THE SPACE-TIME AS A "FIELD" OF MASS

A PROPOSAL FOR A NEW MODEL OF PHYSICAL REALITY

(Flavio Barbiero)

Summary:- Although the mass and the electric charge are strictly associated at atomic level, and the field they generate has the same structure, motion has a different effect on them: while the electric charge remains unchanged, but generates a magnetic field, the mass changes its value, but does not generate any additional field. This different behavior could be only apparent, due to the different form of the transformation equations upon which the interpretation of those phenomena is based.

The behavior of the mass has been deduced in the SR on the base of the transformation equations of Lorentz, obtained by analyzing the linear propagation of a beam of light. The behaviour of the electrical field, instead, seems to be consistent with a set of transformation equations equivalent to Lorentz', but expressed in a different form, as they have been obtained by analysing the omnidirectional propagation of a beam of light. These relations show that motion modifies the space-time by "generating" a spatial component normal to the motion itself. They are expressed in a mathematical form which force us to abandon the traditional concept of the space-time as a "container", however defined, of physical reality and suggests a totally new conception: that of considering the real space-time as a field of the mass, coincident with the gravitational field.

This hypothesis is sufficient by itself to justify the equilibrium in the atoms and also the existence of positive and negative fields of the same order of magnitude of the electrical field, without the need of any other entity or force, in addition to mass and gravity. It also explains in a rational way the structure and nature of the light quanta.

All physical reality, then, could be explained by the existence of a unique Entity, with three different aspects, mass, space and time.

Preliminary remarks

When Sir Isaac Newton formulated the law of universal gravitation

$$1) \quad G = k\frac{M}{r^2}$$

he dismissed as nonsense the idea that the speed of gravity could be infinite. And yet the mathematical expression of his law is clearly in contradiction with his statement, because if the velocity of M is $\overline{v} \neq 0$, it necessarily requires that the speed of propagation of the field is infinite, $c = \infty$.

After a while, Coulomb proposed a similar law for the electrical field E:

$$E = K\frac{Q}{r^2}$$

Also the mathematical form of this law implies that when the velocity of the electric charge Q is $\overline{v} \neq 0$, the speed of propagation of the field has to be $c = \infty$. Experience, however, has demonstrated that the electric field propagates with a finite speed, and that a charge moving at a velocity $\overline{v} \neq 0$ generates a magnetic field normal to the motion:

2) $$\overline{H} = \frac{\overline{v}}{c} \wedge \overline{E} \quad ^{(*)} \qquad (\text{where } \overline{E} = K\frac{Q}{r^2}\frac{\overline{r}}{r})$$

Implicitly, the magnetic field has always been ascribed to some special property of the electric charge, not shared by the mass.

It can be demonstrated, however, that the magnetic component is due precisely to the fact that the speed of the electric field is not infinite, and therefore to the characteristics of the medium in which it propagates, the space-time.

To find out these characteristics it is necessary to examine the modalities of propagation of a central field, or something that can be assimilated to it, like a omnidirectional beam of light.

Einstein analysed the particular case of a light beam propagating along a line, reaching the conclusion that space-time is modified along the direction of motion according to the following relations (also known as Lorentz transformation equations):

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}} \quad ; \quad y' = y \quad ; \quad z' = z \quad ; \quad t' = \frac{t - v\frac{x}{c^2}}{\sqrt{1 - \frac{v^2}{c^2}}}$$

which are at the base of current theoretical physics. No question about the correctness of these equations, but their form is not the most suitable for understanding why and which are the real changes in the structure of space-time. Experience appears to be in good accord with the theory drawn by them, but it still remains inexplicable the different behavior of the electric and gravitational fields. Although the mass and the electric charge are strictly associated at atomic level, and the field they generate has the same structure, according to the current theories motion has a different effect on them: while the electric charge remains unchanged, but generates a magnetic field, mass changes its value, but does not generate any additional field.

Let's then try a different approach by analysing the propagation of a beam of light in all directions, to see if we can have additional information about the characteristics of space-time, that can shed light on these differences.

The basic assumptions

We can start from the same basic assumptions, about the reference frame (RF) and speed of light, made by Einstein in his memory of 1905 about SR, with some additional consideration.

Experimental evidence proves that light propagates in a vacuum always at the same speed with respect to every observer, no matter what his motion is in relation to the source of it. This means that the RF is an entity connected not to the physical phenomena itself, but to the observer. Its characteristics depend on the way he perceives and describes physical

---

[*] Meaning of the simbols: $\overline{a}$ is a vector; $\overline{a} \wedge \overline{b}$ a vectors product

reality and it does not necessarily have to be similar to the real space-time. In order to serve as a "reference", it has to be a Cartesian space-time.

Let's then state our starting conditions:

a) The reference frame is an inertial three-dimensional space, where the laws of Euclidean geometry are valid, and in every point of which space and time have always the same value .

b) Light propagates in the RF at a constant speed in all directions, no matter how the source moves relatively to the RF itself.

This second condition has extremely important consequences. Thanks to it, in fact, although all RFs are compliant with the first condition, the value of both, space and time, is different in each of them with respect to the others.

How motion modifies space-time

Let's consider two observers, A and B, moving with respect to each other at a constant velocity $\bar{v}$. Suppose that in the precise instant when the observers, and therefore the origins of the respective RFs, R_A and R_B, coincide, a flash of light is emitted from the origin in all directions.

The photons of light propagate at a same speed, c, in both RFs and in all directions; therefore, after a certain time $dt = t - t_0$, they will be distributed on the surface of a sphere, which radius is $\bar{r}_A = c\frac{\bar{r}_A}{r_A}dt_A$ and center A in R_A, $\bar{r}_B = c\frac{\bar{r}_B}{r_B}dt_B$ and center B in R_B . The surface where the light is distributed is unique, but it is perceived and described by both observers respectively as in fig. 1a and fig. 1b.

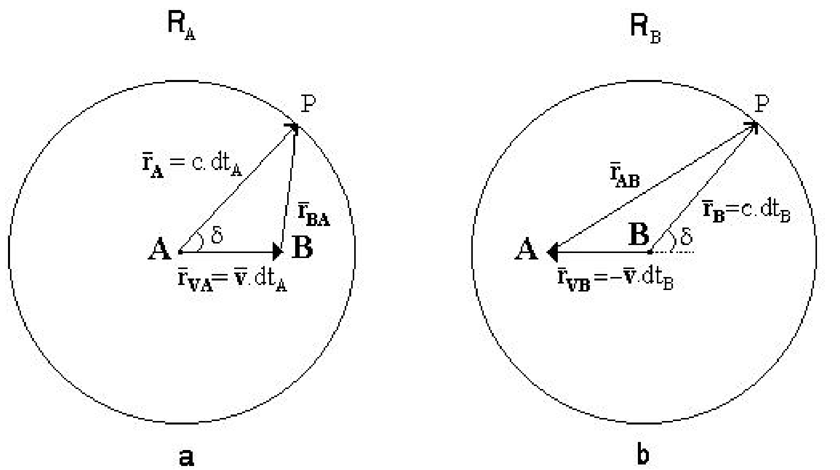


fig. 1

Both descriptions are correct and correspond to what the two observers perceive, calculate and measure. In both RFs the laws of Euclidean geometry are valid, and therefore the center of the sphere is unique, all its radius have the same length and the time needed for the light to cover them is always the same. And yet the spherical surface upon which the light is distributed, although unique, has two different centers.

This necessarily means that the structure of space-time is different in R_A with respect to R_B. Motion, therefore, modifies the space-time of the observers. Let's see how and how much.

In order to better visualize the problem, we'll analyze first the case in which light is propagating on a plane. After a while, it will be distributed on a circle, with radius $\bar{r}_A = c\frac{\bar{r}_A}{r_A}dt_A$ and center A in R_A, radius $\bar{r}_B = c\frac{\bar{r}_B}{r_B}dt_B$ and center B in R_B (fig. 1).

From a geometrical point of view, A and B can be both at the center of the same circumference only if they are located on a line perpendicular to the circumference's plane and passing through its center (fig. 2.a, 2.b). This is achieved by "twisting" the space-time in R_A, with respect to R_B, of a value $\frac{\bar{v}}{c} \wedge \frac{\bar{r}_A}{r_A}$ (where $\bar{r}$ is the radius normal to $\bar{v}$, passing through the origin); that is, by rotating vector $\overline{AB}$ ($\overline{BA}$), along an imaginary direction $\bar{i}$ normal to both axis, *x*/*y*, and to the velocity $\bar{v}$. In this way also all radius $\overline{B_iP}$ ($\overline{A_iP}$) have the same distance from the circumference where the light is distributed.

Taking into account that we have:

$\overline{AP} = \frac{\bar{r}_A}{r_A} = 1$; $\overline{A_iP} = \frac{\bar{r}'_A}{r'_A} = 1'$; $\overline{BP} = \frac{\bar{r}_B}{r_B} = 1$; $\overline{B_iP} = \frac{\bar{r}'_B}{r'_B} = 1'$, we obtain in R_A:

$$\left|\overline{B_iP}\right| = \left|\overline{AP} + \overline{AB_i}\right| = \sqrt{(AP)^2 + (i\frac{v}{c})^2} = \sqrt{1 - \frac{v^2}{c^2}} \ .$$

And vice versa in R_B:

$$\left|\overline{A_iP}\right| = \left|\overline{BP} + \overline{BA_i}\right| = \sqrt{(BP)^2 + (i\frac{v}{c})^2} = \sqrt{1 - \frac{v^2}{c^2}} \ .$$

It is important to note that we have (in R_A and vice versa in R_B):

$$\left|\overline{B_iX}\right| = \frac{\left|\overline{AX} - \frac{\bar{v}}{c}\right|}{\sqrt{1 - \frac{v^2}{c^2}}} \quad \text{, and} \quad \left|\overline{B_iY}\right| = \left|\overline{BY}\right|$$

exactely as in a Lorentz transformation. Therefore the two ways of representing the deformation of space-time are equivalent from a mathematical point of view.

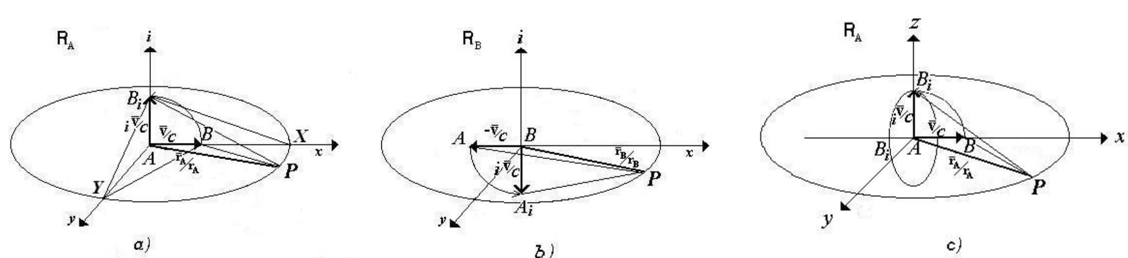


fig. 2

Same considerations can be made for the three-dimensional space-time of R_A and R_B. In order to have both points, A and B, at the center of the spherical surface where the light is distributed, space-time of R_A must be "twisted", with respect to R_B, of a vector $\frac{\bar{v}}{c} \wedge \frac{\bar{r}_A}{r_A}$ along a fourth imaginary direction, normal to the three axis, *x*, *y* and *z*, and $\bar{v}$. This "direction" is coincident with the plane normal to $\bar{v}$, passing through the origin (in fig. 2 c, "point" B_i, obtained by rotating vector $\overline{AB}$ along an imaginary direction normal to x, y, z and $\bar{v}$, is represented by the circumference with radius $i\frac{\bar{v}}{c}$).

We have to conclude that motion "generates" a spatial component equal to $\frac{\bar{v}}{c} \wedge \frac{\bar{r}}{r}$; therefore the radius of the sphere where the light is distributed becomes, in the two RFs, with respect to each other:

$$\bar{r}_A = c\frac{\bar{r}_A}{r_A}dt_A = c\left(\frac{\bar{r}_B}{r_B} + \frac{\bar{v}}{c} \wedge \frac{\bar{r}_B}{r_B}\right)dt_A; \qquad \bar{r}_B = c\frac{\bar{r}_B}{r_B}dt_B = c\left(\frac{\bar{r}_A}{r_A} + \frac{-\bar{v}}{c} \wedge \frac{\bar{r}_A}{r_A}\right)dt_B.$$

As for the time, by definition we always have: $c = \frac{r_A}{dt_A} = \frac{r_B}{dt_B}$. This means that the ratio between space and time in the two RFs is always the same.

From fig. 1, we can see that the angle δ between the direction of $\bar{v}$ and the direction of a generic point P, is the same in R_A and R_B, that is $\frac{\bar{r}_A}{r_A} = \frac{\bar{r}_B}{r_B} = \frac{\bar{r}}{r}$. Therefore the difference between the space of the two RFs can be written as follows:

3) $$\left(\frac{\bar{r}}{r}\right)_{A(B)} = \left(\frac{\bar{r}}{r} + \frac{\bar{v}}{c} \wedge \frac{\bar{r}}{r}\right)_{B(A)}$$

We can regard formula 3) as representative of the variation of space-time in R_A with respect to R_B and viceversa,.

Description of a central field in motion

Relations 3) are equivalent to Lorentz transformation equations, but they have a form that allows us to better understand which are the modifications induced by motion on the space-time's structure, and are by far more useful in practical calculations, in particular in all relations where vector entities are involved, like in the central fields.

All central fields are described in a stationary RF by the relation:

$$\bar{E}_o = k\frac{A}{r^2}.\frac{\bar{r}}{r}$$

If the source A is moving with respect to an observer with velocity $\overline{v}$, then the space-time in which the field is described will be modified according to formula 3). Replacing the value of $\frac{\overline{r}}{r}$ with that modified by motion, we obtain:

$\overline{E} = k\frac{A}{r^2}.\left(\frac{\overline{r}}{r} + \frac{\overline{v}}{c} \wedge \frac{\overline{r}}{r}\right)$, and therefore:

4) $\overline{E} = \overline{E}_o + \frac{\overline{v}}{c} \wedge \overline{E}_o$.

In conclusion, the magnetic component is not due to a particular property exclusive of the electric charge, but to a characteristic of space-time, and appears wherever there is a source of a central field in motion, also necessarily for gravity.

In Einstein's SR, instead, the form of Lorentz transformation has privileged the view that motion does not modify the value of the gravitational field, but that of the mass. From a practical point of view the result should be the same, because the transversal and longitudinal variation of the mass induces a modification of the gravitational field of the same kind (as it should be, because of the equivalence of the transformation formulas). The two methods, then, might appear equivalent, as they seem to provide the same results. From a theoretical point of view, however, the implications are outstanding.

How perception of physical quantities varies with the RF

We have seen that all the RFs, in relative motion to each other, have different values for space and time. As a consequence the same physical phenomenon is perceived in different ways from different observers connected to them.

Suppose that R_A and R_B are two RFs with different values of the space time, because, for example, of a relative motion $\overline{v}$ between them (fig. 6) (but the same considerations are valid for all RFs in which the space-time has different values for whatever other reason).

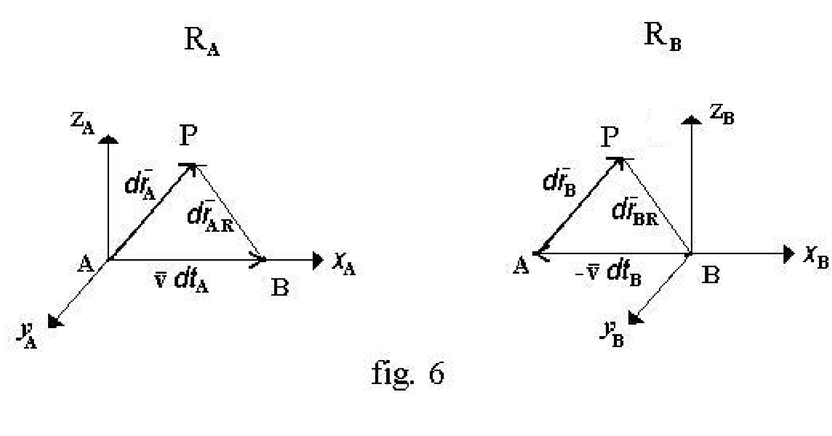


fig. 6

Let's see how A and B perceive and measure a same physical phenomenon, for example the motion of a point from a position A to a position P, in their respective RFs:

a) Times and lengths are different in the two RFs, so the distance $d\bar{r} = \overline{AP}$ will be measured with different values by the two observers, as well as the time that the point takes to travel from A to P.

$$d\bar{r}_A \neq d\bar{r}_B \ , \quad dt_A \neq dt_B \ .$$

b) The speed of the point from A to P is measured with the same value in both RFs. Because the ratio between space (L) and time (T) is the same in both RFs and in all directions, we always have: $|\bar{v}_B| = \left|\frac{d\bar{r}_B}{dt_B}\right| = \left|\frac{d\bar{r}_A}{dt_A}\right| = |\bar{v}_A| = |\bar{v}|$.

Speeds, therefore, have the same value in all RFs. The same is true for all physical quantities in which dimensional formula the ratio between L and T is linear, like in energy = $[L^2MT^{-2}]$.

c) If the motion of the point is accelerated, we have:

$$|\bar{a}_B| = \left|\frac{d\bar{v}_B}{dt_B}\right| = \left|\frac{d\bar{v}}{dt_B}\right|; \quad |\bar{a}_A| = \left|\frac{d\bar{v}_A}{dt_A}\right| = \left|\frac{d\bar{v}}{dt_A}\right|; \quad \text{and therefore: } |\bar{a}_B| = |\bar{a}_A| . \frac{dt_A}{dt_B} .$$

The two observers perceive and measure different values for the same acceleration, and the difference is exactly the same existing between the value of the respective RFs.

As a consequence, if a mass is connected to the point, the two observers will measure different values for the force acting on it:

$$\bar{f}_B = m\bar{a}_B = m\bar{a}_A \frac{dt_A}{dt_B} = \bar{f}_A \frac{dt_A}{dt_B}$$

(although they keep on measuring the same kinetic energy possessed by the mass).

To conclude, two observers connected to RFs with different values of space-time (no matter what the reason is), watching the same phenomenon perceive and measure with the same identical value all physical quantities in whose dimensional formula the ratio between space (L) and time (T) is linear.

They measure, instead, different values for all those quantities where space and time have a non-linear ratio, that is lengths and quantities connected to them, like areas, volumes, the specific mass = $[ML^{-3}]$, the specific weight = $[L^{-2}MT^{-2}]$, pressure = $[L^{-1}MT^{-2}]$ and so on; times and quantities connected to them, as angular speeds and frequencies = $[T^{-1}]$; accelerations = $[LT^{-2}]$, forces = $[LMT^{-2}]$, power = $[L^2MT^{-3}]$ and so on.

The space-time as a "field" of mass

The conception of space-time is crucial for the definition of a model of physical reality. The invariance of the light speed with respect to the observer rules out Newton's conception of an absolute space time, that is a sort of inert "container" of physical reality. The form of Lorentz equations has suggested the conception of a space-time which is still a "container", but it actively interacts with matter and energy and is modified by them, as well as by motion.

Relations 3), however, suggest a totally different conception, which implies the abandoning of any traditional and intuitive idea of the space-time as a container, however defined. They show that motion modifies the space-time in the same way as a central field. This suggests the hypothesis of conceiving space-time as a field. Generated by what? The choice appears obliged: the only entity of which existence we are absolutely certain, mass.

Let's, then, formulate our initial postulate: **mass, space and time are three different aspects of a unique Entity; in particular the space-time can be represented in the RF of the observer as a field of the mass, propagating in it with constant speed c.**

It can appear absurd the concept of a space, the real one, propagating in itself, because apparently it couldn't have dimensions, neither volume. In our Entity, however, space is strictly connected with time, which always "flows" in the same direction; each point of space is therefore associated with a single instant, and that's what gives the observer the perception of volume.

The first consequence of this conception is that we have to talk about space-time in terms of "intensity", not dimensions and duration (which are concepts appropriate to the RF of the observer, Cartesian by definition). The second is that the macroscopic S-T, in which we are immersed and that we perceive with our senses, is due to the sum of the S-T fields of all atoms which compose the matter that surrounds us.

At this point immediately problems arise of compatibility with the experimental evidence. With this postulate S-T is described in the RF of the observer as exactly coincident with the gravitational field, which intensity is maximal near the mass and then decreases rapidly with the distance.

If this was true, travelling through space we should observe a continuous variations of the magnitude of physical phenomena due to the wide variations of the S-T field, according to what we have seen in the previous paragraph. Which is not true: experience shows that S-T has to be considered relatively "uniform" up to astronomical distances, with at the most some intensification in coincidence with concentrated masses, like planets and stars.

Same conclusion we obtain considering the behaviour of rotating bodies. A gyroscope, not perturbed, maintains the direction of its rotational axis always unchanged with respect to the fixed stars. We must ascribe this behaviour to some interaction with the real S-T, which also in this case appears to be relatively "uniform" and "static" up to astronomical distances. Certainly it doesn't look like a gravitational field generated by large concentrated masses .

This is not valid, however, at atomic level, because the rotating atoms of a solid object do not maintain their rotational axis unchanged with respect to the fixed stars, but they maintain it unchanged with respect to a local S-T, apparently "uniform", inside the object itself.

The intensity of the S-T, then, seems to change not like the gravitational field, but by apparently uniform "levels". This seems to rule out from the beginning our starting postulate. Before we discard it, however, let's see if further development of this conception can lead to a rational and complete explanation of the experimental evidence.

The structure of Space-Time

Let's see first how the space-time around us would be structured on the basis of our starting hypothesis. It will be composed by the sum of several components, which can be identified considering the masses and their movements as well.

First we have the radial S-T field generated by the single atomic components. They sum up to form the S-T field of the massive bodies, exactly as their gravitational field is the sum of the fields of all the atoms that compose them.

Second we have the fields generated by motion. Three types of motion are important under this respect.

a) Linear motion, which generates, has we have seen in the previous paragraphs, a “magnetic” component, proportional to the velocity of motion and normal to it, as shown in relations 3) (as in our starting postulate the S-T filed is coincident with the gravitational field, we will refer to the first with the symbols of the latter):

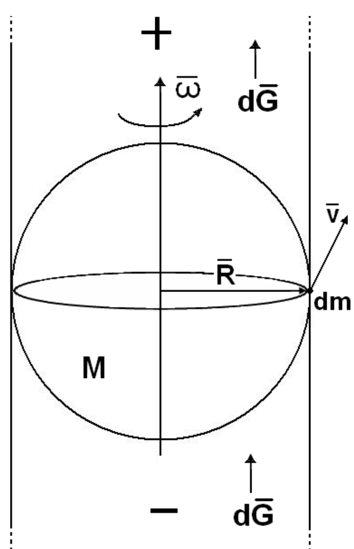
$$\overline{G} = \overline{G}_o + \frac{\overline{v}}{c} \wedge \overline{G}_o$$

b) The circular motion of a mass around another mass (planets around stars and electrons around atomic nucleus), which generates also a magnetic component. This is not different, in principle, from the field generated by linear (or inertial) motion. Due to the fact, however, that the mass moves in a close loop, the result is a polarized field the same type of that generated by an electric charge moving into a spire.

c) Very important, and with some outstanding properties, is the S-T field generated by the rotation of a mass (atoms, stars or planets) around itself.

Let’s consider a spherical mass rotating with angular velocity $\overline{\omega}$. In a rotating body each elementary mass, *dm*, moves with a velocity $\overline{v}$, proportional to its distance R from the axis of rotation. Each particle, therefore, generates a variation of the gravity field $d\overline{G} = \frac{\overline{v}}{c} \wedge d\overline{G}_o$, where $d\overline{G}_o$ is the gravitational field generated by the elementary mass.

The velocity $\overline{v}$ of all particles is always normal to the rotational axis, so the variation of the field generated by each of them has the main component always parallel to such axis, directed in the same direction of $\overline{\omega}$.



The sum of all single contributions is a S-T field, which “propagates” indefinitely along the direction of the axis of rotation from both sides of the rotating mass. It’s immediate to see that this field propagates inside a “cylinder” with the same diameter R of the rotating mass (outside the cylinder the variation of the magnetic field becomes nil for distances >> R). Another fundamental characteristic of this field is that it propagates inside the cylinder **without attenuation**, that is, its intensity does not change with the distance from the mass.

To conclude, a rotating mass generates a cylindrical S-T/magnetic field which intensity is proportional to $|\overline{\varpi}|$ and function of the characteristics of the mass (quantity, radius, density); it has the same direction of $\overline{\varpi}$ and propagates indefinitely with speed c, without attenuation :

$\overline{G_c} \equiv kJ\overline{\varpi}$ (where J is the inertial moment of the mass with respect to the rotational axis).

The space-time aether

Most important are the facts that, after a certain distance, the variations of the S-T generated by rotation become nil outside the open cylinder in which they are confined, and that inside it there is no attenuation. This allows us to justify why the S-T, although a field of the mass, appears to be of “uniform” intensity, at least at macroscopic level.

Every rotating mass generates a sort of spatial (which is also gravitational) string, with the same diameter of the mass, which propagates indefinitely without attenuation, from both sides of the rotating body.

At macroscopic level, the rotating masses normally possess angular velocity too small in order to generate variations of the gravitational (and therefore of the S-T) field detectable with the available instruments. Not so at atomic level. Due to our starting postulate, at this level the intensity of the S-T is much stronger than at the level of the observer (we will see later in the order of 10^{20} times as much); so the cylindrical S-T field generated by the rotation of an atom is perceived and measured by him enormously stronger than the field he calculates with the time and space units of his RF.

We can reasonably assume that each atomic component is rotating around itself (spin). Every rotating atomic corpuscle, then, generates a S-T “string”, which propagates indefinitely from both sides of the particle. All the space that surrounds us, therefore, is saturated by the S-T strings generated by the innumerable atomic components of the all matter which is present in the portion of universe within reach of light.

As it doesn’t make sense talking about negative space or time, in both sides of the string their variation is always positive, even if in opposite direction, so it always adds to the S-T intensity of the environment. Due to the huge number of atoms in the universe, the “density” of the spatial strings in each point of it is very high and relatively uniform in large portions of space.

They constitute a sort of “aether”, made up by a tissue of S-T quanta, which fills up the whole universe. It’s precisely this “aether” that determines the “intensity” of the S-T in the macrocosm. As we have seen, the intensity of the S-T field in each string is in the order of 10^{20} times higher than the field calculated by the observer with the units of his RF. Therefore, the resulting “intensity” of the aether appears to be by and large preponderant with respect to the radial S-T field generated directly by planets and stars.

Further, this S-T aether should “interact” with the movement of gyroscopes, thus providing the spatial reference for the orientation of their rotational axis.

We have to assume that the space-time at atomic level is made "uniform" by a mechanism similar to what happens at macroscopic level. If this is the case, there should be only two "levels" of S-T influencing in a relevant way our perception of reality: one macroscopic, which is more or less uniform at least in very large portions of space; the other microscopic, enormously more intense than the other one. This means that we can not apply the same parameters when we observe and calculate phenomena that take place in one or the other of these two levels.

In conclusion, the starting postulate, which at first sight appeared to be not compatible with the experience, is instead not only compatible, but it can also explain some apparent incongruences of the real S-T that still today continue to feed the debate between those who affirm the existence of the aether and those who negate it. With this hypothesis, the universe is completely filled with something that we can call aether, made up by a tissue of spatial strings (or quanta, if we prefer), generated by the atoms of the whole universe. This aether constitutes a sort of absolute S-T for what concerns phenomena occurring at macroscopic level. It doesn't have, however, any relevant influence at microscopic level.

The electric charge

So far we have not mentioned what appears to be, besides the mass, the other fundamental component of the physical reality: the electric charge.

How does it fit in this conception? Apparently it doesn't have any role at all in structuring the S-T, neither at macroscopic or atomic level. There seems not to be room for the its existence. How can we, then, justify the existence of physical phenomena like electricity, and those associated with it, the nature and structure of light quanta and so on?

We postulate that the elementary electrical charges exist in order to justify two groups of experimental phenomena:

a) the existence at macroscopic level of negative and positive fields, that compel us to hypothesize the existence of elementary particles, bearing a positive or negative charge, which generates a field by far more intense then gravity.

b) The atomic equilibrium and other phenomena at atomic level, which require the existence of forces much stronger than those provided by gravitation.

Starting from the latter. Let's assume as experimentally proven that matter is composed by atoms, formed by a massive nucleus, around which particles with a much smaller mass rotate, called electrons. The linear speed of electrons around the nucleus is relatively small, of the order of hundreds of km/sec, or even less. But their angular speed is incredibly high, because of the very small diameter of the orbit they cover. Only a field capable of exercising a force enormously stronger than that forecast by Newton's law can balance the centrifugal acceleration, thus assuring the equilibrium of the atom.

It was therefore necessary to hypothesize that the elementary electric charges are somehow attached to the mass of atomic components: the negative charge to the electrons, the positive to a particular kind of masses, called protons, thought to be concentrated into the nucleus. Each charge generates a field capable of exercising a force enormously higher than that due to gravity alone, strong enough to balance the centrifugal acceleration developed by the mass of the electron.

This model meets with several difficulties, which are overcome by means of further assumptions, like for example the existence of stronger forces (without specifying their source), necessary to keep together in the nucleus several protons, associated to charges of the same sign; and so on and on, in a never ending race.

In the assumption that S-T is a field of the mass, instead, the atomic equilibrium is justified by gravity alone, with no need of introducing other entities or forces. In the vicinity of the atomic nucleus, in fact, the intensity of the S-T field is by far much higher than that of the RF of the observer. Which means that time and space are much "larger" than what the observer perceives and measures.

We have seen that in RFs with different value of the S-T, speeds have the same value, but accelerations and forces are perceived and measured differently, depending on the ratio of S-T between the two RFs. The ratio between the atomic and the macroscopic S-T is in the order of 10^{20} (this number is derived from the assumption that the difference between the forces exercised by the units of mass and electricity, at macroscopic level, is due to the difference between the macroscopic and the atomic space-time. The ratio between the two levels of S-T, therefore, should be the same as between Newton and Coulomb constants.). As a consequence the observer sees and measures accelerations 10^{20} higher than those existing at atomic level, and therefore forces between atomic particles much stronger than those calculated with Newton's law (actually, the force exercised by the nucleus of an atom of hydrogen on its electron, is calculated in the order of 10^{40} higher than that calculated with Newton's law. This is due to the fact that in that formula space is present as r^{-2}, while time does not appear. On the other side, if we take into consideration only the time, we have to keep in mind that accelerations are in the order of 10^{20} higher than those calculated at macroscopic level. In either case the ratio is in the order of 10^{40}).

This is due exclusively to the different intensity of S-T in the two RFs, and therefore to the altered perception of the observer at macroscopic level, not to the presence of entities different from the mass, or forces different from gravity.

Positive and negative charges

According to our postulate, we can do without the electrical charges for what concerns the equilibrium at the atomic level. But what about the macroscopic level? The force of gravity is always attractive, while experience demonstrates the existence of entities with positive and negative sign, capable of repulsing or attracting, according to their polarity. Can a gravitational field become "repulsive" vs. another mass? To this question the answer has always been negative, but it becomes immediately positive the moment in which we assume that also the movement of a mass generates a magnetic-type field.

Therefore, mass is perfectly capable of generating positive and negative gravitational fields, and the mechanism through which this happens, rotation, provides also a rational explanation of some apparently mysterious physical entities, like for example light quanta.

We have seen in a previous paragraph that a rotating mass generates a variation of the gravitational field, which propagates indefinitely without attenuation in an open cylinder (or string) having the same diameter of the rotating mass.

Most important is the fact that this gravitational field is "polarized", as it possesses positive sign in the direction of $\overline{\varpi}$, negative in the opposite side. The variation of the gravitational field, in fact, is identical from each side of the mass, with the only difference that on one side it is directed toward the mass, on the other side it is directed outward. This means that another mass placed inside the cylinder would be attracted or repulsed, according to which side it is in. The force of attraction, or repulsion, generated by rotation, is added to the radial force due to the central field of gravitation, which is always attractive. The latter, however, decreases with the square of the distance, so for distances $>>$ R the polarized field generated by rotation becomes preponderant.

Very important is the facts that after a certain distance variations of the gravity field generated by rotation becomes nil outside the gravitational string, and that inside it there is no attenuation. This means that a rotating mass exercises a force of attraction or repulsion upon another mass only if and until the latter is on the trajectory of the cylinder generated by rotation; on the other side, this force has always the same value, no matter what the distance between the two masses is, to the limit also at infinite distance.

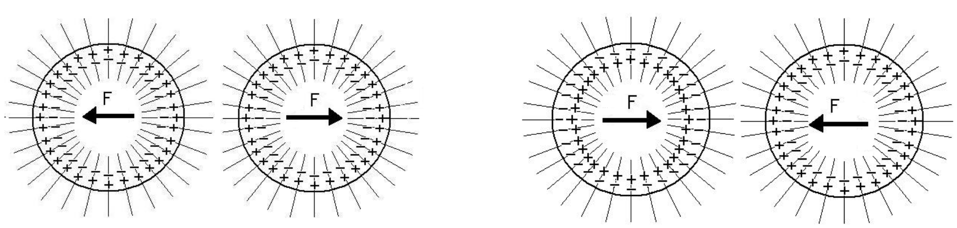
At macroscopic level, the rotating masses normally possess angular velocity too small in order to generate variations of the gravitational field detectable with the available instruments. Not so at atomic level, in which the intensity of S-T is enormously higher than the S-T of the observer; so the cylindrical gravitational field, generated by the rotation of an atom, is perceived and measured by him much stronger than the field he calculates with the time and space units of his RF. Therefore of the same order of magnitude of an electric field.

Every rotating atomic corpuscle, then, generates an "electro-magnetic" string, with the same diameter of the rotating mass; the string propagates indefinitely from both sides of the particle, with positive sign on one side, negative on the opposite.

We can reasonably assume that each atomic component is rotating around itself (spin); this means that an object whatsoever generates as many strings as the number of its atomic components, that is a huge number, such as to saturate completely the surrounding environment.

The strings generated by an object exercise a repulsive or attractive action on the surrounding objects, according to the sign of each of them. If the spin of the atoms in the object are oriented randomly, every external surface will be hit by a more or less equal number of positive and negative strings, thus the gravitational action exercised by them is nil. The only remaining action is due to the radial gravitational field.

However, if we orient somehow a sufficient number of strings in the same direction, for example normal to the surface of the object, the global effect will not be nil: we'll have a field of the same type and same order of magnitude of the electric filed, with positive or negative sign, according to the orientation of the strings.



Rotation of atomic components, therefore, appears to be capable of justifying the existence of positive and negative forces, the same magnitude of those generated by the electric field, with no necessity of assuming the existence of any other entity but the mass.

It's to be noted that the field generated by an anisotropic orientation of the strings is formed by electro-magnetic "quanta" having the same radial dimension of the rotating atomic components.

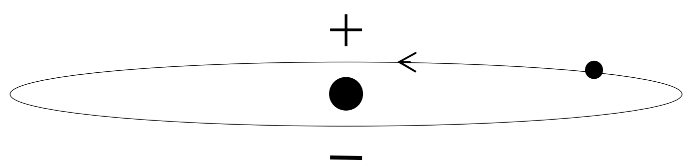
The matter at atomic level

The disappearance of the electric charge at the atomic level, on one side simplifies the terms of the problem, on the other side imposes the building up of a new model of the atom, capable of explaining all physical and chemical characteristics of the matter. A gigantic task, which however can open the way to a better understanding of those characteristics and therefore to new ways of acting on them.

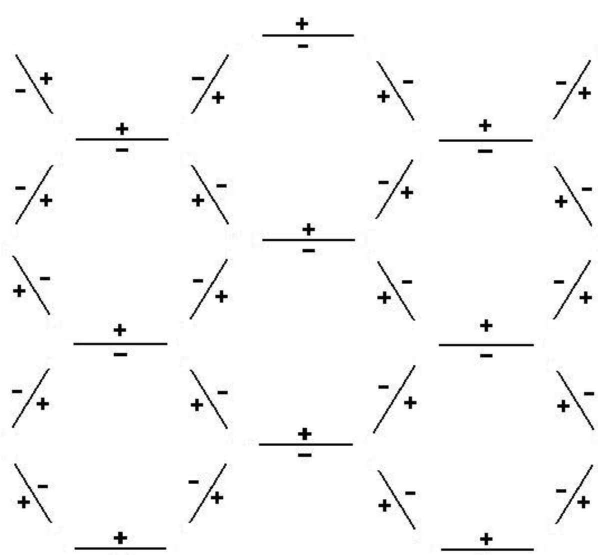
It appears that the model of discrete masses of different size, rotating around each other (besides around themselves), should be maintained. The dynamics and bonds inside each single atom, and between different atoms, should be provided by the gravitational actions, on one side those due to the central field, on the other, no less important, those generated by motion, in particular rotation. It seems that the gravitational strings generated by the rotation of atomic components around themselves have no relevant effect between neighbouring atoms, because it is extremely improbable that one of them remains inside the string generated by another for a time long enough to justify some action.

At this level, however, the actions exercised by the polarised fields generated by masses rotating around each other become very relevant. They are of a much lower intensity, but they exercise their action on a much wider range. In the vicinity of the atom, the intensity of the polarized field is much smaller than the central field. But it propagates in the direction of the axis of rotation without attenuation, therefore for great distances it becomes preponderant. It is precisely the balance between the attractive forces exercised by the central fields and the repulsive forces due to the magnetic components, that should determine the various status of the matter.

As an example, let’s consider the simplest possible atomic structure, that of a massive nucleus around which one or more smaller objects rotate, on the same plane.



Systems like this can be assembled forming very stable structures, as can be seen in the following drawing, where they are arranged in hexagonal cells. The atoms surrounding each cell are linked together by the central attractive forces, but they cannot move towards each other, because of the repulsive forces due to the magnetic fields of the two opposite sides.



Various combinations of rotating atomic masses should provide explanation for all states of matter.

The light

The starting postulate provides a possible explanation also for the nature and structure of light, which experimentally has the characteristics of both, an electromagnetic wave and a corpuscle (quantum).

Let's consider an atomic corpuscle rotating around its axis with angular velocity $\overline{\varpi}$. It generates, as we said, an electro-magnetic string, which propagates indefinitely without attenuation, having the same diameter of the rotating particle and intensity proportional to $\overline{\varpi}$. Let's suppose that this atom starts pulsating with frequency Ω. We know that each pulsation provokes a variation of the angular speed and therefore a variation of the field inside the string; this variation propagates along the string, without attenuation, as a wave with frequency Ω, superposed to the main frequency $\overline{\varpi}$. The field inside the string, in fact, would be:

$\overline{G}_c \equiv kJ\overline{\varpi}\left(1 + Asen\Omega\right)$, where $A < 1$ is the amplitude of the oscillation.

In this way, energy is transmitted along the string, undoubtedly of a undulatory nature; but in the same time it can be considered as being corpuscular, because it is concentrated along a string having the radial dimension of a corpuscle. The light, therefore, could be generated by the pulsations of rotating atoms, which emit a definite amount of energy, propagating indefinitely along the strings.

It should be noted that the energy is transmitted by the rotating body in both directions of the string (with the only difference that they have opposite phase), which is not supported by the current explanation for the generation of light quanta; this does not mean, however, that it's not compliant with experience.

Pulsating stars

At macroscopic level there is a good example of the mechanism that generates the light quanta: the pulsating variable stars RR Lirae and δ Cephei. The diameter of these stars changes with great regularity, with periods that span from a few hours to about 50 days, with a peak of frequency between 12 hours and 5 days. The interesting fact is that the distribution of the frequencies of pulsation is not homogenous, i.e. random, but presents peaks and lacunae, like a light spectrum.

If we multiply the frequency of the pulsating stars by a factor equal to the ratio existing between the macroscopic and the atomic S-T levels ($1{,}31.10^{20}$, this number is given by the ratio between Coulomb's and Newton's constants), the pulsation periods of the variable stars fall exactly in the field of luminous radiations. The wave length of the violet (0,39 μ), in fact, corresponds to a period of about 5 h of a pulsating star, that of the red light (0,79μ) to about 10 h, while the major concentration would be in the infrared, between 1 and 10 μ, corresponding to 0,5 ÷ 5 days of the pulsating stars.

A casual coincidence? Could be. But in any case it would be very interesting, in order to establish this causality, to analyze the spectrum of the frequencies of those stars, reported to the atomic scale of times.

Conclusions

By analyzing the omnidirectional propagation of a beam of light, we obtain a set of transformation equations equivalent to those of Lorentz, but expressed in a mathematical form that force us to abandon the traditional concept of the space-time as a “container”, no matter how defined.

Representing the space-time as a field of the mass, coincident with the gravitational field, allows us to build up a consistent model of physical reality which is in good accord, apparently, with the experience, with no need to introduce other entities beside the mass, or other fields beside gravity, or whatever other law beside the one that governs the gravitational field.

The whole physical reality, in conclusion, could be reduced to the existence of a unique Entity, made up by three different aspects, mass, space and time, and governed by a unique mathematical relation.