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 fields they generate have the same structure, motion has a different effect on them: while a moving electric charge remains unchanged, but generates a magnetic field, mass changes its value, but does not generate any additional field. This difference should not be substantial, but only formal.

The behavior of the mass has been deduced in the SR by Einstein based on the Lorentz transformation equations, worked out by analyzing the linear propagation of a beam of light, in the assumptions that the light speed in a vacuum does not change with the motion of the source.

By analysing the omnidirectional propagation of a beam of light, however, we obtain a set of equations which show that motion modifies the space-time by generating a spatial component normal to the motion itself. These equations force us to abandon the traditional concept of space-time as a "container", however defined, of physical reality and suggests a totally new conception: that of considering the 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 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. According to it, the space-time at macroscopic level is formed by a sort of aether, made up by a tissue of spatial strings generated by the atoms of the whole universe within reach of light. It also explains the structure of matter and its various status, the wave/particle duality of photons and the (apparent) wave/particle duality of the atomic particles.

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

Preliminary remarks

When Sir Isaac Newton formulated the law of universal gravitation

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

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 $\bar{v} \neq 0$, 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 $\bar{v} \neq 0$, 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, c, and that a charge moving at a velocity $\bar{v} \neq 0$ generates a magnetic field normal to the motion:

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

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 an 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):

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

which are at the base of current theoretical physics.

Experience appears to be in good accord with the theory drawn by them, but the different behavior of the electric and gravitational fields remains inexplicable. 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 theory 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.

(*) Meaning of the simbols: $\bar{a}$ is a vector; $\bar{a} \wedge \bar{b}$ a vectors product

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 reality and it is not necessarily conforming to the real space-time. To serve as a “reference”, it has to be a Cartesian space-time.

Let’s then state our starting conditions:

a) *The reference frame (RF) is a 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 RFs in motion with respect to each other.

How motion modifies space-time

Let’s consider two observers, A and B, moving with respect to each other at a constant speed, $\bar{v}$. 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 all directions in both RFs; 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.

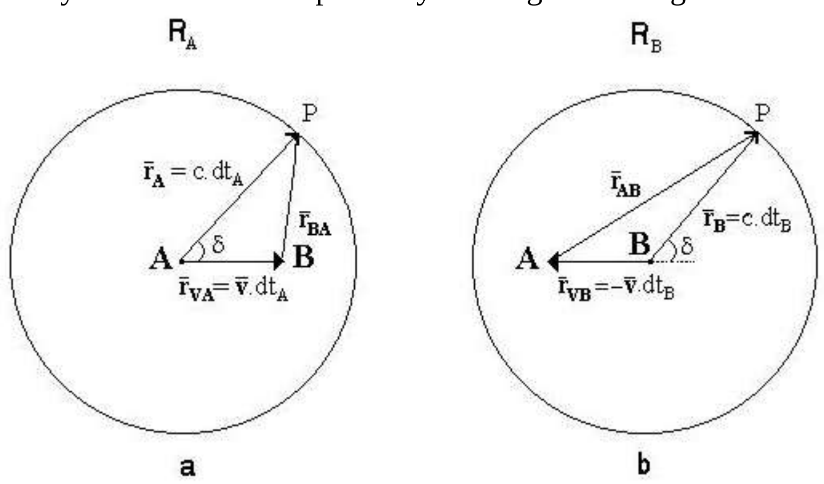

fig. 1

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, A and B.

This necessarily means that the structure of the RF 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.

To better visualize the problem, we'll analyze first the case in which light is propagating on a two-dimensions space-time. 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 have both a constant distance from 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 $\overline{B_i P}$ ($\overline{A_i P}$) have the same distance from the circumference where the light is distributed.

Considering that we have:

$$\overline{AP} = \frac{\bar{r}_A}{r_A} = 1; \quad \overline{A_i P} = \frac{\bar{r}'_A}{r'_A} = 1'; \quad \overline{BP} = \frac{\bar{r}_B}{r_B} = 1; \quad \overline{B_i P} = \frac{\bar{r}'_B}{r'_B} = 1' ,$$

we obtain in R_A:

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

And vice versa in R_B:

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

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

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

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.

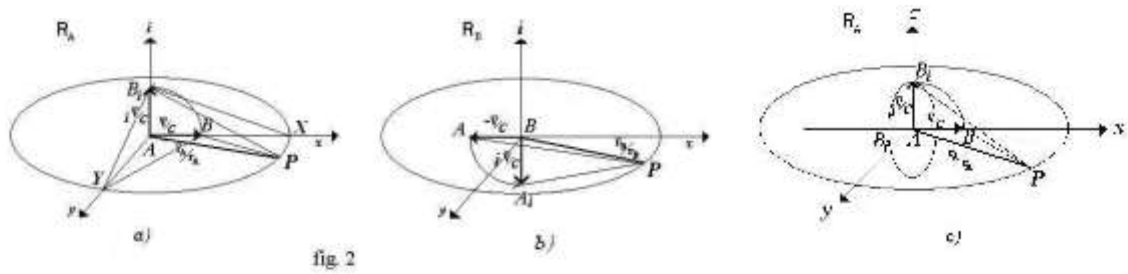

fig. 2

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 should 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:

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

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

Description of a central field in motion

Relations 3) have a form that allows us to better understand which are the modifications induced by motion on the space-time's structure, and are more convenient in all calculations where central fields in motion are involved.

All stationary central fields are described in the observer's RF by the relation:

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

If the source A is moving with respect to the 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 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 generate an additional field, but modifies the value of the of the mass. From a practical point of view the result should be the same, because the transversal and longitudinal variations of the mass induce a modification of the gravitational field that should be equivalent. From a theoretical point of view, however, the implications are outstanding.

How perception of physical quantities varies with the RF

We have seen that two RFs, R_A and R_B, in relative motion $\overline{v}$ to each other, have different values for space and time (fig. 3). As a consequence, the same physical phenomenon is perceived in different ways from different observers connected to them (the same considerations are valid for all RFs in which the space-time has different values for whatever other reason).

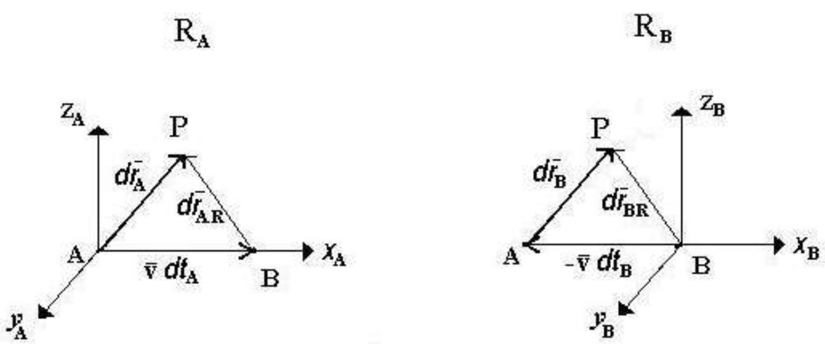

Fig. 3

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 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 for example in energy = [L^2MT^{-2}].

c) If the motion of the point from A to P is accelerated, we have:

$$|\bar{a}_B| = \left|\frac{d\bar{v}_B}{dt_B}\right| = \left|\frac{d\bar{v}}{dt_B}\right|; \quad |\bar{a}_A| = \left|\frac{d\bar{v}_A}{dt_A}\right| = \left|\frac{d\bar{v}}{dt_A}\right|;$$

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 the same existing between the value of the respective RFs.

Therefore, 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: $E_A = \frac{1}{2} m v_A^2 = E_B = \frac{1}{2} m v_B^2 = \frac{1}{2} m v^2$).

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 perceive and 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 which 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 idea of conceiving space-time as a field. Generated by what? The choice appears obliged: 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 awkward 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 should talk about space-time in terms of "intensity", not dimensions and duration (which, however, 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 the atoms which compose the matter surrounding 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 continuous variations of the magnitude of physical phenomena due to the wide variations of the S-T field, in agreement with what we have seen in the previous paragraph. Which is not true: experience shows that the "intensity" of the S-T should 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 not perturbed gyroscope 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 the 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 central 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 consequences, is the rotation of a mass (atom, star or planet) around itself, with angular speed **ω.** This generates two types of gravitational field, a cylindrical one, having the same direction of **ω**, and a field that we can call "centrifugal", always perpendicular to that direction.

Let's see them.

The strings of space-time

Let's consider a spherical mass rotating with angular velocity $\overline{\varpi}$. 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 elementary particle *dm*, therefore, generates a variation of the gravitational field $d\overline{G} = \frac{\overline{v}}{c} \wedge d\overline{G}_o$, which is normal to $\overline{v}$ and $\overline{R}$.

The velocity $\overline{v}$ of all particles is always normal to the rotational axis, so the variation of the field generated by rotation is always parallel to such axis, directed in the same direction of $\overline{\varpi}$.

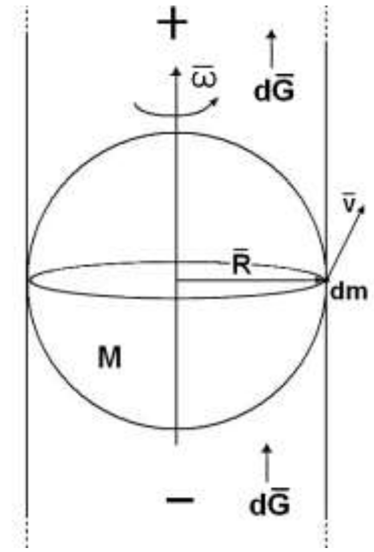

Fig. 4 – A space-time "string"

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. This field propagates inside a "cylinder" with the same diameter R of the rotating mass. Another important 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 is a 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 aether

The fact that inside a S-T string there is no attenuation allows us to justify why the S-T at macroscopic level, although a field of the mass, appears to have an almost uniform "intensity".

Every rotating mass generates a sort of space-time "string", with the same diameter of the mass, which propagates indefinitely without attenuation, from both sides of the rotating body.

At macroscopic level, rotating stars and planet normally possess angular speed too small 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 (the atomic equilibrium would be justified if it was 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 the observer 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. The space that surrounds us, therefore, is saturated by the S-T strings generated by the innumerable atomic components of the matter which is present in the whole portion of universe within reach of light.

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. 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 central S-T fields generated directly by planets and stars. Further, this S-T aether should “interact” with the movement of gyroscopes, thus providing the spatial reference for their orientation.

The aether, however, is a mesh too wide to have a relevant influence at atomic level, because the atoms have the same diameter of the S-T strings and therefore it’s improbable that they could stay within the radius of one of them long enough to be submitted to some significant action. We should assume, therefore, that the space-time at atomic level is made “uniform” by a mechanism like what happens at macroscopic level. If this is the case, there should be at least two relatively uniform “levels” of S-T that determine our perception of reality: one macroscopic, which is more or less uniform in very large portions of space; the other microscopic, enormously more intense. This means that we cannot apply the same parameters when we observe and calculate phenomena that take place in one or the other of these two levels.

The centrifugal gravitational field

According to our postulate, space-time is a field “emitted”, instant by instant, by the surface of a mass and it coincides with the gravitational field. If the body is rotating around itself, the field emitted on a certain moment is “shifted” with respect to the field emitted the following instant. This means that the rotating mass produces a torque in the generated field, which propagates indefinitely. This torque must have a gravitational effect.

Let’s consider a massive body, rotating around itself with angular speed $\overline{\varpi}$, Earth for example. Due to its rotation, the weight of a mass at its equator is smaller than the weight of the same mass at the poles; that is, at the equator the gravitational acceleration is smaller than that calculated with Newton’s formula.

This is a well-known fact by scientists, who ascribe it to the centrifugal acceleration due to the planet’s rotation, which opposes its Newtonian acceleration. A mass on the Earth’s surface is subject to a centrifugal force:

$$\mathbf{F} = m\,(\mathbf{v} \wedge d\,\mathbf{v}/d\,t) = m\,(\mathbf{v} \wedge \boldsymbol{\omega})$$

where $|v| = R_o\, \omega \cos \alpha$, with R_o = terrestrial radius, α = latitude.

At the equator, the centrifugal force has the highest intensity : $F = m\, R_o\, \omega^2$, that decreases with latitude, down to zero at the poles. It is always repulsive and always normal to **ω.**

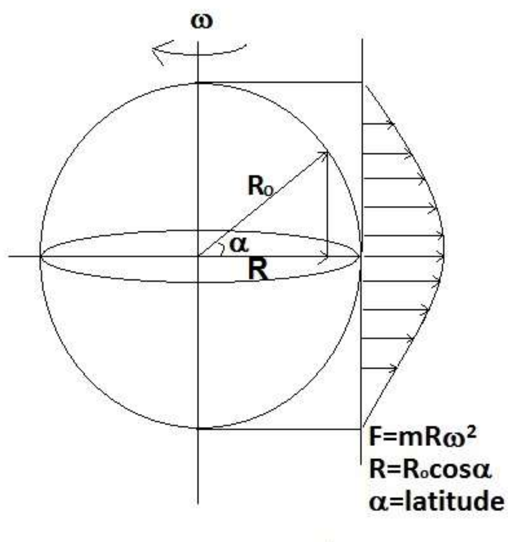

Fig. 5 – The centrifugal field

According to the present theory, this force is due to the “torque” of the S-T field produced by the Earth’s rotation around itself, which generates a field (that from now on will be called “centrifugal”), opposite to the Newtonian field. Due to the centrifugal field, a mass placed on the equatorial plane is repulsed from Earth with a force proportional to ω^2.

Therefore, the gravitational acceleration **G** exerted by the Earth on whatever mass is equal to the difference between the Newtonian, **G**n, and the centrifugal, **G**c, accelerations:

G = **G**n – **G**c

This difference does not depend on the presence of a mass in a certain point, and obviously it propagates in space. An essential difference between the two fields is that while the Newtonian is a central field, which always maintain its direction towards the centre of mass, the centrifugal field is not central, as it propagates in space keeping its direction always normal to the axis of rotation. Thus, the intensity of the first decreases with the square of the distance, while that of the centrifugal force decreases in a measure slightly smaller.

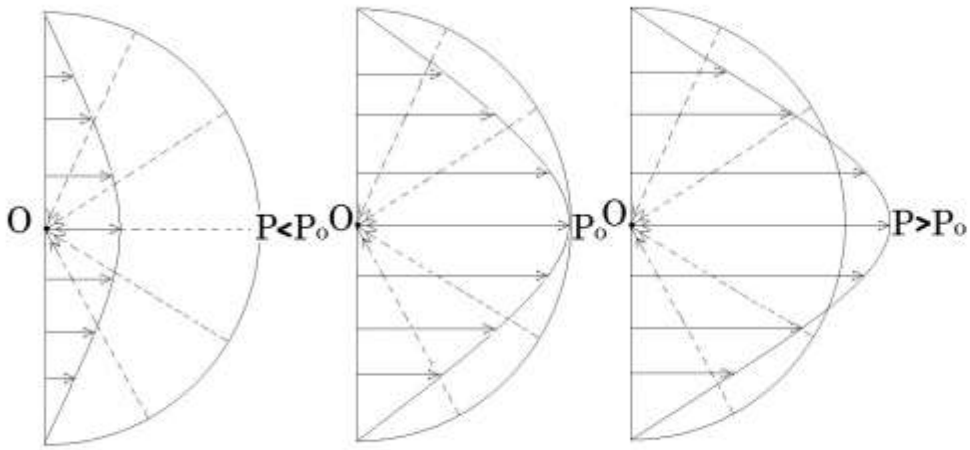

Fig. 6 – Ratio between the Newtonian and the centrifugal fields with distance

For this reason, the initial ratio between the Newtonian and the centrifugal fields, for any given direction, is not constant, but it changes with the increase of the distance from the source. The repulsive force exerted by the centrifugal field diminishes of a smaller amount than the attractive force of the Newtonian field; therefore, at a certain distance, Po, from the source they will have, on the equatorial plane, the same intensity, but opposite direction. For larger distances than Po, there will be an equatorial section inside which the force is repulsive (see fig. 6).

A mass placed at a distance smaller or equal to Po is always attracted towards the source. For larger distances, the force will be repulsive if the mass is situated inside that equatorial sector, always attractive outside. If the distance tends to infinity, the gravitational field tends to zero, but it becomes entirely repulsive.

Fig. 7 shows the curve where the Newtonian and the centrifugal forces annul each other. If a mass is inside that curve, the gravitational force acting on it is repulsive; if it is outside, the force is always attractive.

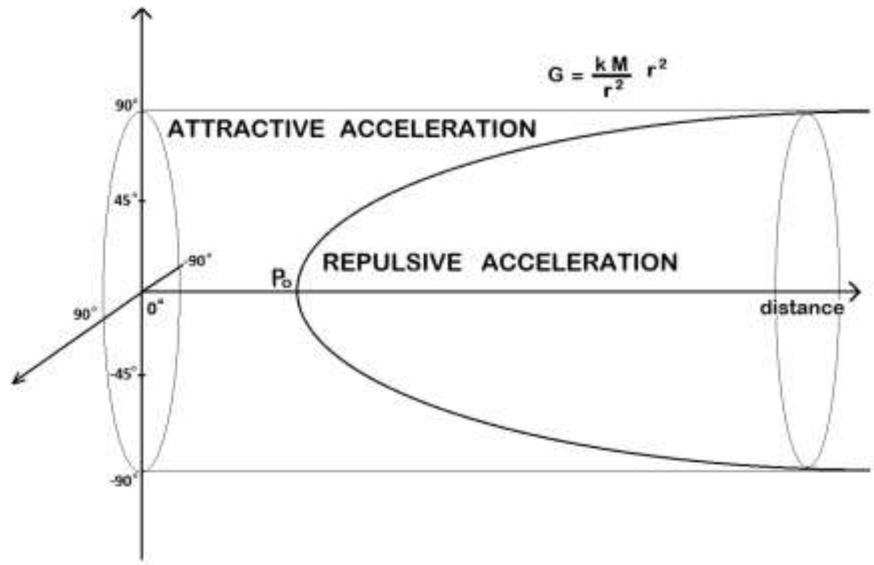

Fig. 7 – The surface where the gravitational acceleration of a rotating mass is null.

At macroscopic level the gravitational force of a rotating body (like Earth, for example) at a distance Po is so small, that no influence can be measured or calculated on the movement of a mass at that distance. Not so at atomic level. We have seen that an observer watching a physical phenomenon happening in a different S-T, perceives and calculates speeds with the same value, but accelerations with different values, depending on the ratio between the two S-Ts. Therefore, the observer perceives and measures, for a rotating atom, an angular speed that is about 10^{20} times the angular speed at atomic level, and forces generated by the centrifugal field of the same order.

The electric charge

According to the classic theory, the electric charge is a fundamental component of physical reality. Its existence has been postulated in order to justify two groups of experimental phenomena:

a) The atomic equilibrium which require the existence at atomic level of forces much stronger than those provided by gravitation.

b) the existence at macroscopic level of fields, different from gravity, responsible for the electro-magnetic phenomena.

The atomic equilibrium

Let's accept that matter is composed by atoms, formed by a massive nucleus, around which particles with a smaller mass rotate, called electrons. From the observer's S-T, the linear speed of electrons around the nucleus is seen and calculated as relatively small, of the order of hundreds of km/sec, or less. But their calculated 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 of the electrons, thus assuring the equilibrium of the atom.

It is therefore necessary to hypothesize the existence of “something”, the elementary electric charges, somehow attached to the mass of atomic components: the negative charge to the electrons, the positive to a different kind of masses concentrated into the nucleus, called protons. 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 electrons.

This model meets with several difficulties, which are overcome by means of further assumptions, like for example the existence of much stronger forces, necessary to keep together in the nucleus several protons, associated to charges of the same sign (which are supposed to repulse each other); and so on and on, with no end on sight.

In the assumption that the 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. At the atomic level, in fact, the intensity of the S-T field is by far much higher than that of the RF of the observer, which gives to the latter the perception of accelerations and forces enormously stronger. Therefore, there is no more reason for the elementary electric charges to exist.

The electric charge at macroscopic level

Experimentally, an electric charge can be obtained introducing in a metallic sphere a certain number of minute particles, the electrons, to which is attached a “quid”, the elementary electric charge, that exerts a strong repulsive force towards other similar particles. The surface of the sphere has the same role with respect to the electrons of the walls of a container for a gas, because it prevents them to outflow. The more electrons are introduced in the sphere, the more the electric potential (equivalent to the gas pressure) increases, until an escape way is open through which the electrons outflow, thus generating an electric current.

(Conventionally the charge of the electron is considered “negative”, but at macroscopic level this convention doesn’t make sense, because the “positive” charge, connected to proton, does not have any role in the electro-magnetic phenomena)

This model can be maintained also in the present theory. There is no problem in hypothesising the existence, at atomic level, of a great number of particles, with the same mass of the electrons, spinning around themselves.

When this particle is circling around a more massive nucleus, the distance from the latter and from similar particles, also circling around it, is smaller than Po (fig.7); therefore, the force between all these components is always attractive and they stay together in a stable manner.

If, however, these particles (that we keep on naming electrons) for some reason get out of their orbits into the interatomic space, then the distance between them will be larger than Po and, therefore, they will exert a strong repulsive force Vs each other, the same that we measure between two electrons. In this case their behaviour and their electro-magnetic effects are the same of the electrons in the classic theory.

The matter at atomic level

In this theory the model of matter made up by 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, then, would be provided by three types of fields: central Newtonian fields, always attractive; magnetic-type polarized fields, generated by rotation of components each around the other; centrifugal fields, generated by the spin of the single components, always repulsive and normal to the spin's axis.

The structure of matter depends on the equilibrium between the various forces exerted by these fields. Single atoms are stable because their single components are situated at such a distance that the force between them is always attractive. When two or more atoms come together, then the repulsive forces start to play a decisive role.

As an example, let's consider the simplest possible atomic structure, that of a massive nucleus around which one or more smaller objects rotate, thus generating a magnetic polarized field:

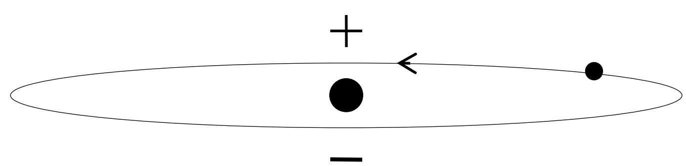

Fig. 8

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.

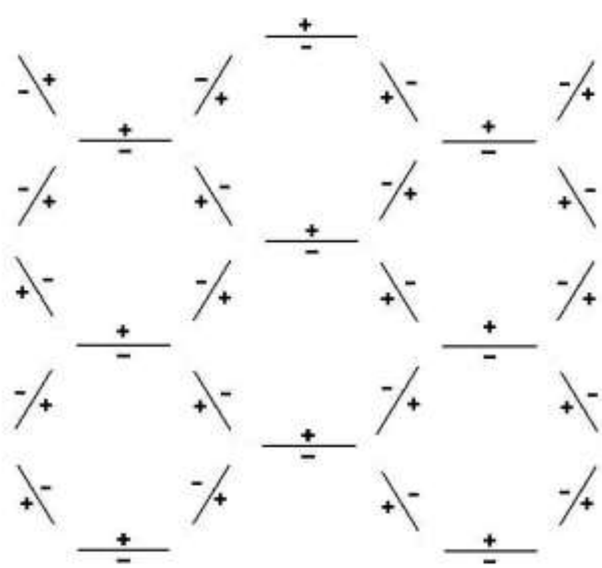

Fig. 9 – A stable structure of matter

Various combinations of rotating atomic components should provide explanation for all chemical properties and structures of matter, whose architecture is determined by the equilibrium between Newtonian attractive forces and the attractive/repulsive forces generated by the rotation of the particles around each other and around themselves.

The states of matter

The centrifugal field can explain the various states of matter, solid, liquid, gaseous. Matter is made by molecules, composed by one or more atoms linked together by the Newtonian attractive forces. Each component of the molecule is spinning around itself, generating a repulsive centrifugal field. Thus, the overall gravitational field of the molecule should have one (or more than one at different angles) critical distance Po, where the force from attractive becomes repulsive.

Let’s examine, for simplicity, the case of fig. 10, with only one critical distance on the equatorial plane.

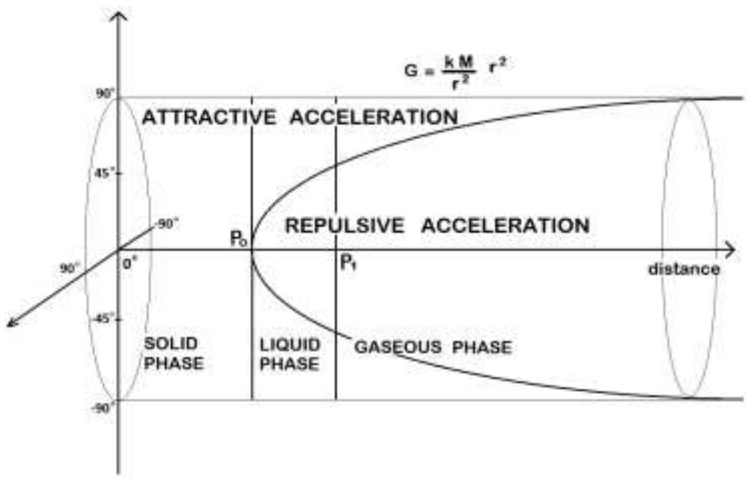

Fig.10 - The various states of matter

If two molecules are at a distance smaller than Po, the gravitational force between them is always attractive and they will be linked to each other in a way capable to assure the equilibrium between the different forces acting on each component. In this case the body of which the molecules are part is a solid, because they are linked together in a stable manner.

When the temperature increases, the molecules start wobbling , at a point that the critical distance Po is often exceeded, with random repulsive actions between the molecules, which although not permanent are sufficient to break the gravitational links holding them together in a well-organized way. At this point the matter becomes liquid. In fig 10 we have a liquid phase when the mean distance between the molecules is between point Po and P_1, where the attractive and repulsive forces are more or less equivalent.

With a further increase of the temperature, the mean distance between the molecules becomes larger than P_1, and therefore the repulsive force becomes prevalent. At this point begins the gaseous phase, because the molecules always repel each other.

Pulsating Mass

An important case is when a rotating mass, for some reason, starts pulsating with frequency Ω. If the body is rotating at an angular speed ω, the pulses provoke a rhythmic variation of this speed, with frequency Ω; thus, we have rhythmic variations, with the same frequency, of both the equatorial centrifugal field and the polar magnetic string.

If the pulsating mass is an astronomical body no measurable effect is perceived at macroscopic level. If instead the pulsating body is an atom, then at macroscopic level the frequency Ω is perceived and measured 10^{20} times as much. This can provide a satisfactory explanation for a mysterious phenomenon: light.

The light

Experimentally the light has the characteristics of both, an electromagnetic wave and a corpuscle.

Let's consider an atomic corpuscle rotating around its axis with angular speed $\overline{\varpi}$. 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 particle 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 an 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 and lasts as long as it keeps on pulsating. The light, therefore, should be generated by the pulsations of rotating atoms (or atomic components), which in this way emit a definite amount of energy, propagating indefinitely along the S-T strings.

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. Interesting is the fact 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 it would be interesting to analyze the spectrum of the frequencies of those stars, downscaled to the atomic time.

Heat and temperature

In the classic theory, heat and temperature are given by a generic "level of agitation" of the molecules. Temperature is strictly related to the frequency of the light emitted by a certain body: the higher the temperature, the higher the frequency and energy of the emitted quanta. It's not clear, however, why there is this relation between the level of agitation of the molecules and the frequency of light, from the moment that a quantum is emitted when an electron changes its orbit.

In the current theory, instead, there is a clear connection between these two concepts. A pulsating atom generates a light quantum along a polar string; but at the same moment it provokes a variation, with the same frequency, of the centrifugal field (which is normal to the direction of the quantum), due to the variations of the angular speed.

They provoke a rhythmic variation of the critical distance Po and therefore of the force exerted Vs the nearby molecules, which turns from attractive to repulsive and vice versa, with the same frequency of the light quanta. As the emitted energy is proportional to the frequency of the pulsations, the actions exerted on the nearby molecules would be the more "strong" the higher is the frequency.

When the frequency increases also the actions between nearby molecules increases, and therefore their distance, thus changing the status of matter from solid to liquid and finally to gaseous.

The (apparent) double nature wave/particle of all atomic particles

The interferometric experiments show that not only photons, but all the atomic particles, like electrons, protons, atoms and associations of several atoms as well, in certain conditions behave like proper waves. For that reason, quantum mechanics upholds that they have a double nature of corpuscles and waves, like photons. It is not clear to which type of waves they belong; certainly not to the electro-magnetic type.

In quantum mechanics the state of a particle is described (in Schrödinger's representation) by a "wave function", a concept that does not describe a proper wave, but rather the probability that a given particle could be in one place or another. And yet the atomic particles generate interferometric phenomena exactly like photons.

This behaviour is perfectly explained in the present theory. The atomic particles are "visible" at macroscopic level only if they rotate, either around themselves either around other particles, because rotation is perceived 10^{20} higher and therefore generates fields strong enough to be perceived and measured. A particle that doesn't rotate is invisible at macroscopic level, because it doesn't' generate a field strong enough. Therefore, what we visualize in our experiments is not the particle itself, but the field generated by its rotation, which gives way to interferometric phenomena like a proper wave.

Dark Matter

It’s worth mentioning the fact that the present theory can provide a simple explanation to one of the most intriguing problems of modern cosmology; that of the dark matter, which according to a number of astronomical observations should constitute more than 80% of the total mass of the universe. The name refers to the fact that it does not emit or interact with observable electromagnetic radiation, such as light, and is thus invisible to the entire electromagnetic spectrum.

Many hypotheses have been proposed in order to explain the nature of this matter, none of which capable of unravelling the mystery. In the present theory the answer is immediate: only rotating particles emit electromagnetic radiation detectable at macroscopic level. If around and between the galaxies there are clouds of non-rotating isolated particles, they are totally “invisible” to our instruments and their existence can be inferred only thanks to the gravitational effects that they induce on the galaxies’ movements.

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 form that forces 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.