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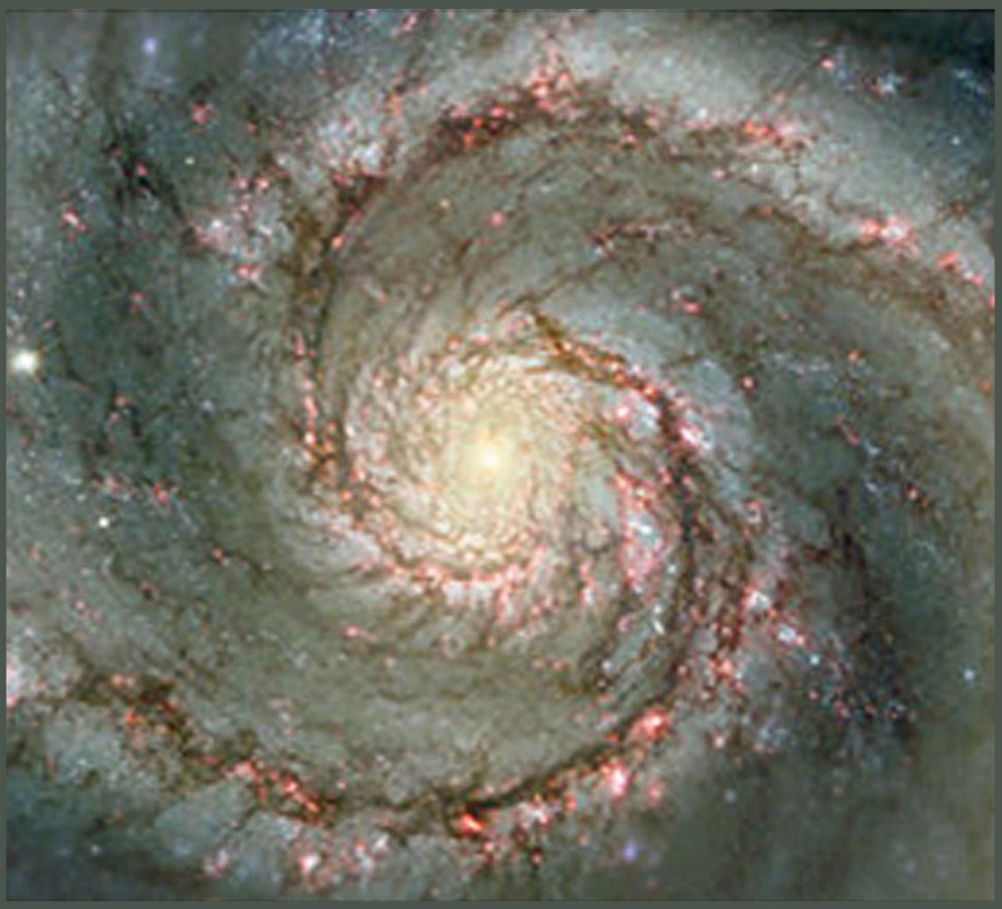
THE NINE REAL DIMENSIONS OF SPACE-TIME EXPLAINED TO ALL STUDENTS



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The space in which we live, grow, run or stand still is not as we have imagined it for millennia. The same goes for the time.

Albert Einstein demonstrated, a little over a century ago (1), that space fused with time, space-time, can always deform, bend, contract or expand, like all other entities of physics. This nature of space-time, that is, the fact that every portion of space-time is always curvable, has the fundamental consequence of the non-existence of the straight line.

In fact the straightline cannot curve, because, by curving, the ends would coincide. Which is contrary to the very definition of a straight line.

Therefore, when we move in space-time we always travel along curves, even when we believe we are following a straight line, which actually consists of a huge circumference (2).

Einstein also demonstrated that it is the bending of space-time that causes and describes the gravitational attraction, that attraction between two crumbs or between two clusters of galaxies, and between us all and the Earth, which thanks to this we can inhabit.

The curving of space-time and the related generation of forces is a phenomenon that geometry has also demonstrated and this double demonstration, physical and geometric, highlights how physics and geometry are never separable.

But now let's ask ourselves a question.

Does the fact that the gravitational force is generated by the bending of space-time have any important geometric and physical consequences?

The answer is yes, if we think that there are other forces of nature, besides the gravitational one, and that these forces too, as physicist T. Kaluza pointed out many years ago, must be generated by the curving of space-time.

You will then agree with Kaluza that also the other forces of nature, i.e. the electromagnetic force and the nuclear forces, weak and strong, had to necessarily be generated by bending of space-time.

The phenomenon is somewhat reminiscent of that of the air which, undergoing different treatments, generates different sounds. Similarly, different conformations of space-time generate different forces.

Returning to Kaluza, a long search for these mysterious conformations began, the search for the unknown dimensions configuring a space-time that seemed elusive and that nevertheless had to exist. It was a work that engaged for many decades not only Einstein and Kaluza, but many other physicists, because the

solution of this enigma was really important. In fact, it would have resolved the gap between the physics of general relativity, the nature of the macrocosm, and quantum physics, the nature of the microcosm. From then until now this enterprise has been massively tackled by theoretical physics, but without achieving any results.

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On the other hand, geometry, before now, had never bothered to prove the curvature of space-time, nor does it seem to have ever bothered to look for where the unknown dimensions were, those dimensions whose bending generates the other forces already known.

If he had done so, he might have discovered for a long time that these dimensions, anything but hidden, as some claimed, were and always are in front of our eyes.

How then to know and master the other dimensions, as happens for the first three, which seem innate to us?

Since the dimensions are necessarily different conformations of the same known space-time, it is appropriate to turn our attention to the first three, to know what relationship exists between them. This same relationship can in fact allow us to arrive at the subsequent dimensions.

It is easy to understand that each dimension does not exist separate from the others, because only the set of dimensions represents real space, the physical entity that we call space-time.

We start from the Euclidean description, taking into account, however, unlike Euclid, the first fundamental and immediate consequence of the curvature of space-time, that is, the substitution of the circumference for the straight line.

The 1-dimensional space-time s_1 is that of the circumference.

The 2-dimensional space-time s_2 is that of the spherical surface.

The 3-dimensional space-time s_3 is that of the spherical volume.

What is the relationship between the first dimension and the second, between the second and third, between the third and fourth, and so on?

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The spherical surface, thanks to the possession of the second dimension, allows the curvature of the first dimension, of the circumference (3). This, bending, covers the spherical surface.

Similarly, the spherical volume, thanks to the third dimension, allows the curvature of the first two dimensions, of the spherical surface. This, bending, covers the spherical volume.

Then the fourth dimensional space-time s_4, thanks to the fourth dimension, is what allows the change of curvature of the first three dimensions, of the spherical volume. This, by varying its curvature, covers four-dimensional space-time (4).

The directions of expansion and contraction are therefore the two opposite directions of the fourth dimension. This variation in the extension of three-dimensional space-time is the one already demonstrated by Einsten.

We therefore understood that in order to discover the successive dimensions of space-time existing in nature, in addition to the first three notes for centuries, we must gradually configure a n-dimensional space-time s_n that allows the curving of s_{n-1} space-time to n-1 dimensions.

In the meantime, it is easy to become aware of the fourth dimension, if we carefully reflect on the fact that thanks to the expansion of three-dimensional space-time (or, which is the same, to the shrinking of the observer) we can have the knowledge of an increasing number of new details, new beings or particles that were previously completely invisible.

Without the fourth dimension we could not in fact have the magnification of the microscope or telescope, and not we could simply have the visual enrichment that we obtain by approaching an object with the naked eye.

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At this point I would like to point out a surprising fact, namely how the nature of numbers, in their unlimited extension, was a very ancient inconscious, advanced knowledge of ours, because it was capable of describing the expansion in the fourth dimension (5).

The bipolarity of space-time

To find the configuration of all the dimensions and therefore of the forces expressed by them, it is necessary to describe a second fundamental and immediate consequence of the curvature of space-time, also unknown to Euclid.

In fact, the non-existence of the straight line trivially implies that even the radii of the circumference are curved.

So what happens if we enlarge a given circle $+\gamma$ having center + C?

On the other hand, what happens if we consider a circumference $+\gamma$ with center + C, getting smaller and smaller?

In the first case the observer, enlarging himself (F. 1), would see that the circumference is forced to invert its curvature, varying the magnification in shrinking, in correspondence with I_M, until it becomes the circumference $-\gamma$ extended as the $+\gamma$ and having center -C (Fig. 1). In I_M there would be a maximum circumference.

The cancellation of the curvature in the maximum circumference I_M is relative to the observer (2), when he is unable to evaluate the curvature of the circumference.

*

Therefore the circumference that appears maximum to one observer does not appear such to another.

Due to the presence of the two centers, or poles, initial and final, we could call this phenomenon of magnification inversion in shrinking, and vice versa, *bipolarity* or *bipolar inversion* of space-time.

This phenomenon leads to a conclusion of extraordinary importance for our knowledge. Bipolarity, being an immediate consequence of the curvature of

space-time, must be present, not only in the known dimensions, but also in all the unknown dimensions that we are looking for.

The observation of the bipolarity of space-time is a great step in the research and we can already draw a fundamental consequence.

We know that every force is generated and described by the curvature of space-time. Therefore every force must be subject to bipolarity.

In each dimension, that is, a field of forces necessarily diverges from one pole and converges on an other pole.

Do we already have experience of bipolarity?

Yes, because it is well known in the forces of electromagnetism, but we now know that it is also present in gravity and nuclear interactions.

Let's go back to the second question.

What happens now if we consider an ever smaller circumference?

The observer, shrinking, would see that the circumference is still forced to reverse its curvature, changing the shrinking into enlargement, in correspondence with Im, until the circumference $-\gamma$ coincides with $+\gamma$. In Im there would be a minimum circumference.

*

Similarly, the maximum of the curvature in the minimum circumference I_m is, as explained, relative to the observer, when he is not able to evaluate the curvature of the circumference.

Thanks to the consequences of the curvature of space-time and the fourth dimension, it is now possible to explain, after 24 centuries, a precious jewel of human ingenuity, the famous paradox that sees a turtle always ahead of the very fast Achilles in the exceptional ridiculous competition conceived by Zenone.

With his impeccable reasoning, the great scientist of Elea already showed at that time the insufficiency of Euclid's three-dimensional geometry in the representation of the microcosm (6).

The first triad of dimensions

Now we are very careful.

When we describe dimensions, we describe together the forces associated with them. We have just clarified that in every dimension there is a force field diverging from one pole and converging at the other pole, phenomenon due to the curvature of space-time. We now describe the dimensions, taking into account the bipolarity.

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In the first dimension we pass from the absence of space-time of the point $+M_0$, the first pole, to the circumference of the space-time s_1 whose development diverges from $+M_0$ and converges to the second pole $-M_0$, center of gravitational attraction.

Space-time s_2 allows the curving of space-time s_1. Due to the existence of the two poles, the curving of s_1, diverging from + M_0 and converging to $-M_0$, occurs in the form of a helix that covers the spherical surface s_2.

This surface, thanks to the third dimension, curves, forming a star of helices, the one that, having the two centers, + M_0 and $-M_0$, we could define a *bistar*, which covers the spherical volume s_3 in three dimensions.

In summary, each ray s_1 of the bistar of space-time s_3 curves according to a helix diverging from + M_0 and converging to $-M_0$ (Fig. 2).

Considering the bipolarity in gravity we have come, as mentioned, to a fundamental conclusion. The gravitational attraction corresponds to the gravitational repulsion.

That is, there must be the center of gravitational repulsion from which the force field derives to reach the center of gravitational attraction.

Why don't we know the centers of gravitational repulsion?

Because they reject matter, curves the light and therefore are not visible.

*

The second triad of dimensions

We have found that each new dimension n allows the curving of space-time s_{n-1}.

Thanks to the fourth dimension, space-time allows the curving of the first three dimensions, that is, the expansion and contraction of space-time s_3, , the opposite directions of the fourth dimension.

As the point separates the opposite directions of the first dimension, so the spherical volume separates the opposite directions of expansion and contraction of the fourth dimension.

Considering the bipolarity, the spherical volume expanding from the particle + M_3, due to the curvature of its rays, is reversed into spherical volume in contraction to the particle $-M_3$ and vice versa.

Therefore the existence of the fourth dimension implies the presence in nature of spherical volumes, particles, which separate the opposite directions of expansion and contraction in the fourth dimension of the three-dimensional space-time s_3 and therefore the opposite directions of the relative forces generated.

*

The particles + M_3, that have an expansive force field outside, they must have a contractive force field inside.

The particles $-M_3$, that have a contractive force field outside, they must have an expansive force field inside.

These particles are obviously the electron and v n positron of which we have been acquainted for a long time (7).

We can now repeat for the second triad of dimensions, 4, 5, 6, the same geometric development, the helical curving, described for the first triad, 1, 2, 3,

replacing the radius s_1 with the helical bistar s_3 , expanding from + M_3 and in contraction to -M_3.

I called + M_3 and –M_3 these particles, because, although they are generated by the opposite directions of the space s_6, their three-dimensional material volume belongs to the space-time s_3 and is the reference quantity of s_3.

It is the opposition of the directions of the second triad of dimensions 4, 5, 6, the opposition of the directions of the electromagnetic field, that allows the concreteness of reality, matter.

As the points, separators of the opposite directions of the first dimension are all equal, so the particles, separators of the opposite directions of the fourth dimension, are all the same.

The presence of an M_3 particle implies the presence of a pair + M_0 -M_0 inside it and another one outside it, that is, the expanding and contracting space-time s_3.

The external poles -M_0 repel each other, being of the same sign, but attract the M_3, which belong, as explained, to the space-time s_3.

The external poles + M_0 repel each other, being of the same sign, and repel the M_3, from which they are far away.

*

The third triad of dimensions

We keep climbing the scale of dimensions.

The space-time s_6 is that of the particles + M_3 and -M_3, electrons and positrons.

The seventh dimension must then allow the curving of the pair + M_3 -M_3, which we call M_6.

Considering the bipolarity, the space-time s_6 expanding from the particle + M_3, due to the curvature of its rays, is reversed into s_6 , in contraction to the particle –M_6 and vice versa.

There must be particles in nature, which separate the opposite directions of expansion and contraction of the pair + M_3 -M_3 in the space-time s_7 and therefore the opposite directions of the relative forces generated.

The particles +M_6, that have an expansive force field on the outside, they must have a contractive force field inside.

The particles, -M_6, that have a contractive force field on the outside, they must have an expansive force field inside.

We can then repeat the same geometric development, the helical curvature, described for the previous triad, substituting the +M_6 and –M_6 particles for the spherical volumes, that is the +M_3 and -M_3 particles.

In each M_6 particle we have two pairs of +M_3 -M_3 particles, electron and positron, one expanding, the other contracting.

Due to the attraction and repulsion of positive and negative electric charges, the four particles must be located at the vertices and center of an equilateral triangle (Fig. 3).

*

Considering the areas in which the charges mutually cancel each other, three charges remain at the vertices, +2/3, -1/3, -1/3. These, as you can see, are equal to the charged notes of the quarks u and d. One positron remains hidden by the other three particles.

There are only two types of particles in nature corresponding to the characteristics of $+M_6$ and $-M_6$ particles: the neutron and the antineutron. In the antineutron at the center of the triangle there is an electron.

So far it is stated, as is known, that a neutron is composed of three quarks, a quark u and two quarks d, but it is not explained how fractional electric charges are born, nor does it explain how beta- decay produces an electron, charge -1, leaving a proton composed of two quarks u and a quark d. The quarks would inexplicably transform from u to d and vice versa.

In the antineutron at the center of the triangle there is an electron.

The third triad of dimensions of space-time explains instead that there are four quarks in the neutron, one of which is hidden. They are the two pairs of particles $+ M_3$ $-M_3$, electron and positron, the first in expansion, the second in contraction.

*

Beta- decay occurs when a loosening of the grip that tighten $+ M_6$ to $-M_6$, at the boundary of the atomic nucleus, allows the outer $+ M_3$ particle of $+ M_6$, in expansion, to move away from the nucleus. Then the positron, placed in the center of the triangle, moves at the vertex left free by the electron $+ M_3$ which has moved away.

Considering the areas in which the charges reciprocally cancel each other, three charges now remain at the vertices, -1/3, +2/3 and +2/3, the charged notes of the u and d quarks of the proton (Fig.5).

In beta + decay, a positron is produced, transforming a proton into a neutron.

It should be remembered that due to the bipolarity of space-time, the presence of a particle implies the presence of the relative antiparticle, as evidenced in the annihilation or in the production of particle-antiparticle pairs.

Therefore in the beta + decay an electron is generated together with the positron that allows the proton to become a neutron (Fig. 3).

The production of particle-antiparticle pairs confirms how the growth of energy is the growth of the curvature of space-time, which manifests itself in the particles of matter.

Finally, remember that M_3 are present in M_6 particles, in expansion and contraction, in neutrons and antineutrons. So the $-M_0$ particles that attract the M_3 to themselves remain captured inside the M_6, while the $+ M_0$ repel each other away from the M_6, from the atomic nucleus, located around the celestial bodies.

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The light

Before dealing with the dimensions of light and its fundamental importance, let us summarize what we have dealt with so far.

The curving of the first triad of dimensions generates helical bistars extended from + M_0 in expansion to -M_0 in contraction, that is, it generates the repulsive and attractive space-time s_3.

The curving of the second triad of dimensions generates helical bistars extended from + M_3 in expansion to –M_3 in contraction, that is, it generates the repulsive and attractive space-time s_6.

The curving of the third triad of dimensions generates helical bistars extended from + M_6 in expansion to -M_6 in contraction, that is, it generates the repulsive and attractive space-time s_9.

The variation of the three-dimensional space-time demonstrated by Einstein is that in which, by changing the space-time s_3, the diameter of the spherical particles M_3 changes and consequently the size of the M_6. Being made of these particles, we can experience this directly, only in the growth of the observer from child to adult. For this reason, objects or environments appear larger in our memories than we see as adults.

*

We instead experience the electromagnetic field, that is the expansion and contraction of space-time s_3 in the fourth, fifth and sixth dimensions, outside and inside the M_3 particles.

What are the dimensions of light, ie the electromagnetic wave?

It is generated, as we know from the oscillating circuit, when a particle + M_3 accelerates and therefore has an increase in extension in the fifth and sixth dimensions. This would lead to an increase in the extension s_6 proceeding transversely to the motion of the particles. Then the part of the space contiguous to that in which the forces vary, restores equilibrium, curving in the same dimensions in the opposite direction, as in the positron, transmitting the increase to the contiguous space. This gives rise to the phenomenon again, creating a chain of inversion, a wave, that is, the six-dimensional entity Q_6 known as a photon.

This passes from the size of the electron to that of the positron.

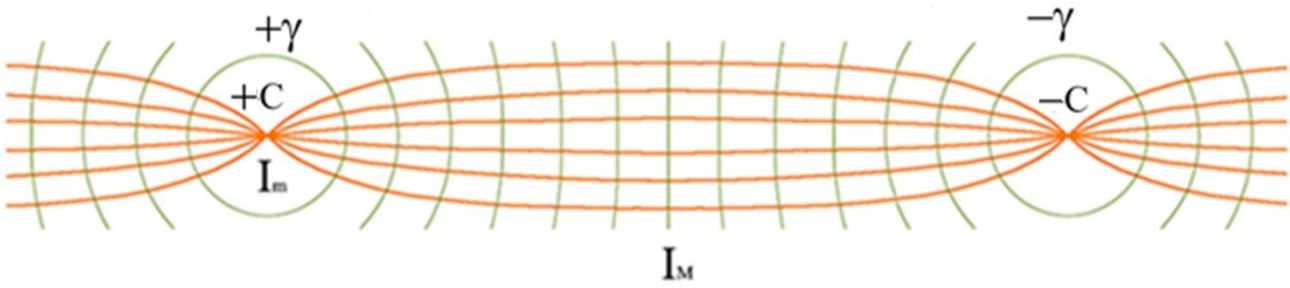
Its oscillatory nature, which instantly assumes and loses state of matter, would explain why, although it has no resting mass, it nevertheless has momentum.

A process analogous to the production of the photon Q_6 in the dimensions 4, 5, 6, of the space s_6 occurs in the triad 7, 8, 9, of the space s_9 . In beta-decay, the electron emitted by the neutron accelerates in s_9 space. The Q_9 particle that is produced is erroneously called antineutrino, even though it is neutral like the neutrino produced in beta+ decay.

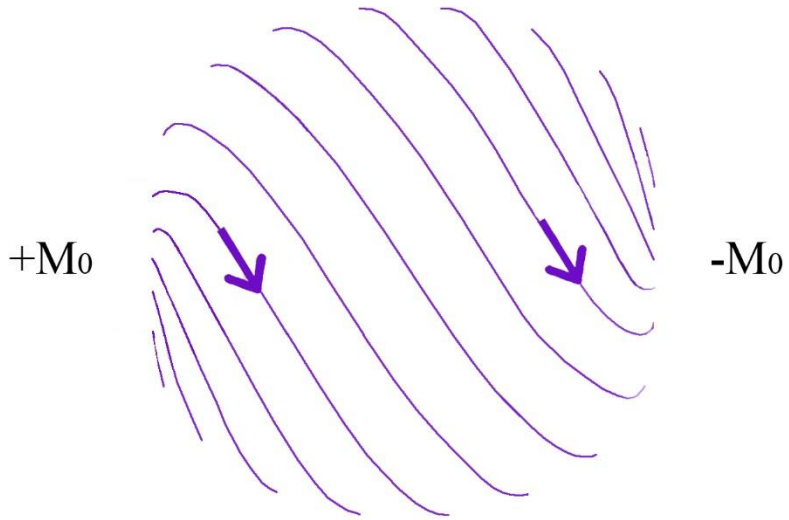
Let's go back to the photon.

Thanks to this space-time nature s_6, thanks to its origin in the deep microcosm, the electromagnetic wave, composed of photons, expands from the microcosm into spherical waves s_6, until it meets a lens in the mediocosm, which converges these waves into a very small area, giving to the microscope the enlarged image of the body of the microcosm, from which they derive.

Therefore we can have knowledge of an increasing number of new details, new beings or particles that were first entirely invisible, as if we were shrinking into the fourth dimension.

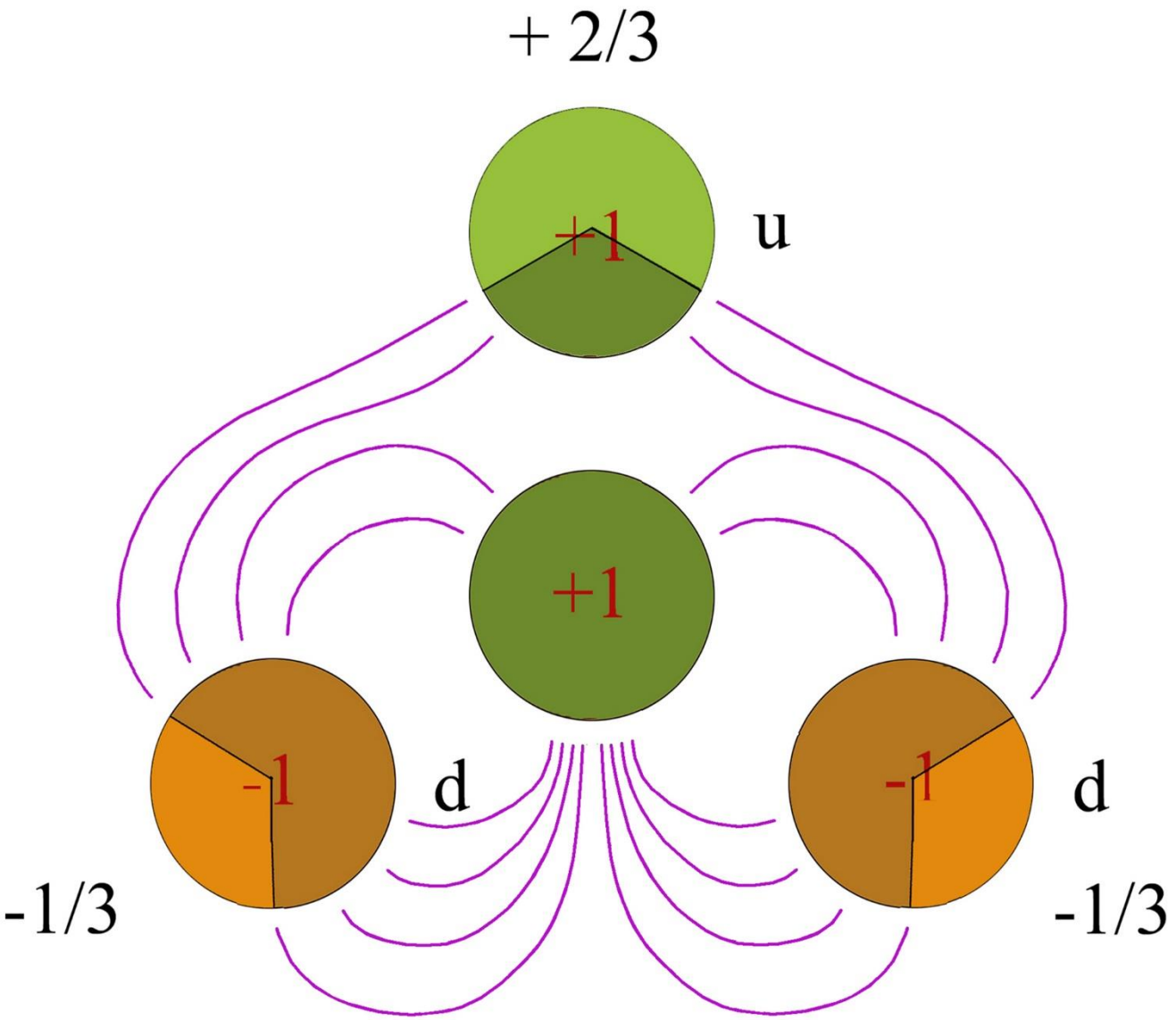


F. 1

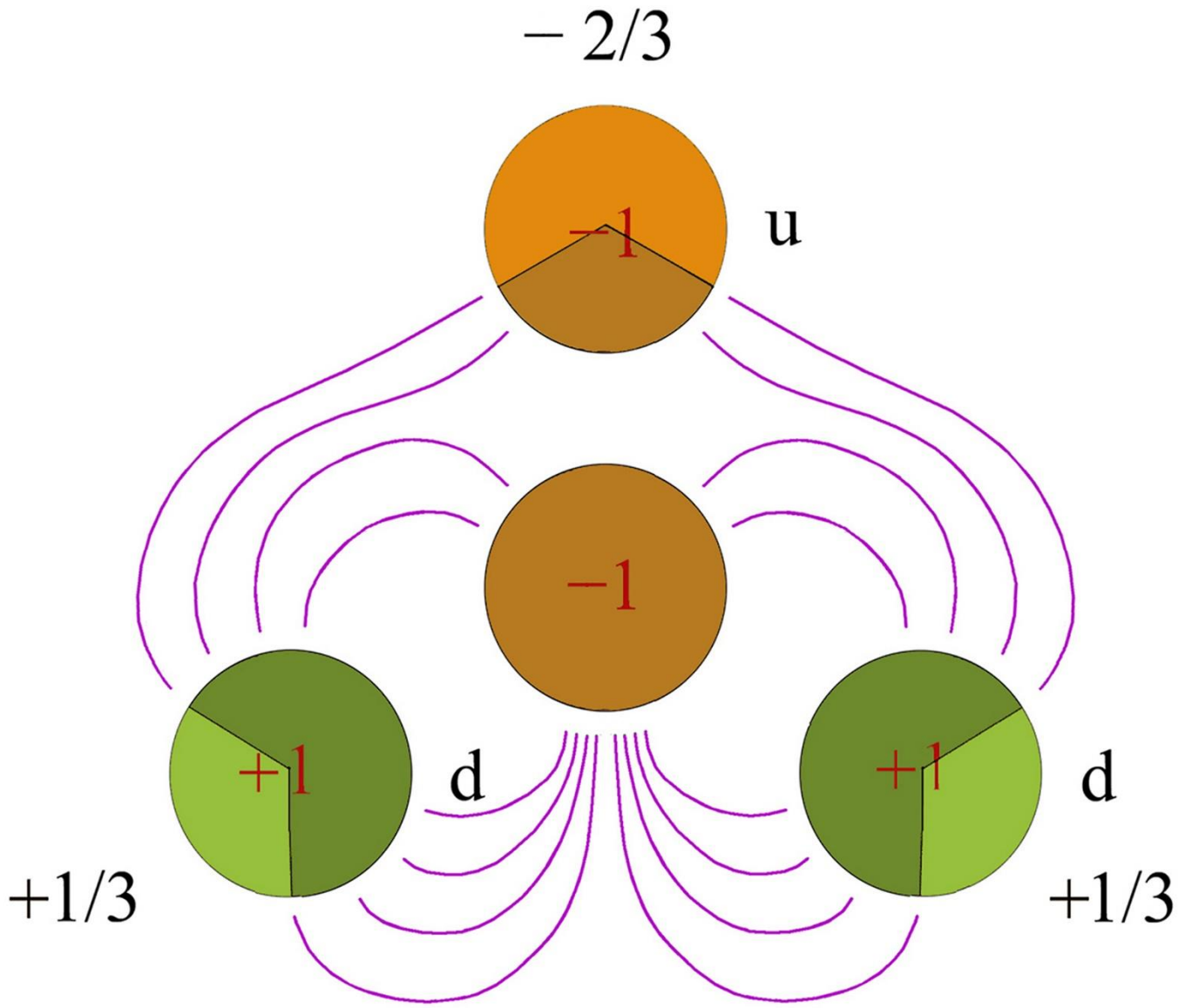


F. 2

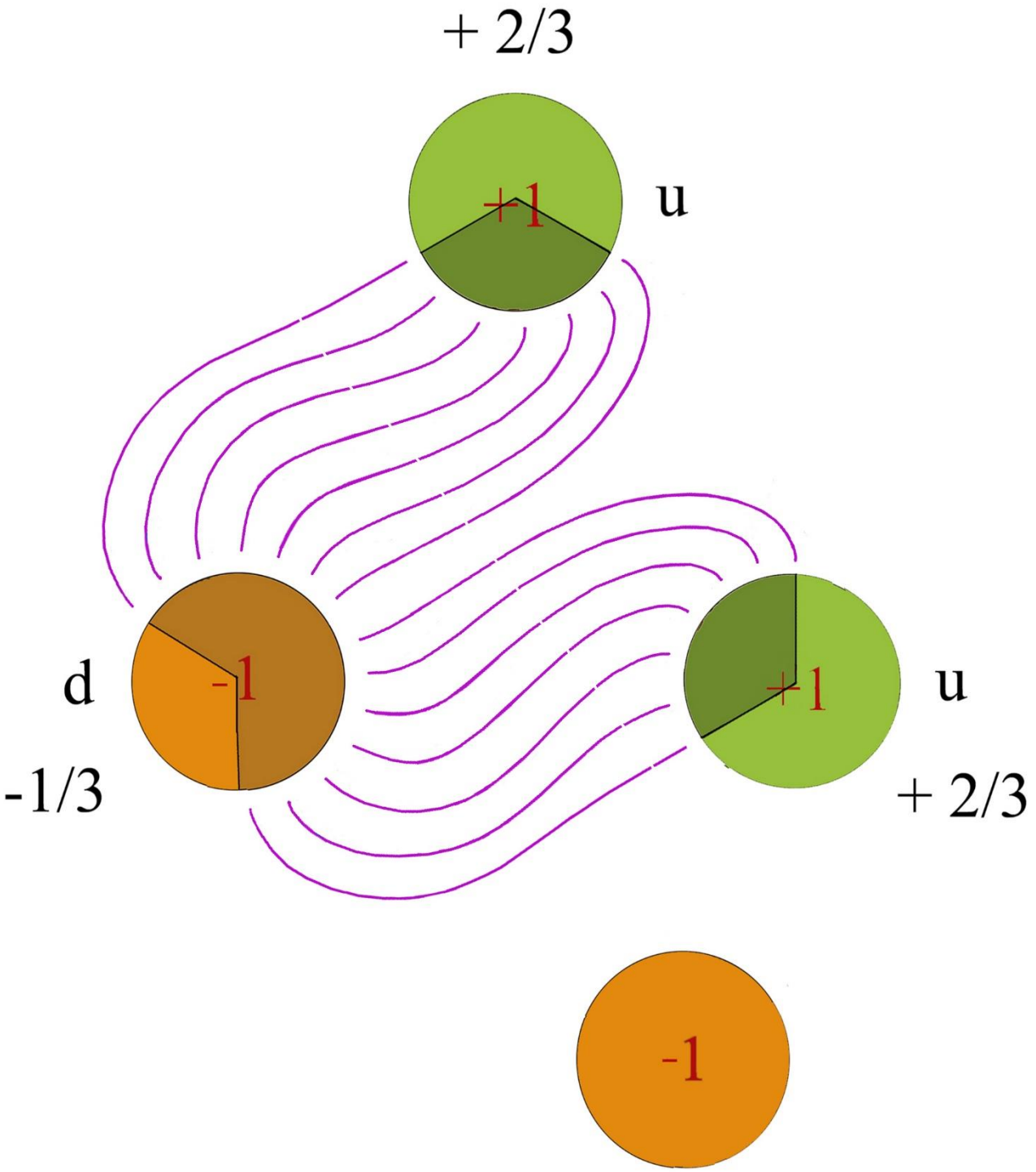
The resulting forces expressed by the first terna of dimensions have helical trajectories.



F. 3
Neutron



F. 4
Antineutron



F. 5

Proton

1 Albert Einstein, *Die Grundlagen der allgemeinen Relativitatstheorie*, Newton & Compton editori, Rome 2006.

2 The concept of a straight line arises from the alignment of irradiating point sources that have coincident images on the retina. The retinal receptor is in this case an observer belonging to the same single dimension of the line to which the sources belong. It is therefore unable to evaluate the curvature of this axis.

3 Remember that the curvature of a circumference is the inverse of the radius.

4 Giuseppe Maria Catalano, *Nine real dimensions of the space-time discovered*, International Institute for Advanced Studies of Space Representation Sciences, Palermo 2017.

5 Giuseppe Maria Catalano, *Numbers describe the fourth real dimension of the space-time*, International Institute for Advanced Studies of Space Representation Sciences, Palermo 2021.

6 Giuseppe Maria Catalano, *The finite space-time of the microcosm explains the paradox of Achilles and the tortoise*, International Institute for Advanced Studies of Space Representation Sciences, Palermo 2021.

7 The balance between the two opposite directions of the electric field is in accordance with the third principle of dynamics, with the electron model described by P. Dirac in 1962 and is also in agreement with the completely electromagnetic interpretation of mass.