenomena.

Faraday's was a magnificent idea, tending to consider matter as a concentration of attractive and repulsive forces.

And light revolutionises space

Meanwhile, Maxwell's equations demonstrate that the electromagnetic wave, therefore light, does not follow Galileo's principle of relativity. It is discovered that its speed is always the same in all inertial reference systems, that is, in uniform rectilinear motion.

This phenomenon is the first sign that a revolution in the concept of space is imminent; it is the very spark that ignites the revolution. But the constancy of the speed of light is also, as we shall see further ahead, the first sign that there are more dimensions than the three that had governed all the laws of physics until that point.

Despite the great work by J.C. Maxwell that demonstrates the non-elastic nature of luminous waves, the idea of ether being immobile in absolute space persists, until electro-dynamic experiments like those of A. Michelson and Morley, aimed at demonstrating the immobility of ether, give negative results and lead to a denial that it even existed.

The distinction between mathematical space and physical space widened considerably with the work of F. Klein, a mathematician who proposed the transformation group theory, a set of abstract operations with characteristic properties.

Klein broadens, by generalizing it, the meaning of geometry, intended as theory of the properties of invariants with respect to a certain group of transformations. In this way we have the total detachment of geometry from ordinary sensorial perception.

It is important to reflect on this step in the history of thought, because it is here that the reason for the enormous difficulty in conjugating the most advanced physics studies with the backward knowledge of space is to be found.

The detachment of geometry from experience gets to the point where it rejects the idea that geometry can describe the space we live in, and suggests that the study of space has become a problem for physics.

For H. Poincaré, the choice of a geometry is just a convention among scientists, the choice that permits us maximum simplification in the description of natural laws. He is convinced, however, that this choice always reverts back to the ancient geometry handed down to us from Euclid.

All of a sudden, a turning point

However, in 1915 something completely unexpected and mind-blowing happened, something that brought down H. Poincaré's concept of space.

Ten years before, two profoundly revolutionary articles arrived at the famous German journal, *Annalen der Physik*. In the first, it was demonstrated that light is made up of particles, like matter. In the second, the theory of matter and the theory of light are unified.

Our gratitude goes to the journal, to its enlightened editors, for having had the intelligence to publish these two articles, despite the fact they had been submitted by someone who, at that time, was an unknown employee in the patent office in Bern.

This is the beginning of the revolution that will lead to the general theory of relativity.

Einstein revolutionises the idea of space, demonstrating that space, fused with time, deforms, curves. Geometry goes back to adhering to empirical reality, such that it merges with physics.

In fact, it is demonstrated that spacetime is a physical entity, not homogenous or isotropic at all.

Space is not what for centuries it was thought to be, although the representation based on Euclid's axioms is still sufficient for all human activities that do not involve macrocosm and microcosm.

Being a physical entity, spacetime can and must be represented by a geometry that conforms to experience, able to explain known phenomena and anticipate as yet unknown phenomena.

The original role of geometry of studying real dimensions in accordance with experience is confirmed.

The spacetime of relativity, however, is still quite distinct from matter and energy. What distinguishes these three physical realities?

The mystery of entanglement

Meanwhile, the studies on light that lead to the theory of relativity also lead to quantum mechanics, the theory that describes the behaviour of matter and energy, that is, of elementary particles, atoms, nuclei and radiation, whose properties assume only discreet values.

What quantum mechanics affirms is experimentally evident, but as is well known, it remains incompatible with the theory of relativity, despite the fact that Einstein was one of the main authors of the former, with the concept of quanta of light.

Einstein considers quantum mechanics “incompatible with every reasonable and realistic conception of the universe”, when it affirms that the results of measurement of a given observable are not fully determinable. He holds that the values of observables exist objectively, regardless of whether they are measured or not.

It seems that the concept of space has no evolution in quantum mechanics, but the theory highlights a new phenomenon, difficult to accept, which E. Schrodinger calls ‘entanglement’, a phenomenon certainly linked to space.

The phenomenon is substantiated by the experiments of Bell, Clauser, Aspect, Rarity and Tapster, which appear to contradict the principle of locality assumed by Einstein.

If we have two particles that originate in the same instant by a natural process or division, like photons deriving from a single photon in Mendel’s experiment, whatever the distance between them, the value of a property of a particle instantly determines the corresponding value in the other, maintaining the initial global value.

Whatever the distance between them!

What happens, basically, is exactly what Einstein held to be absurd and impossible when he proposed the EPR experiment.

There doesn’t appear to be any relationship between this incredible reality and the astounding reality of a curved space and time. And yet both indicate the presence of forces. What link is there between the forces of nature and space?

An inadequate space

In 1919, a few years after the birth of the general theory of relativity, the mathematician, T. Kaluza, thinks that if Einstein describes the force of gravity in terms of deformations and curving of spacetime, then perhaps it is possible to use the same idea, the same model, with the other known force, the electromagnetic force.

But if three-dimensional space describes gravity, then which space do we use to describe the electromagnetic force? Kaluza contemplates, therefore, the possibility of more dimensions than the three we already know.

In a space with four dimensions instead of three, he describes the deformations and curvatures and arrives at the equations of Einstein, plus a new equation, and discovers that this new one coincides with the equation that had for some time described the electromagnetic force.

But where is the fourth dimension?

Many scientists, including Einstein, seek, like Kaluza, a unified theory that can describe all the forces of nature with a single set of ideas, a theory of everything.

It is thought that the existence of other real dimensions as well as the three that were already known could lead to this dream coming true. In 1926, Klein postulated large, clearly visible dimensions, and very small, curled up dimensions that are impossible to see, but this geometry does not adhere to reality.

So it goes no further. The theory doesn't take off. In the second half of the last century this extraordinarily fascinating hypothesis is disregarded and there is no more talk of dimensions.

Then, in more recent times, due mainly to work by Schwarz and Scherk, a new theory, as fascinating as it is revolutionary, is developed, a theory that seeks to unify the laws that govern our world. This is known as the string theory.

It inexorably puts the focus back on Einstein's spacetime and the dimensions of Klein and Kaluza.

For this theory to be formulated, there have to be ten real dimensions of space. At first glance, this might seem like madness, like Einstein's revolution of space had seemed many years before.

Where can so many dimensions, which had until then been unknown to man, be hiding?

According to the theory, there is a cluster of filaments of energy within particles, strings to be precise, which vibrate. Like the strings on a violin, these vibrations can produce different tones and vibrate at different frequencies, producing the different particles that exist in the Universe, electrons, quarks, photons, gravitons, etc.

If only these ten dimensions really existed, the dream of scientists would come true.

In any case, we have still to discover a new geometry adapted to the revolution that took place in the last century and shook physics, generating the mighty branches of general relativity and quantum mechanics.

What revolutionary development of the Euclidean map can describe phenomena we know as well as anticipate as yet unknown phenomena?

The discovery of ten real dimensions of spacetime

Our path brings us to the present day, to the discovery, as revolutionary as it was anticipated, of the ten dimensions of spacetime we live in.

We outline it here in a simple manner, in a way everyone can understand, and refer those who wish to delve deeper to the published article on the discovery (1).

It is not difficult to understand where and how these ten dimensions extend, because they are all based on a few very simple rules, experienced in the first three dimensions, and therefore common property of all.

As we know, spacetime formed by these dimensions curves.

Something that is less well known is a consequence of the general theory of relativity. The fact that spacetime can always curve means the straight line does not exist in the reality of space.

The straight line, an open entity, can never become a curve, a circumference, a closed entity (2).

The straight line is actually the maximum circumference possible with respect to a human observer, that is, with respect to our eye-brain system.

Having clarified this, we move on to the few rules drawn from the first three dimensions.

The first rule is that every dimension extends in opposite directions.

The second rule is that every n-dimensional space curves and covers the whole extension of n+1 dimensional space (for example, when the radius and therefore curvature of two-dimensional space, the spherical surface, changes, like when a balloon is inflated, it covers the whole three-dimensional volume of the sphere).

The third rule is that the geometrical entity that separates the two opposite directions of the n-dimension has n-1 dimensions (for example, any parallel that separates the second dimension of the spherical surface of a world map has only one dimension).

Finally, the fourth rule is that if, from a separating entity of dimension n we follow on the n the direction diverging from it, we will come to any other separating entity of n in the direction converging toward it (for example, if from a separator point of the first dimension, from a point on a meridian, we follow on it the direction diverging from it, we reach any other point on the meridian in the direction converging toward it).

These few rules suffice to describe all the dimensions of spacetime, and that is how we discover an unexpected reality, extraordinarily harmonious, a melody of incomparable elegance.

Let's start from what we know about the first three dimensions.

S_1 one-dimensional space is space with any maximum circumference.

S_2 two-dimensional space is space with any maximum spherical surface.

S_3 three-dimensional space is space with any maximum spherical volume.

We said that two-dimensional space belonging to three-dimensional space curves, changing radius and therefore curvature, and covers the entire extension of three dimensional space (second rule). Obviously, curving of two-dimensional space, namely the spherical surface, causes the circumferences that are a part of it to curve.

Therefore, curving of three-dimensional space into the fourth dimension must cover the whole extension of four-dimensional space, but must also curve the spherical volumes, spherical surfaces and circumferences that are a part of it.

So what does to curve three-dimensional space mean?

It means to expand or contract it, so that it changes the curvature of spherical volumes, spherical surfaces and circumferences that are part of it.

It is easy to imagine the fourth dimension, because enlargement by microscope or telescope simulates the reality that expands into the fourth dimension, or rather seen by an observer, contracts into the fourth dimension.

But our visual system also simulates the fourth dimension when we move closer to or further away from an object.

We shall see that without the fourth dimension we would have no light and therefore no knowledge.

Matter

Let's continue to focus briefly on the fourth dimension and try to apply the rules explained above; however initial reflection leads us to affirm that four-dimensional space most certainly cannot accommodate corpuscular nature.

Matter would have infinite superimposed three-dimensional states, which would make our reality impossible.

With this in mind, what, we ask ourselves, is the shape of the separating entity of the fourth dimension, that we would like to know in nature.

This entity is a spherical volume (third rule) that separates the two directions of the fourth dimension, separates, that is, an expanding concentric spherical volume (like a balloon inflating) from a contracting concentric spherical volume (like a balloon deflating).

As it has to be able to expand and contract, this must necessarily be a sphere, which we refer to as M_3, with a well-defined radius with respect to we human beings.

It is possible to diverge from or converge toward a separating entity (fourth rule), but the opposite directions are not superimposable. The same spacetime cannot expand and contract together.

So we will have: (F. 1)

$+M_3$, s_3 sphere that separates the opposite directions of the fourth dimension diverging from it, of s_3 space expanding outwards, contracting inwards;

$-M_3$, s_3 sphere that separates the opposite directions of the fourth dimension converging toward it, of s_3 space contracting outwards, expanding inwards.

Thus, if from a $+M_3$ sphere we follow in the fourth dimension the direction of divergence from it, that is, the direction in which it is expanding, we come to any other $–M_3$ sphere in the direction of convergence toward it, that is, in the direction in which it is contracting (fourth rule).

Obviously this means that expansion in the fourth dimension is linked to contraction by a transition stage in which inversion occurs.

The rays of the star described by points of $+M_3$ during expansion converge in an anti-star described by points of $–M_3$ during contraction. Star and anti-star form what we could call a bi-star $+M_3$ $-M_3$.

At this point, we ask ourselves where these M_3 entities reside in the reality we live in.

As you will shortly understand, in order to answer this question we should take a look at the fifth and sixth dimension.

So, let's curve four-dimensional space into the fifth dimension.

The moving closer of $+M_3$ and $–M_3$ is a direction of the fifth dimension, because four-dimensional space contracts into the fifth dimension.

The moving away of two $+M_3$ o $-M_3$ is the opposite direction, because four-dimensional space expands into the fifth dimension.

The extension of the fifth dimension manifests therefore through a force that moves M_3 spheres closer together or further apart.

A force?

Yes, there needs to be a force that has two opposite directions, one that drives expansion and the other that drives contraction.

A $+M_3$ and a $–M_3$, superimposing their fourth dimension directions, that is the directions of expansion and contraction of the force, draw closer, realizing a fifth dimension direction.

Two $+M_3$ or two $–M_3$, superimposing their fourth dimension directions, that is, the directions of expansion or contraction of the force, move apart, realizing the opposite fifth dimension direction.

This conclusion is very important, because the exquisitely geometric development has led to the discovery of forces in the extension of the dimensions, of all the dimensions.

Actually, we should have expected this, seeing as also the general theory of relativity describes spacetime as a physical entity with a curvature that changes in relation to the size of the curving mass. Relativity shows, that is, the presence of forces that soundly link matter and spacetime.

Mindful of the fusion of forces and dimensions, we now move on from the fifth to the sixth dimension.

Five-dimensional spacetime s_5 separates the opposite directions of the sixth dimension (third rule).

Contraction of s_5 is a direction of the sixth dimension. Expansion of s_5 is the opposite direction.

Overall (F. 2) the resultant of forces expressed by the fourth, fifth and sixth dimension, part of a ray of the $+M_3$ $-M_3$ bi-star, curves along a helix on a rotation surface of the bi-star.

The sixth dimension permits rotation around the extension of the fourth dimension, just like the third dimension permits rotation around the extension of the first dimension.

We now have enough facts to identify where nature manifests the fourth, fifth and sixth dimension.

Physics demonstrates that the curving of three-dimensional space into the fourth dimension manifests in the electric field.

The direction of expansion of the fourth dimension corresponds to the field created by a positive charge, the direction of contraction to the field created by a negative charge.

The convex curve of expansion is linked to the concave curve of contraction by a transition stage in which inversion occurs.

If we refer to the curving of n-dimensional spacetime into dimension n+1 as the flow, we can affirm that the flow time of the fourth dimension is simply the time it takes for the field to propagate.

Particle $+M_3$ corresponds to the electron.

Particle $-M_3$ corresponds to the positron.

Now we understand what gives substance to the reality. In accordance with the third principle of the dynamics, it is the contrast between the directions of the fourth dimension, the opposition of force f_4 directions, diverging in the electron, converging in the positron, that permits the substance, the corpuscularity of matter.

The curving of the fourth dimension into the fifth manifests in the electrical current.

The curving of the fifth dimension into the sixth manifests in the magnetic field.

In general, that is, for all dimensions, the alternating between entities $+M_3$ and $-M_3$ realizes a balanced extension of n-dimensional space. The forces expressed by this space oppose a change to this balance.

This reaction of the forces expressed by dimensions to change in their extension explains an extraordinarily fascinating phenomenon that is important for our understanding of our world.

Acceleration of a $+M_3$ spacetime particle, an electron, would increase the normal extension of the fourth, fifth and sixth dimension. To oppose this increase, the part of space adjacent to that in which the extensions vary, proceeding transversally to the motion of the particles, curves into the same dimensions in the opposite direction. This second increase, in turn, leads to the same phenomenon, creating a chain inversion, that is, the six-dimensional entity known to us as quantum of energy.

Thus we reach an important conclusion.

The quantum Q_6 expressed by six-dimensional space goes from being limit between the divergent directions of the fourth, fifth and sixth dimension, like the particle of matter, to being limit between the opposite converging directions, like the particle of anti-matter.

Its oscillating nature, instantly taking on and losing corpuscularity, explains why, despite not having mass at rest, it nevertheless has quantity of motion, momentum.

The speed of electromagnetic waves, of photons, is always the same, because it is the speed of flow of the fourth, fifth and sixth dimension. Light, therefore, being six-dimensional extension, cannot accelerate or slow down, nor follow the rule for the sum of the speeds of two material bodies in motion.

In the famous double split experiment, the explanation for similar behaviour manifested by $+M_3$ electrons and by Q_6 quanta lies in the fact that both the former and the latter separate the two opposite directions of the fourth, fifth and sixth dimension in the same way.

At this point, we ask ourselves how the spacetime revolution, the coincidence of forces and dimensions, can reconcile quantum mechanics with general relativity.

Gravity and antigravity

The study of the fourth, fifth and sixth dimension shows that all the dimensions, therefore also the first three, in accordance with the theory of relativity, are fused with just as many forces in nature.

Force f_1 corresponds to the first dimension.

We move from an absence of dimensions to the first dimension of spacetime.

We know that the M_0 separating entity of the opposite directions of the first dimension is the point, but the discovery of the fourth, fifth and sixth dimension has demonstrated that the force associated with any dimension always takes on the two opposite directions of the dimension itself.

So we will have $+M_0$, the point that separates the opposite directions of the first dimension diverging from it, and $-M_0$, the point that separates the opposite directions converging towards it.

In every $+M_0$ centre we move from nothing to spacetime and, vice versa, in every $-M_0$ centre we move from spacetime to nothing.

This, as we shall shortly see, can explain fundamental phenomena in the Universe that have until now remained a mystery.

Force f_2 corresponds to the curving of one-dimensional space into the second dimension. Force f_3 corresponds to the curving of two-dimensional space into the third dimension.

The curvatures, superimposing on each other, ensure that every curve, that is every one-dimensional space, curves through $+M_0$ and $-M_0$ along a helix coiled on a rotation surface of the $+M_0$ $-M_0$ bi-star.

The resultant of forces f_1 f_2 f_3 travels along these rays in opposite directions of divergence and convergence.

Divergence.

We knew about the convergence produced by the curvature of spacetime, but now an unknown reality opens up, a reality that we had already sensed existed, however.

Experiential evidence shows that the curving of the first three dimensions manifests in the gravitational field, but the dimensions reveal a larger and more complete field than we had previously thought.

The disposition of converging forces $–f_1$ $–f_2$ $–f_3$, attractive to point $–M_0$ explains the aggregation of $+M_3$ and $–M_3$ particles of matter to it.

The disposition of diverging forces $+f_1$ $+f_2$ $+f_3$, repelled by point $+M_0$, explains why $+M_3$ and $–M_3$ particles move away from that centre, or in other words, the absence of matter and radiation.

At this point we can observe that 3d space manifests immense in the universe and infinitesimal in every 3d particle. Both contain dimensions 0d, 1d and 2d.

It is the same dimensional phenomenon we see when we consider an isolated surface and a separating surface of a volume. The latter is limited by the size of the volume, while the former has no limits. Both have the same characteristics, they contain dimensions 0d and 1d.

So inside a 3d particle are points $+M_0$ and $–M_0$ with balanced forces acting on them, as is the case in the immense space of the universe.

In this space, when 3d particles resulting from the fourth dimension are present, these particles, in as far as they are portions of 3d space, are attracted or repelled by forces f_1, f_2 and f_3 corresponding to the curving of spaces s_0 s_1 and s_2, according to whether the curvature increases, as is the case in points $–M_0$, or diminishes, as is the case in points $+M_0$.

According to the configuration of the dimensions, the attractive spaces of atoms in planets, stars and galaxies are matched with just as many invisible repulsive spaces, dark celestial bodies. The repulsive forces gather particles towards the attractive centres, adding their effect to that of the attractive forces, like an invisible substance would.

This would explain the enigma of dark matter. It would be aggregates of $+M_0$ repulsive centres.

These aggregates on the edges of galaxies would prevent the orbital speed of stars decreasing in the peripheral regions of galaxies, predicted by Kepler's third law.

The same phenomenon might explain how light is deflected even in spaces where there is no matter.

Moreover, curving of the first dimension due to the non-uniform motion of particle M_0 would produce the gravitational wave.

The quantum Q_3 would go from being limit between diverging opposite directions to being limit between converging opposite directions.

Therefore, even if we don't realize it, an accelerating body would produce a gravitational wave of Q_3 quanta.

Like electromagnetic waves, gravitational waves also would be transverse. Attractive or repulsive forces of three-dimensional space would prevent any bodies from having a constant curving motion.

A body with a uniform curving motion continues undisturbed along flow s_3 if it is not subject to other forces. Forces exerted by living beings would be needed to oppose the natural flow of the dimensions.

The alternation of attractive $–M_0$ centres and repulsive $+M_0$ centres presents a balanced universe, in accordance with the cosmological principles whereby the laws of nature are the same in spacetime

This alternation provides a new explanation for Olbers' paradox. Dark celestial bodies alternating with luminous bodies would explain why the sky is never entirely bright. It is this alternation that gives us the marvellous effect of the starry sky.

The moving away of the most distant galaxies at a speed proportional to their distance from the Earth would only be apparent, considering that the space between two dark galaxies would be expanded by repulsive forces. The lengthening of wavelengths of light coming from a galaxy, attributed to its moving further away, the redshift effect, would therefore be due to crossing space between two dark galaxies, a crossing that is repeated more times, the further away the luminous galaxy is from the Earth.

The expansion of dark galaxies would be balanced by the contraction of luminous galaxies. The Universe would, as a whole, manifest neither contraction nor expansion.

In accordance with the cosmological principle of homogeneity and isotropy, information coming from afar does not suggest that the state of the universe was very different to what it is today, but this information may be the final effects of a transmission of energy from a similar state located at an enormous distance from the Earth.

Cosmic microwave background radiation would be the light that reaches us after its wavelength gradually lengthened as it crossed enormous spaces expanding from $+M_0$ centres (redshift effect).

Therefore the Big Bang would not be necessary.

Moreover, the nature of the dimensions shows that time is not a dimension, but a characteristic of every dimension, because it is part of the extension of every dimension.

Time manifests in the flow of n-dimensional space, that is, in the curving of this space into dimension n+1, a shift that renews the existence of space moment by moment.

Spacetime thickens

Let's go back to the sixth dimension

The seventh dimension is the space into which the first six dimensions curve.

It manifests, therefore, in the curvature of the helicoid that describes six-dimensional space.

The helicoid obviously separates the opposite directions of seven-dimensional space (third rule).

We will have:

$+M_{6,}$ that separates the opposite directions of the seventh dimension diverging from it, of six-dimensional helicoidal space expanding outwards, contracting inwards;

$-M_{6,}$ that separates the opposite directions of the seventh dimension converging towards it, of six-dimensional helicoidal space contracting outwards, expanding inwards (F.3).

To simplify understanding of the subsequent dimensions, we depict the six dimensional helicoid as an ellipsoidal particle.

Expansion in the seventh dimension is linked to contraction (fourth rule) by a transition stage in which inversion occurs.

The helicoid, extending in the seventh dimension, therefore describes a bundle of helicoids.

Let's move on to the eighth dimension.

The bundle of helicoids separates the opposite directions of the eighth dimension (third rule).

The moving closer of $+M_6$ and $-M_6$ particles is a direction of the eighth dimension. The moving away of two $+M_6$ or $-M_6$ particles is the opposite direction.

The bundle of helicoids, extending in the eighth dimension, describes a bundle of bundles of helicoids.

Finally, let's move on to the ninth dimension.

The bundle of bundles of helicoids of the eighth dimension separates the opposite directions of the ninth dimension (third rule).

The contraction of this bundle is a direction of the ninth dimension. The expansion of the bundle is the opposite direction.

The two curvatures into the eighth and ninth dimension, superimposing themselves, cause every pair of $+M_3$ $-M_3$ particles, that is every six-dimensional helicoid, to expand and contract from $+M_6$ to $-M_6$ along helicoidal trajectories (F.4)

Along these helixes, the resultant of forces f_7 f_8 f_9 expressed by the seventh, eighth and ninth dimension travels in opposite directions of expansion and contraction.

Finally, it should be noted that nine-dimensional spacetime implies the existence of the tenth dimension, just as one-dimensional spacetime implies the existence of the null dimension.

We now ask ourselves once again where these latter dimensions manifest, these nine-dimensional particles that incorporate electrons and positrons.

To begin with, the knowledge that $+M_3$ and $–M_3$, namely electrons and positrons, are the only three-dimensional particles, therefore the only particles attracted by points $-M_0$, centres of gravity, we come to an important conclusion.

Although expanding or contracting in nine-dimensional space, they must necessarily be the constituents of atomic nuclei, because if this weren't the case, the nuclei particles would not be aggregated around an $-M_0$ point, and they would get lost in space instead of being part of the planets, stars and galaxies.

We would expect, then, that the six-dimensional particles, $+M_6$ and $-M_6$, are the neutron and its anti-particle.

The strong nuclear force, therefore, is the manifestation of the seventh dimension. The weak nuclear force is the manifestation of the eighth and ninth dimension.

A loosening of the grip produced by the forces of the eighth and ninth dimension, that ties $+M_6$ to $-M_6$, that is, a curving into the tenth dimension, at the edge of the atomic nucleus, would permit the external particle $+M_3$ of $+M_6$, the electron expanding in nine-dimensional space, to move away from the nucleus, leaving a proton inside it and prompting the generation of a quantum Q_9 (decay β□□according to a process that is analogous to the one that generates quanta Q_3 and Q_6.

The quantum Q9 would be none other than the *electronic neutron.*

Incidentally, it is interesting to remember that there is uniform electron motion when there is no curving into the fifth dimension.

Therefore, also the motion of the particle in the atom is uniform. This explains why, in so far as it is circular, during this motion there is no emission of energy like there is, on the other hand, in the accelerated particle rotating in the cyclotron.

Moving up the ladder of dimensions, we note how the dimensions thicken spacetime along subsequent helicoidal involutions. A first helicoid moves along a helicoidal trajectory and the helicoid of the helicoid that results from it moves in turn along a helicoidal trajectory, producing the helicoid of the helicoid of the helicoid.

The forces linked to the dimensions consequently thicken, becoming enormously more substantial.

Nevertheless, although the three-dimensional particles, electrons and positrons, expand in the subsequent dimensions, they maintain the force relating to the fourth dimension, that is, the charge.

So in the six-dimensional particle, in the neutron, containing a $+M_3$ $-M_3$ pair, electron-positron expanding in the seventh dimension, and a $+M_3$ $-M_3$ pair, contracting electron-positron, we must find two negative electric charges and two positive electric charges.

Let's now consider the charges of quarks in the neutron and in the proton.

In the transition from neutron to proton, a d quark (charge -1/3) releases an electron, turning into a u quark (charge +2/3). We therefore have -1/3 -(-1) = +2/3 charge.

If the second d quark in the neutron releases another electron we would have another u quark in the proton, that is, again a charge of +2/3.

If the u quark in the neutron releases a positron, we would have a d quark in the proton. We would have +2/3 -1 = -1/3 charge.

Thus, in the proton would remain the charge +2/3 + 2/3 -1/3= +1 of $-M_3$, a positron.

Therefore we have two negative electric charges and two positive electric charges in the $+M_6$ neutron, as predicted by the configuration of the seventh dimension.

Space goes back to representing the Universe

Summing up, the discovery of the ten dimensions reinforces the fusion of spacetime with the forces of nature and extends it to matter and energy.

It is confirmed that this reality, which the general theory of relativity announced for three-dimensional space, is present in the whole Universe, manifesting in different ways depending on the number of dimensions and therefore of forces that become thicker and thicker, as they climb the dimensional ladder, along a succession of helicoids.

This results in a conceptually simple and harmonious structure, aimed at universal balance.

This model of the Universe is based on experience, on elementary rules we all know.

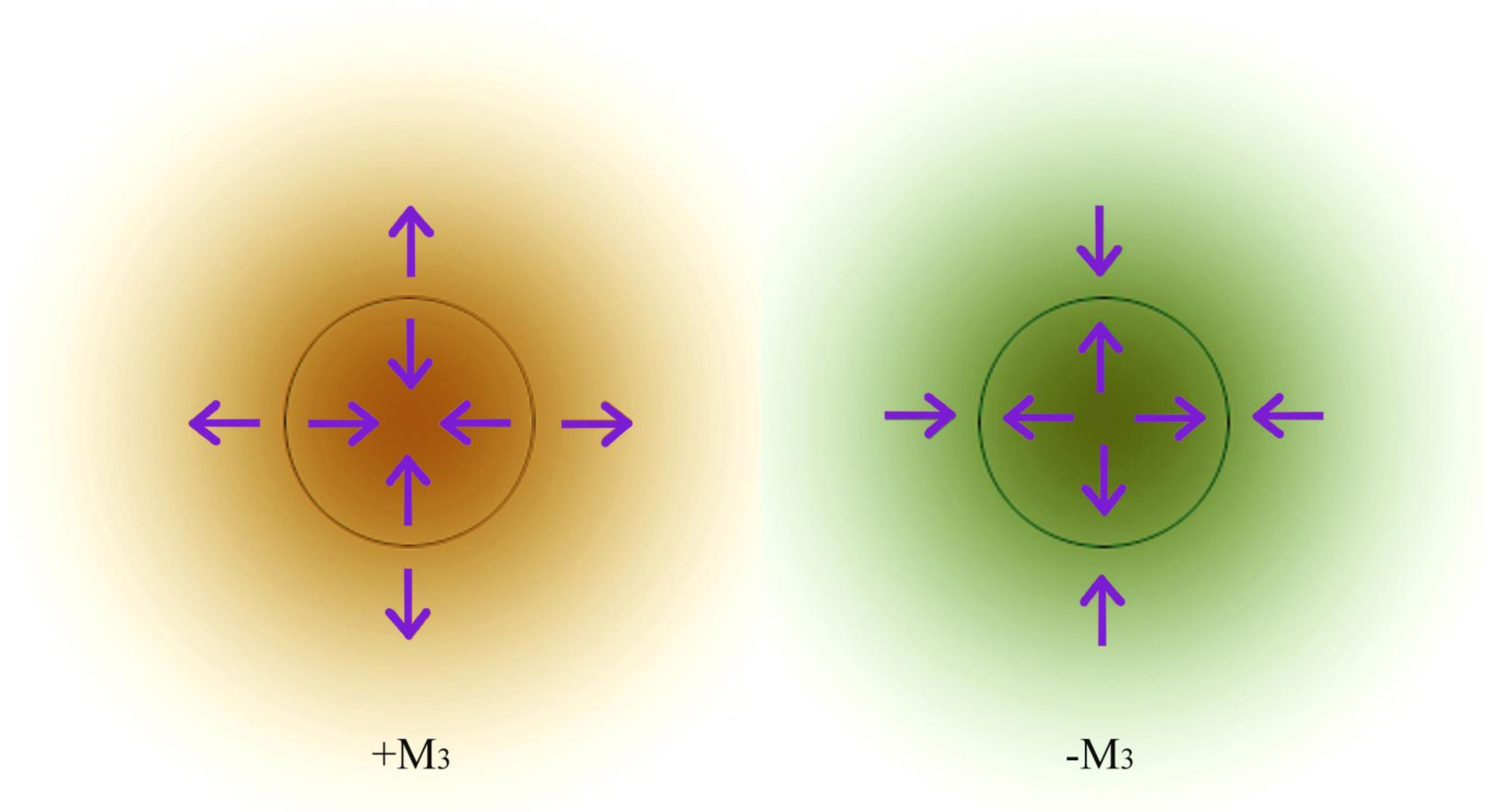
From the theory of relativity to string theory, physics, the science of nature, has for many years now been indissolubly fused with space science.

The discovery we have looked at together here is part of this wonderful fusion, which makes science great.

Note

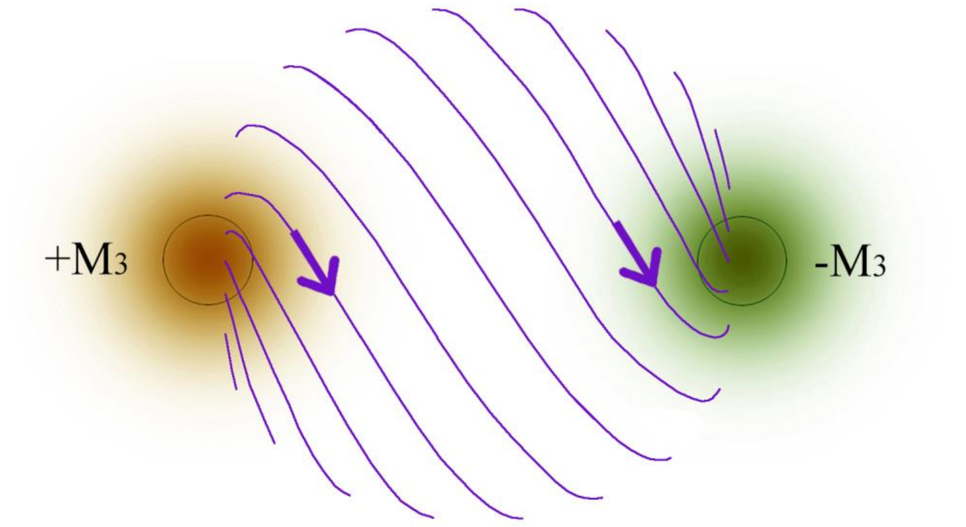
1 Ten real dimensions of spacetime discovered, International Institute for Advanced Studies of Space Representation Sciences, Palermo, Italy

2 The theory on the curvature of space demonstrates that *space cannot be represented with straight lines* (Giuseppe M. Catalano, Le dimensioni dello spazio, International Institute for Advanced Studies of Space Representation Sciences, Palermo 2008, pp. 4-6).
The curved spacetime of general relativity already implies that the line does not exist. The concept of the straight line originates from the alignment of radiating punctiform sources that have coinciding images on the retina. The retina receiver is an observer with the same dimension as the line the sources are a part of. It is therefore not able to evaluate the curvature of that axis.



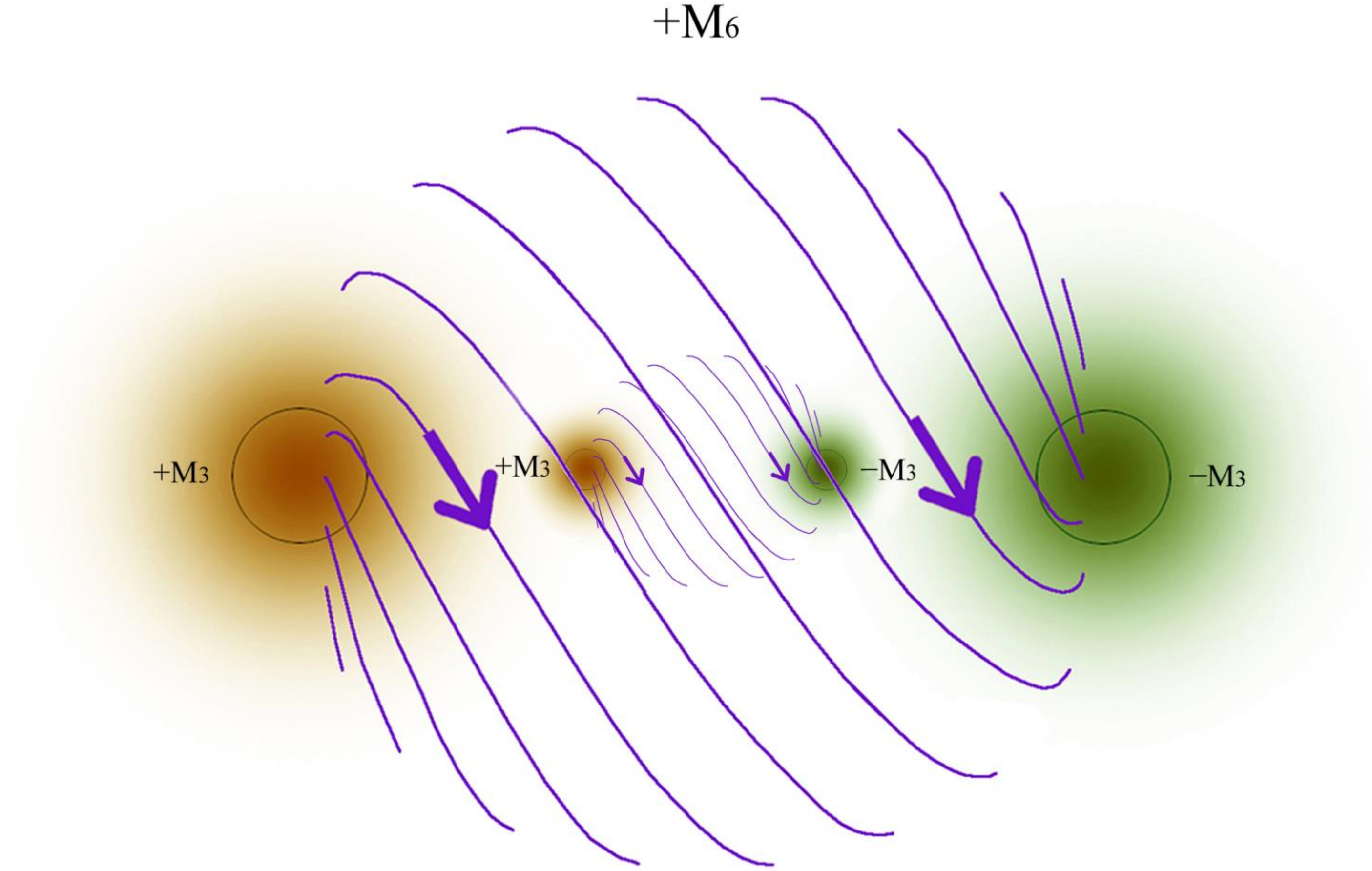
F. 1

The fourth dimension consists in the curving of three-dimensional space, just like the second dimension consists in the curving of one-dimensional space, etc. The curvature, that is, the extension of the fourth dimension, has two opposite directions of expansion and contraction, intrinsic to three-dimensional space, that is of spherical volume. Like zero-dimensional space, the point, separates the opposite directions of one-dimensional space, that is the circumference, three-dimensional space, the spherical volume, separates the opposite directions of four-dimensional space. As these directions are not superimposable, we will have: $+M_3$ spherical volume that separates the opposite directions diverging from it, expanding outwards and contracting inwards: $–M_3$ spherical volume that separates the opposite directions converging towards it, contracting outwards and expanding inwards.



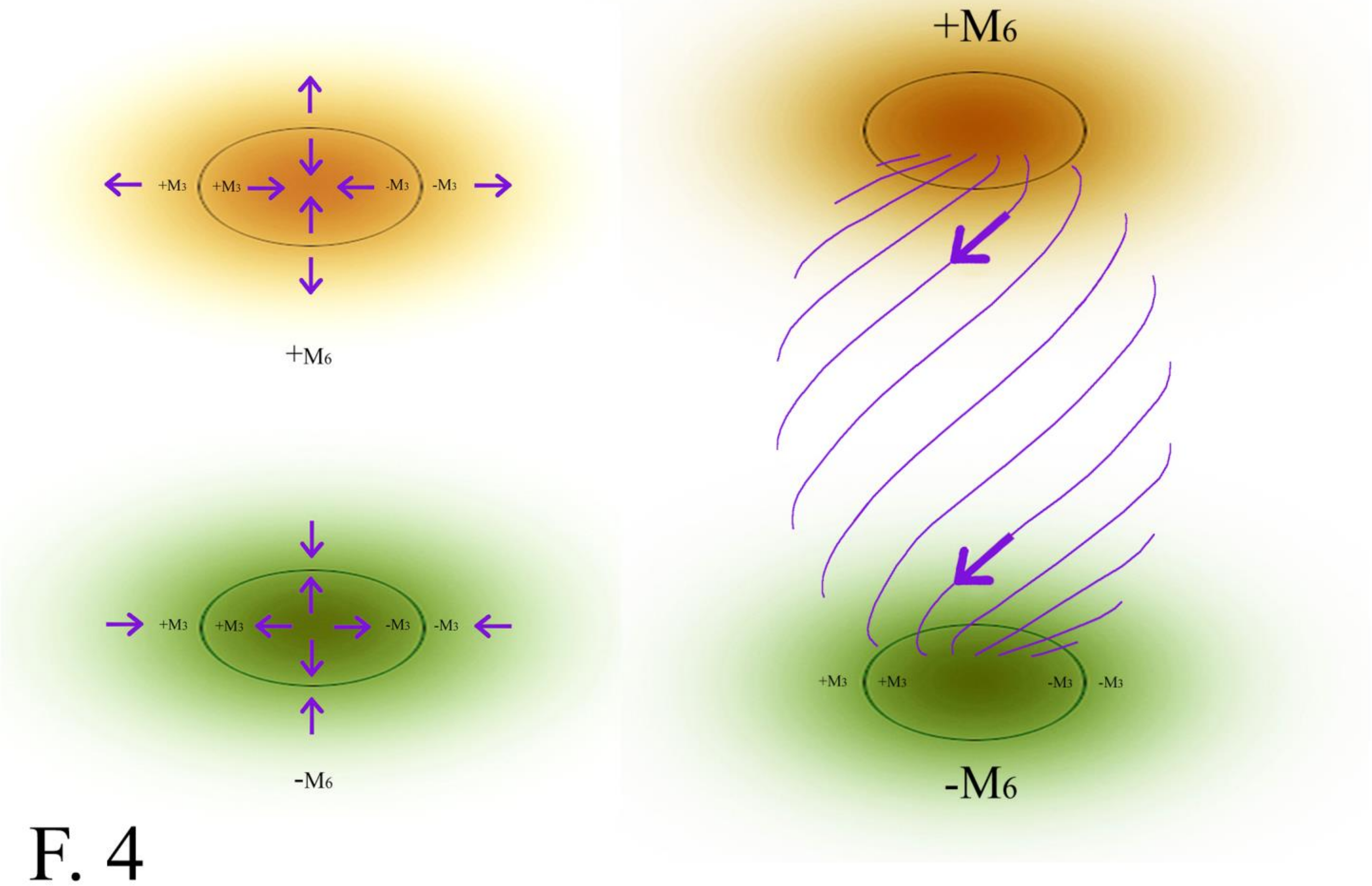
F. 2

The resultant of the forces expressed by the fourth, fifth and sixth dimension, with opposite directions of expansion and contraction, adopts helicoidal trajectories.



F. 3

The seventh dimension is the space into which the first six dimensions curve. It manifests therefore in the curving of the helicoid that constitutes s_6 space. The s_6 helicoid separates the opposite directions of the seventh dimension.



F. 4

For simplicity's sake, we portray the helicoid of six-dimensional space as an ellipsoidal particle.

$+M_6$ is the six-dimensional space that separates a helicoid expanding in the seventh dimension from one that is contracting.

$-M_6$ is the six-dimensional space that separates a helicoid contracting in the seventh dimension from that is expanding.

The resultant of the forces expressed by the seventh, eighth and ninth dimension, with opposite directions of expansion and contraction, adopts helicoidal trajectories.

F. 5

The helicoid is the form along which spacetime extends in the microcosm and the macrocosm. The spiral shape of the galaxies is in actual fact part of a three-dimensional helicoidal spacetime.