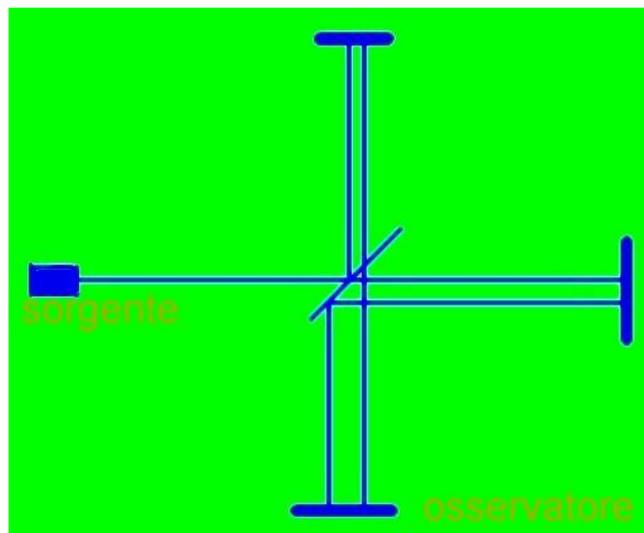


ENERGY MASS PARTICLES
FIELDS FORCES
AND
NEW ETHER (AETHER) OF PHYSICS

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- Michelson's Interferometer -

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(This English text may contain grammatical errors. We apologize to our readers.)

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Preface

In this and all other writings of [ricercaetereperduto](#) website, which can be found on Google, we identify the ether with - physical space and its physical qualities - as has been proposed by P. Drude and M. Abraham towards the end of '800 , and by Einstein after 1916, and as is widely described in the file - the new Einstein's ether - which is always in [ricercaetereperduto](#) website.

The ether, then, is no longer something contained within the space, like older models were, but it is precisely the space with all its physical properties that here we try to highlight well, while they are systematically hidden from the word - empty space- and mathematical formalism, as the field in vacuum and the curvature of the vacuum. So much so that - empty space - has become wrongly synonymous of – nothingness - .

In this nothingness, however, there are a lot of physical phenomena: there are fields that can exert forces at a distance, there is the curvature of space, there are dielectric and the magnetic polarizations and the displacement current, there is the energy associated with fields, there is a potential difference between two points in space, there is also the temperature of vacuum.

In addition, modern telecommunications technology shows us that the vacuum can contain and travel within itself a very large number of radio and television channels and many others telecommunications modulated in various ways.

And quantum mechanics teaches us that the vacuum is fluctuating of energy and it can be generated and annihilate virtual particles. Moreover it also has the presence of bosons, neutrinos, photons and other particles.

But many people are still convinced that in order to explain everything that happens in the vacuum is sufficient to exclaim - with the field!

As if it were enough to pronounce the magic word to explain all these phenomena that occur in the "vacuum". And they add that all depends from the intrinsic physical properties of the vacuum, but space is absolutely empty because the famous experiment of Michelson and Morley showed that ether does not exist and, moreover, with the theory of relativity, Einstein denied the opportunity of the existence of a privileged reference frame related to the ether and, consequently, also denies the existence of the ether.

If this explanation does not convince you, because the nothingness can not have all these physical properties and they can not be attributed to nothingness, and try to know more about this, soon you will find that the Michelson-Morley experiment did not show anything, and Einstein himself after 1916 introduced three new models of ether for which we can not establish an absolute system of reference so they are consistent also with his theory of special relativity.

Indeed, in 1915 Einstein explained the theory of general relativity, which discuss the reference systems in accelerated motion and gravitation. In particular, the

gravitation is proposed as a result of the curvature that space assumes for the presence of masses. Curving space shows a further proof of its physical property (in addition to the electromagnetic properties already known from the time of Faraday and Maxwell), making it also capable of interacting with matter and that can not be attributed to the vacuum, as a space with nothingness inside, because nothingness can not change state, and we can not have a nothingness different from how it was before or from another nothingness in another point of space. Therefore Einstein proposed to return to the ether, that he disclaimed earlier in 1905, and later presented at least three new models of ether, identifying ether with - physical space with its physical properties-. But they were soon forgotten by physicists of the twentieth century, which instead were very committed to affirming the existence of space made of "nothingness", and to reduce to mathematical formalism all physical phenomena of vacuum.

The reader who wants to study this question can read the file - The new Einstein ether - on the website [ricercaetereperduto](#) that you can find with Google, or the book - Einstein and the Ether - Kostro author. In this book the author just calls into question the widespread opinion that Einstein has permanently deleted the concept of ether in physics.

Actually Einstein, before 1915, mainly considered superfluous the concept of ether postulated by Maxwell and Poincare and, of course, also all previous models which considered the ether distinct from the space and contained within the space.

While Einstein, after 1916, as already written, identifies the ether with - physical space with its physical properties -. And we follow this idea.

So in this paper we will use the word ether, physical space, space, or space-time, with identical meaning.

This work takes up precisely the last model of ether proposed by Einstein.

In this model of ether the matter is seen as an effect of energy in the ether, and not as a foreign body. This allows overcoming all contradictions of all previous models of ether, principally the wind of ether, and also permits to find a rational and acceptable explanations to many phenomena of vacuum, as the interference, and corpuscular and wave properties of the particles.

Among the reasons that support this new proposal of the ether, there is a rational and credible explanation of the forces at distance, also called interactions.

Unfortunately, even today, many people believe that to explain the forces acting between two bodies away from each other is sufficient to exclaim: - with the field! - And then draw two vectors on a sheet of paper, or on the board.

That is, they use the simple graphical and mathematical formalism without any physical interpretation.

But it is not so, because the field is only the map of the forces and not the explanation. And it is necessary to understand what happens in a region of space with the field and how the space with the field interacts with matter, and these answers can't be found in nothingness.

For the current physic, the field is defined as a state of vacuum, so it's a purely abstract concept (Feynman's words). But since nothingness of the vacuum doesn't exist, while the field exists, and produces real effects in the world of matter, should arise doubts on identification of empty space with nothingness. Descartes highlight the absurdity of the concept of space made of nothingness in this way: the space exists and is measurable in extension and volume, while nothingness just does not exist; therefore argue that the space is made of nothingness it is a contradiction because it is equivalent to saying that nothingness exists.

In other words, the fact that the space can be measured already shows its substantial physicality. And one hundred cubic metres of space, or thousands cubic metres of space, have a precise meaning.

Instead one hundred, or one thousands, cubic metres of nothingness do not mean anything.

Newton already stated: - To thought that two bodies can act on distance each other without the presence of an intermediate medium, it is complete senseless -.

He attributed the properties of gravity, not to the masses, but to the medium that fills the space; although he had not proposed interpretations as this happens, and said (in Latin): - Hypothesis non fingo-.

Not even the exchange of particles between two bodies (QED theory) is the real answer to the interactions, because it simply translates the problem from large objects to smaller objects.

There are also the phenomena came to light at the end of nineteenth century thanks to Fitzgerald and Lorentz, describing the increase in mass, the length contraction and time dilatation depending on the speed, expressed by known equations:

$$1) L = L_0\sqrt{(1-\beta^2)}, \quad 2) m = m_0/\sqrt{(1-\beta^2)}$$

$$3) dt' = dt/\sqrt{(1-\beta^2)}, \quad \text{with } \beta = v/c$$

(v speed of the object, c the speed of light, m₀ rest mass, L₀ length at rest, t rest time).

The state of rest can be defined with respect to the observer, but, more properly, can also be defined with respect to the "fixed stars" or to background radiation.

You define: 4) $\gamma = 1 / \sqrt{1-\beta^2}$

where the Greek letter γ is called gamma factor, or Lorentz factor, and is one of the fundamental elements of the theory of relativity.

Then the 2) can also be written in this way:

5) $m = \gamma \cdot m_0$ here m indicates the relativistic mass

These three phenomena, even if they have been checked and accepted as real fact by science for many years, continue creating wonder and disbelief. In fact we are accustomed to consider the mass, the size of the object and the time's rhythm immutable, because our experience includes motions of bodies at speeds much smaller than c . But these three formula say explicitly, and unequivocally, that if the velocity of an object reaches values that are not negligible compared to the speed of light, then its dimensions parallel to the motion are contracted, all its particles move more slowly and its mass is increased compared with the values of rest.

Of the three, the increasing of mass with velocity generates more reluctance, although, in reality, it was the first to be verified since the early years of '900. In fact, the contraction of bodies is within our physical experiences, and in the case specifically, it can be explained by the contraction in the direction of motion of electromagnetic fields according to the speed of charged particles, called - Lorentz contraction - and because the fields are the link between core and electrons cloud and between atom and atom, these contracting, contracts also objects.

About time dilation, for many years with the television we can see events (especially sport events) at reduced speed, then we can imagine that the same thing could happen in reality with the motion of the object and the particles move more slowly than when the body is stationary to the observer; and this fact is called as "time dilatation".

While the increase of the mass of an object moving in empty space, really seems inexplicable. Because we have to ask ourselves: where can come the increase in mass, if there is nothingness all around the object?

And the question is more than legitimate. But since the mass increment really happens, because it is experimentally verified in particle accelerators of all the world, then we must have doubt on vacuum, and the historical concept, but still rooted to these days, of the independence of object from the space that surrounds it.

For some years the equation 2) $m = m_0 / \sqrt{1-\beta^2}$, with m called relativistic mass, is no longer used by some texts, while other university textbooks continue to use it today.

The university textbooks that do not use the relativistic mass, however, express the momentum with:

$$6) p = \gamma * m * v \quad \text{and the energy with:} \quad 7) E = \gamma * m * c^2$$

Now in the equations 6) and 7) m denotes the rest mass, while in the 2) the rest mass is indicated by m_0 .

But also the 6) and the 7) contain the gamma factor, therefore implicitly reaffirm the mass variation with speed, because within them the gamma factor always multiplies the rest mass; being, in the first, the speed known with great accuracy by measures in particle accelerators; and in the second, c a constant, also it known by such a high precision that can be considered an exact value.

So the mass variation with speed returned immediately with the momentum and the energy, which always contain the gamma factor.

At this point, there is the doubt that some texts do not want show the relativistic mass, contained in the equations 2) and 5), because it indicates clearly that in the modern physics is missing something fundamental, and precisely the physical substantiality of space. Because if we consider the space made of nothingness, that formula is just unexplainable, while it is confirmed by thousands of experiments in particle accelerators of all the world.

Therefore we will continue to use the relativistic mass, in accordance with many university textbooks.

Considering the particle such as an energy effect in the physical space, increasing the kinetic energy also increases the mass of the particle, then we find a clear and simple explanation for the increase in mass with velocity, as well as for the famous equation:

$$7bis) E = mc^2, \quad (\text{here } m \text{ indicates the relativistic mass } m = \gamma * m_0).$$

From many years, quantum physics defines the vacuum as a fluctuating energy and a dense swarm of virtual particles. And the standard model currently presents a unified field that reminds to a continuous medium. It seems that we need only the courage to call the space with its historic name: ether.

Even corpuscular and wavelike properties of particles and interference phenomena can't be explained by considering the particles as foreign objects to the empty space that surrounds them. While they become fully interpretable with our hypothesis.

To summarize briefly the innovative concepts proposed by this text, we can say that the new model of ether identifies it with the physical-space. Then, ether, physical space, space or space-time are synonyms, as already said. And the

word ether is useful precisely to highlight the physical substantiality of space. Physical space is presented as a medium continuous, isotropic and homogeneous, in which, due to energy, particles are produced in "some way", not yet known, perhaps as infinitesimal thickening, or very small changes of state.

Each particle is not a foreign body in the ether, but is an physical event that happens in it following the fluctuations of energy, taking shape where the energy exceeds a specific density level and annihilating when energy falls below this levels.

Also macroscopic bodies (including ourselves, being made of particles) are generated by energy in the space, and entirely belong to it.

The energy contained in the space is seen as a perturbed state compared to the state of rest of space. Matter and energy are two states of ether those can move in it, in the sense that the particles are formed where energy has shifted and it exceeds the specific level already said. (See the examples of chapter two).

This new concept allows us to understand the motion of bodies through the "medium" without encountering any resistance (the ether wind). Expresses perfectly the equivalence between mass and energy, and the corpuscular and wavelike nature of the particle.

The interactions, or forces at distance, are clearly explained like the effect of the tendency of the space to assume the state of minimum potential energy.

All these points are widely exposed in the respective chapters.

The current physics, however, is still anchored to the notion of the nineteenth century that consider the particles, and the bodies formed, as "objects" autonomous and foreign to the space in which they move. But many discoveries of the twentieth century contradict these assumptions. For example we know that the electron during its motion can disappear in one place and can reappear in another place, in other words it can move from one point to another without passing through intermediate points. And it is practically impossible to give a rational physical explanation with the current assumptions; so that this motion is interpreted only with abstract mathematical equations.

Considering the particle as an effect of energy in space, not empty but with its physical substantiality, that we can express with the word ether, with the concepts presented before, instead, we find a rational and logical explanation to this and other phenomena already said before, as is widely exposed in the next chapters.

We also know that the volume of protons, neutrons and electrons, which are made all atoms of a macroscopic body, is very small. For example, for a man we have about a millionth part of a cubic millimetre of these particles arranged in an orderly fashion throughout its volume.

If we consider these particles as "events in the ether" produced by the energy,

then we see that ourselves are not strangers to the space around us, but in reality we belong entirely to its substantiality.

Practically we are small flames of energy in the space.

And the phrase : -- We are such stuff as dreams are made on -- is very near to reality.

Chapter 1

In search of lost ether

Until the beginning of the twentieth century all the great men of science believed that the space emptiness is so only for our senses and our instruments of investigation, but in reality it was full of ether, a mysterious substance difficult to define.

Before Aristotle, and after many dark centuries, Newton, Descartes, Huygens, Fresnel, and others, argued and tried to define the cosmic ether.

There were subsequent processing by W. Thomson, Faraday, Maxwell, Hertz and H.A. Lorentz. Until define ether as a vehicle for all the gravitational and electromagnetic forces and the displacement current contained in the famous equation of Maxwell.

In particular, Maxwell, who is considered the greatest scientist between Newton and Einstein, was a passionate supporter of the ether in a period in which already began emerging the supporters of empty space, with "nothingness" inside.

We see what he wrote in 1890 in "Field and Ether" : - The immense regions planetary and interstellar space will no longer be regarded as deserts of universe that the Creator did not think it suitable to be occupied by the symbols of the manifold order of His kingdom. We find they are occupied by this wonderful ether.... it extends the same from star to star....The hypothesis of an ether has been supported by various thinkers for reasons very different. For those who supported the existence of a plenum as principle of philosophical nature, the horror of nature for the vacuum was a reason to imagine a ether that pervades everything, even if all the evidence was against it. For Descartes, who made the substance a necessary condition for the extension, the mere existence of the bodies distant from each other (and that interact one with the other) proved the existence of a continuous medium interposed --. (From Field and ether, contained in – Relatività, esposizione divulgativa – Italian Editions Boringhieri).

Maxwell and Descartes thought so. And they are among greatest personalities

in the science of all time.

For them, the ether was distinct from space and content within the space.

While at the end of nineteenth century P. Drude and M. Abraham proposed to identify the ether with physical space. This new idea was picked up by Einstein after 1916, and even in this paper we proceed for this new route.

Then we will use the word ether, physical space, space or space-time with the same meaning, to indicate just the physical substantiality of space (as already written).

For supporters of the ether the forces act at a distance through the physical medium, the electromagnetic and gravitational fields were considered as states perturbed of the ether with respect to the ether state of rest; the electromagnetic waves were considered fluctuations of the polarization of the ether, as well as the waves sound are air pressure fluctuations; the potential gravitational energy could think contained in the volume of the space curved by gravitational fields, such as the elastic energy of a spring is contained in its mass deformed by external forces. The same thing was true for the energy contained in volume of space subject to the polarization of the electric or magnetic fields.

And the displacement current, produced by the change of dielectric polarization of vacuum, was considered a real current that occurred in the medium.

On the other hand, with the old model of ether, it was difficult to explain the motion of bodies through the ether, for example, the planetary motion, without any dissipation of kinetic energy by viscous friction with the wind of ether.

With several experiments, observing only what happens in the laboratory, the scientists were unable to bring out the observer's speed respect to space, in other words an absolute motion with respect to the reference absolute of ether, considered stationary in space.

And to measure the speed of the Earth from space (looking only inside the laboratory) were conducted many experiments, all with negative results.

The most famous of these is the Michelson & Morley experiment.

Experiment of Michelson and Morley

Michelson's interferometer

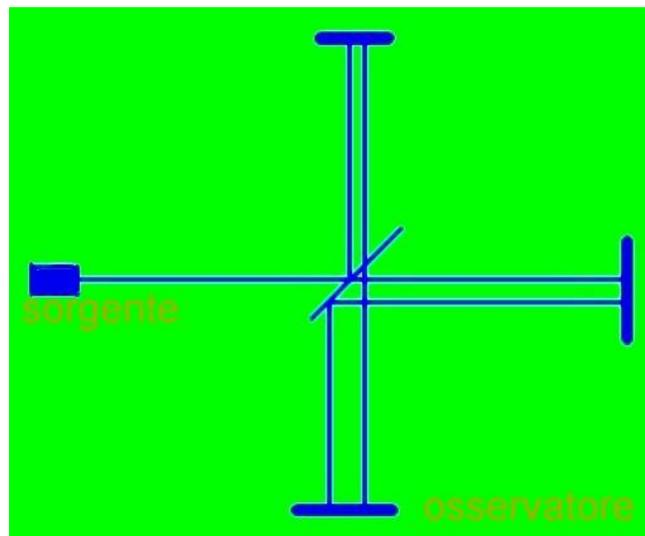


Fig. 1

Michelson, true supporter of the ether, wished to prove its existence and built the instrument shown in Figure, just known as Michelson interferometer, in which a beam of monochromatic light, produced by a source bound to the interferometer, is sent to a semitransparent mirror tilted by 45° and able to split the beam in two parts, one goes in a straight line, while the other is reflected, so as to obtain two beams perpendicular one to another. The two beams are reflected by two mirrors and both come to the eyepiece of the interferometer, so as to allow to observe the phase shift. The beam parallel to the motion of the earth should take a little time higher in its journey, and this would cause a phase displacement with the other beam. Orienting the interferometer in different directions respect the motion of the earth, the observer should detect variations of the phase difference between the two rays of light.

Michelson in 1887, with the help of E. W. Morley, made several attempts to this type, but the interference fringes were always the same.

Similar experiments were carried out later by other researchers, all with negative results.

Explanation of Fitzgerald - Lorentz

The M & M experiment was immediately interpreted as proof of non-existence of the ether.

But in 1893 the Irish G. F. Fitzgerald proposed a curious and ingenious explanation of the experiment. He argued that the side of the interferometer parallel to the travel speed of the Earth is shortened as a function of the speed in order to make exactly equal the same journey times of two beams, according to the equation:

$$1) L = L_0\sqrt{1-\beta^2}.$$

This hypothesis very daring for that time, but absolutely true, as was demonstrated later, was the first concept of the modern theory of relativity. Shortly after Fitzgerald, by independent way, also Lorentz introduced the lengths contraction and the two other relativistic phenomena, which are: the increase of mass and time dilation, expressed by equations 2) and 3) already described in the preface.

The length contraction with the speed, at that time, seemed an assumption done on purpose for the occasion, but in the second half of last century, was confirmed in countless experiments with particle accelerators, and currently is recognized as true all over the world.

It is also one of the basic concepts of the theory of relativity, known as a "contraction of the length with the motion" contained in the transformations of Lorentz.

Moreover the three formulas 1), 2), 3) of Lorentz-Fitzgerald are also the basis of Einstein's theory of relativity, and we can say that they are also supported by the completeness of this theory.

Clear descriptions of the experiment and the causes of its failure are in many books, for example :

Space, Time and Gravitation – of Eddington,

- Laws of nature – of R. E. Peierls,

or the famous – Six Not So Easy Pieces - of R.P. Feynman.

Other books, such the old edition of Halliday-Resnick, and some encyclopaedia, omit these considerations; however, in all other chapters they expose the contraction of the moving length.

Einstein and Infeld in the book: -The Evolution of Physics - in the description of M-M experiment do not consider the contraction of the interferometer side parallel to the motion and say: - It is time to forget the ether and no longer pronouncing this name. Then we will say that our space has the physical ability to transmit some waves. But the omission of a word from our dictionary is not a

remedy. Our embarrassment is very -

But 14 pages later expose the contraction of rulers in motion, which instead, have not considered prior for the experiment of M & M.

In our days should be well known and accepted by all that the experiment of M & M. committing the systematic error of neglecting the contraction of the side of the interferometer parallel to the travel speed of the Earth, because then it was not known, and therefore its negative conclusions on the existence of the ether are not valid.

Anyway Michelson continued to believe strongly in the ether until last moment of his life.

We can therefore say that the M & M experiment failed to demonstrate the existence of the ether, but it has not demonstrated that the ether does not exist.

It 's surprising (and disconcerting) to note that, even today, the experiment of M & M is defined by some writers as "the most important experiment with failure in the history of science ". But, in so doing they commit a serious misrepresentation and, consequently, their interpretation becomes: the greatest imposture of the history of science.

This happens not through the fault of Michelson, but of people that have used his experiment for deny ether.

Anyway the experiment was useful to science, because discovering the length contraction as function of speed, and the gamma factor, gave a fundamental turn point to physics, opening the street for the theory of relativity.

Not observable or not existing

From the three phenomena described by the Lorentz equations 1), 2), 3) (accepted for many years as objective facts from all world's physical), it follows that the ether is not observable, like it has been described by Lorentz in his " Principle of Corresponding States", and later by Poincare.

It has been turned into "non-existence of the ether," according to the Einstein's criterion arguing that what is not observable does not exist, or it is as if it does not exist.

This question is highly debatable, but it was accepted by the majority of physicists physicists, so in the first decades of the '900 they claimed the hypothesis of non existence of the ether, and afterwards the empty space, with "nothingness" inside, had successful.

What is - not observable - depends only on the state of science and technology of the period.

Many things have been not observable for a long time: bacteria, virus, electrons,

protons, neutrons, quarks. Even the planets of other star systems were not observable until a few decades ago.

Physics has often suggested the existence of particles - not observed – but including within well-defined theories, and their existence were verified experimentally after years of research and technological progress, only when new and more powerful means of investigation are achieved. It happened with the quarks, it happened with the Higgs bosons, and other particles, first provided by the theory and then observed only after years; some, like gravitons, not still observed.

A analogous fact occurred with the discovery of remote planets of the solar system, Neptune and Pluto, theoretically expected, examining the perturbations of Uranus orbit, before being observed directly.

The ether currently is - not observable - as the motions relating to it. But it is not absolutely excluded that in future we can find an experiment that allows observing it.

With regard to the principle of relativity of motions must be said that the observer can not determine its motion with respect to the space only if he looks at the effects of the experiments inside his own laboratory, without looking out. If he also looks out, then he can extend its investigation domain even at distant stars, the so-called "fixed stars", or to other galaxies, and their observation can obtain information useful for determine own motion with respect to the space, for example by means of two physical phenomena: the Doppler effect and the aberration of starlight.

There is also the background radiation of the universe and from some years we can measure the motion of the Earth with respect to it, that indicates an absolute speed of about 400 km/s. As it is described in the following paragraph. The current unobservability of the ether directly implies the impossibility to define a reference system bound to it, called absolute, or privileged over the other inertial reference systems; so there is no incompatibility with the first principle of the theory of relativity, and it is wrong to claim that the first principle excludes the existence of the ether.

It 'should be noted that, in contrast, is the first principle that comes from the unobservability of the ether and of motions with respect to it and by the impossibility to define an absolute system of reference (looking only inside the laboratory).

Aberration of light, Doppler effect and background radiation

As we just mentioned, the aberration of starlight and the Doppler effect make clear the relative motion between the observer and the "fixed stars."

Let's examine the first: to observe a star the angle of orientation of a telescope must be adjusted according to the vector sum of the speed of light from the star and the speed of the Earth, that is not fully negligible compared to the speed of light. And it is well known that the speed of light in space is independent of the motion of the source that generates it.

The vector sum must be made in accordance with the method of Lorentz.

However, since the term $(v/c)^2$ is very small (v speed of the Earth, c speed of light) it almost coincides with the vector sum done by the classic method.

To better illustrate this phenomenon there is the simple example of the rain in a day without wind: for an observer standing on the roadside the raindrops fall vertically, while for another observer in motion, for example in a car, the rain hits the windshield with inclined direction. A similar fact happens to photons of light coming from the away stars and received by the Earth moving in the space.

It should be noted that this involves only a change in the direction of speed of light received by the observer, and not as a variation of the module because the sum of speed must be made with the Lorentz method.

However, for correct interpretation is necessary to consider the velocity of the observer, as a variation of the angle of incidence light.

The aberration of light was discovered by Bradley in 1726 and it provided further evidence of the mobility of the Earth in the space, particularly important at the time. It also allowed to calculate fairly accurately the value of c .

Currently, instead of the fixed stars, other galaxies are taken as reference points. In this way you can evaluate the motion due to the rotation and the translation of Milky Way.

The Doppler effect shows the relative speed between the source of electromagnetic waves and the observer, just as a change in frequency.

It's very important and is known in astronomy in the field of optical and in that of radio frequencies.

It also occurs for sound waves and is easily detected it, for example, with the passage of a helicopter or a whistling train.

So these two phenomena give precise information about the motion of the observer; as well as the observation of the background radiation.,

Indeed, recently there are also observations of the Earth's speed compared to background radiation, and show us that the Earth has a speed in relation to the space of about 400 km/s, which almost coincides with the estimated values of the two previous methods.

And today some scientists, for example Selleri, propose to use the observation of the background radiation to define a new privileged reference system.

In conclusion, if the observer looks at only the effects produced by the experiments made inside the laboratory, then he can't determine its motion with respect to space. Instead, looking outside the laboratory, or observing the

background radiation, the observer can obtain information relevant to his motion. And this is valid for the observer who is in the hold of the famous ship of Galileo, as for who travels within a hypothetical spaceship super fast. In this way you can easily solve all the paradoxes of the Theory of Relativity, the main one is that of the twins.

Difficulties of definition of the ether and inconsistency of previous models

In the past centuries there were also some objective difficulties to defining properties of the ether, and this contributed to his downfall.

In fact, in addition to the ether wind, there were the following questions: light waves are transverse waves, their oscillation is perpendicular to the direction of propagation, and only solid medium can transmit transverse waves. It also should permeate all substances transparent to light and it should not hinder any movement at all of no one corps, from the rotation of the planets around the Sun, to the trembling leaves.

After the discoveries that established the electromagnetic nature, and not elastic, of electromagnetic waves, was overcome the hypothesis of the elasticity of the ether, however, it still remains to this day as regards the gravitational waves, which were unknown in the nineteenth century.

But in old models of ether the objects were always considered foreign bodies inside the ether and then persisted the difficulty of movement because their motion would have met the ether wind.

In addition to this, the experiment of M-M and the postulate on the relativity of motion contributed to the abandonment of the ether.

Abandoned all the old materialistic models, the sky became free from the "cobwebs" that had built its supporters with their interpretations of the mechanistic and atomistic medium, but at once legitimate doubts arose on the vacuum. Let us examine some.

Perplexity and inconsistency of the vacuum made of nothingness

The empty space made of nothingness presents immediately a long-standing philosophical doubt. In fact, propose a space made of nothingness is like claiming that exists what does not exists.

Descartes indeed argued that any extension needs a substance.

Space exists and it is measurable in extent and volume, while nothingness just does not exist, so it's impossible to identify nothingness with space.

As already written, a cubic meter, or a thousand cubic meters of space, are well

defined and distinct concepts. While a cubic meter of nothingness, or a thousand cubic meters of nothingness, they haven't any logical sense. In our day, in addition, we know also that the space contains fields and their energy. In fact, eliminated the ether, was left the field. So it became: the field defined as the state of nothingness.

Not only that, there are also all the other physical phenomena that occur in a vacuum.

Thus we have the empty space with inside a "nothingness" a bit 'strange, because it isn't always identical to itself (in the "nothingness" there's nothing that can change, but if, instead, its status changes means that it is something with physical characteristics that can change).

In fact, now we have the space done with the "nothingness", but this nothingness can bend, it can polarize as the materials, it can conduct the displacement current, it can contain the fields, it can have a potential difference between two points, it can exert forces at distance, it can store different types of energy, it can generate and absorb particles, it can have its own temperature, it can contain and can travel inside itself simultaneously hundred television news in hundred different languages. And everything in nothingness.

For the Physics all these events are interpreted with pure graphics and mathematical formalism, as the field and the curvature of the space, but always and rigorously identifying space with nothingness; and they are defined: intrinsic physical properties of space (vacuum), always understood as the nothingness. We frankly think that in this "nothingness" there are too many things.

With reference to the field in vacuum, Feynman saw literally: - The best way is to use the field abstract idea. That it is abstract it is unfortunate, but necessary - . (The Feynman Lectures on Physics)

So the field in the space now is reduced to an abstract idea, a graphical formalism, to overcome something basic of space that physics does not know. For other authors, less famous, it's suffice it to say: - the field (like an abstract mathematical formalism) is all that is necessary to know in space - and close the argument.

To explain the forces at a distance, some people believe that it is enough to draw two vectors on a sheet of paper and exclaim: - with the field!

Instead, the fields are the most important physical subject of the universe. More of mass, because it holds together all the matter, from atoms, to planetary systems and galaxies. It fills all the space and brings us the images of stars and galaxies. The volume of objects is essentially field, because the volume of particles is very small (see related paragraph). But if we try to look at the space where there is a field to find what's supporting this important entity, the present physics answers us: nothingness!

For this aspect of the camp reminiscent of a book by Italo Calvino:

- The nonexistent knight - which tells of a very valiant knight, but consisted only by the armour. Inside the armour there was nothing.
The author says: - The cavalryman was pure will.
Therefore we could define the field as - the nonexistent knight of modern Physics -.

Quantum vacuum

The quantum Physics began to develop the theory of quantum fields and stated that in reality each type of field fills the space of particles also act as mediator forces. They defined: photons in the fields electromagnetic, gravitons for the gravitational, gluons for the strong nuclear forces, bosons for the weak. These theories have been tested in the sense that the particles assumed were all found, except gravitons.

However, it should be noted that the fact to assign the exchange of forces at a distance to other particles, it means simply to shift the problem to large objects to smaller objects, and does not solve the problem.

Afterwards, always with the quantum theory, the vacuum has filled with a continuous appearance and disappearance of virtual particles, formed by particle-antiparticle pairs. But physicists say that they, like quantum field, always and only appear and disappear from "nothingness", i.e. they are generated and annihilate into nothingness.

The vacuum, seen on macroscopic scales, is quiet and calm only because the creation and annihilation of all particles occurs in very short distances.

Just like a stormy ocean appears smooth and flat if it is seen from an airplane at high altitude.

The virtual particles are produced by the vacuum fluctuations of energy and are called "virtual" because they exist for a short time so that you can't measure them directly. However, they produce effects well evaluable as alterations of the energy levels of atoms and the Casimir effect.

In 1948, Casimir showed that two very near and electrically neutral metal plates alter the spatial distribution of virtual particles, decreasing it inside the two plates. The result is that the virtual particles remain outside are more numerous, and perhaps larger, causing a "pressure" more on the external surfaces and then there is a force of attraction, very weak, between the two plates.

It should be added that there are also other interpretations of these forces between the two metal plates, such as the polarization of the atoms on the two facing surfaces.

Anyway, in the quantum theory of the vacuum there is energy constantly fluctuating and in the apparent calm of the vacuum appear and disappear pairs of particles - antiparticles. Antiparticles have mass equal to the corresponding

particles and opposite charge.

As already said, it is frequently couples electron – positron, or quark - antiquark, which immediately annihilate each other in space releasing the energy corresponding to their masses, which, in turn, immediately produces other new pairs of virtual particles.

Also for the Standard Model the space is full of energy, fields, particles, bosons of Higgs, field of Higgs, and other fields.

It has also defined the zero-point energy (ZPE): the lowest energy level in the vacuum.

Modern physics continues to fill the void with new and ever more mysterious particles, such as the Higgs boson, so that it is legitimate to ask how we can still be able to see stars on a clear night.

Aristotle had said: - Nature has horror of the vacuum -. Modern science says that the vacuum contains all of Physics, in the sense that everything that exists is created and shaped by the vacuum.

In some physics journal is curious to read articles written by famous scientists that are forced to admit all these physical phenomena in the vacuum.

They start with a little embarrassed saying - the idea that the vacuum, intended as "nothingness", can hold energy, and other physical properties, may appear contrary to intuition and logic, but .-... but, here it is that everything really happens in the vacuum space.

Of course we think that is contradictory to attribute to nothingness all these phenomena that occur in the space. Instead, they demonstrate the physical substantiality of space, very different from matter and difficult to define, but that still exists, and supporting physical and logical sense at all these facts with its different states.

Forces by QED and QCD

The theory that describes the interactions between electrically charged particles is quantum electrodynamics, QED (Quantum Electro-Dynamics, acronym) founded by Feynman and his collaborators in the forties.

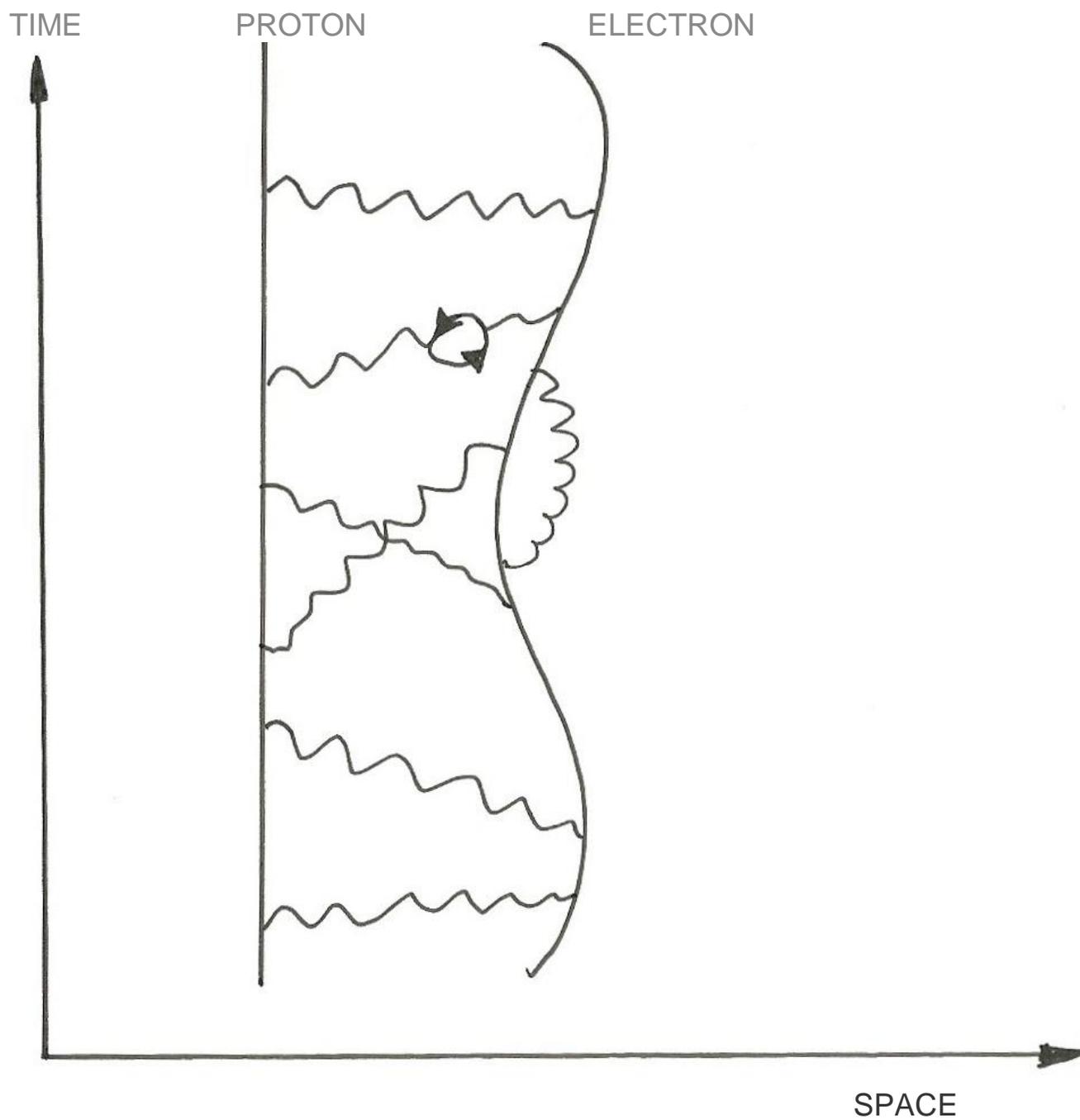
QED is also the title of his famous book, subtitled: the strange theory of light and matter.

For it the electromagnetic interaction happens via exchange of photons. These particles act as mediators of the forces and interactions are graphically represented by Feynman diagrams in which shows the trajectories of the particles that combine in strange ways.

In these diagrams some photons would return back in time???

But I think that from some years is no longer accepted the motion back in time of

the particles.



Exchange of photons between the protons in the nucleus and an electron

as it is shown in QED.

The discovery of quantum particles as mediators of the forces is certainly a step forward respect the field in the nothingness, but, as we have already said, in this way it translates simply the problem by objects bigger to objects smaller and, at most, it may explain the repulsive forces and not the attractive.

Also according to the QED vacuum is populated by electron-positron pairs and photons. The photon, in fact, has no charge, so its antiparticle is identical to the photon. Couples electron - positron are polarized as the matter, and this can add support to the polarization of the vacuum and make logical sense to the displacement current, when polarization changes.

The strong interactions, acting between the quarks and between protons in nucleus of atoms, are mediated by gluons. Since quarks have colour charge, which can be of three types, green, red and blue, the theory that studies these interactions is called quantum chromo dynamics, QCD.

It admits eight types of gluons and says that the vacuum is populated by virtual pairs quark- antiquark that form and annihilate in a flash.

Both QED and QCD theories do not explain how the particles are able to mediate forces, however they are framed in a mathematical model that allows to make very precise calculations, especially QED, but there is not a physical interpretation of the interactions between particles, and doubts remain legitimate.

To expose these questions more broadly we think, for example, just to protons in the nucleus. We know that between the protons there are repulsive Coulomb forces, which, for the very small distance, take very high intensity, such that the core should blow up, which instead remains united and very compact, as if the protons also acted much more attractive forces than repulsive forces. One might say, jokingly, that the nucleus is held together by glue special.

Well, the attractive forces are precisely attributed to the mediating particles called "gluons", with other words: particles with glue. And this seems almost a joke, but it must be said that the gluons have been found with the accelerators, although there is not a physical explanation of the forces but only an abstract mathematical model. But we can always believe that they have really the glue. Or we can use the slogan: - with the field!

Anyway, we must keep in mind that we explain the forces of Coulomb drawing two vectors on a sheet of paper and exclaiming: - with the field! (of course in the "nothingness"). And many people still consider this as a reasonable and comprehensive explanation.

But our doubts remain because we might say :- if between protons in the nucleus attractive forces are exchanged via gluons, then between gluons and

gluons, how is the exchange forces? Perhaps with other particles even smaller? And among the latter particle, as interactions occur? Perhaps even more with other particles smaller still? - And so on.

To try to explain the exchange of forces at a distance through the exchange of particles, sometimes it gives the example of two players who throw a ball at each other, or playing tennis, thus exerting forces on each other at a distance. Or the example of two soldiers who shoot each other with machine guns. But these methods are certainly dissipative, because the bump is never perfectly elastic; while the fields forces are perfectly conservative.

In addition, for the attractive forces players should throw the ball from the side opposite of the other player, so that it reaches him from the rear, and not the front. So there should be a "boomerang effect". But to have a curved trajectory the motion must take place in a medium, that instead the Physics excludes it. For gravitational forces, argue that those forces are caused only by the action of particles, called gravitons, appears simply grotesque: try to imagine the Sun and Jupiter, the Sun and Saturn, or the Sun and the Earth who exchange gravitational forces through (and only) by exchange of particles.

It 's clear that this theory is incomplete, because the main vehicle of action at a distance be missing. And this may be only the physical substantiality of space, that we can call ether, or new ether.

Photons are only corpuscular sign of the presence of fields, but actually to exercise the forces is the substantiality of space with its states that tend to move towards the conditions of minimum potential energy.

Concluding it's clear that the QED and QCD don't give satisfactory answers from physical point of view, but they reduce the argument to a pure mathematical formalism.

The Higgs boson

In vacuum space, in addition the presence of virtual particles, there are also certain types of bosons. Among these, the Higgs boson is particularly important. Theorized in the year 1964, the Higgs boson has been finally observed in 2012 during the experiments conducted with the LHC of Genève.

According to the theory of Higgs, it is believed that boson generates the mass of all other fundamental particles.

At this point of the theory it should only understand what is the origin of mass of the boson itself? But nor Higgs, or others, give an answer to this question.

Because modern physics states that all around these particles there is just the "nothingness". While it is more logical to think that the mass of the bosons has its origin, as an effect of energy, from the physical substantiality of space.

At boson is also associated his field, said precisely Higgs field, which is of scalar type and which would occupy all the space (of the universe), and that must be added to the other fields that are already known.

The Higgs boson complete the Standard Model and explains the difference in mass between the different types of particles.

Without the introduction of the Higgs boson, for the equations of the Standard Model, which are very symmetrical, the particles appear all with the same mass.

This obviously contrasts with the reality. So was added something that differentiate the mass of different types of particles: this is the Higgs boson.

Depending on how the particles interact with it, for acquire their different masses.

However, it must be pointed out that the bosons and the Higgs field are in the "empty space", where, some say there should be nothing.

So the vacuum space appears more and more full of particles, fields, bosons and fundamental physical events.

Dielectric and magnetic induction of vacuum, displacement current and Maxwell equations

The electromagnetic phenomena are manifested with the following vector fields: the electric field E , the magnetic field H , the dielectric induction D , the magnetic induction B .

We have: 8) $D = \epsilon_0 * E$, 9) $B = \mu_0 * H$

with ϵ_0 dielectric constant of vacuum and μ_0 permeability of vacuum.

Classical physics defines the dielectric and magnetic permeability of vacuum space without posing the slightest doubt about how the nothingness can have properties defined by physical constants.

In fact, between the dielectric and magnetic constant of vacuum μ_0 and ϵ_0 , and those of materials there are only the coefficients of proportionality ϵ_r and μ_r , both dimensionless. And this means that the polarization of matter and the vacuum must be phenomena qualitatively of the same type.

The ϵ_0 and μ_0 values depend on the units of measurement system adopted; for example with the International System (SI) you have:

$$\epsilon_0 = 8.85 * 10^{-12} \text{ (F / m)} \quad \text{and} \quad \mu_0 = 1.26 * 10^{-6} \text{ (H / m)}.$$

While with the CGS Gauss system we have:

$\epsilon_0 = 1$ $\mu_0 = 1$, both dimensionless.

But they exist because 1 is a definite value. They are not equal to zero.

With CGS, having chosen $\epsilon_0 = 1$ and $\mu_0 = 1$, there is a third constant, usually denoted by α , equal to the speed of light.

Instead in the SI system α is equal to unity.

With the CGS Gauss system, you have the dielectric polarization of the vacuum $D = E$, and the magnetic polarization of the vacuum $B = H$.

Even D and B , with the CGS Gauss, exist (they are not null). And reading the previous two formulas from right to left, it can be said that it is precisely their existence that gives the physical sense to the fields E and H in the vacuum.

Thanks to quantum physics, now we are no longer bound to an abstract concept (and also absurd) of a vacuum induction as a state polarized of nothingness, or state polarized that does not exist. But with virtual dipoles, finally, the electromagnetic field in vacuum can acquire a concrete and real physical meaning with their alignment.

Similarly, the magnetic induction will be achieved by preferential aligning of the spins possessed by the virtual particles along the lines of the inductor magnetic field .

The polarization of the vacuum via electron-positron pairs, or quark-antiquark, now is only a hypothesis. But if these particles do not line up, then will be others virtual particles, yet unknown.

Something that polarizes must be necessarily, otherwise the polarization of the vacuum would not exist.

With polarization there is associated also energy for unit volume, and the displacement current, when the polarization varies in time.

Practically we return to the representations that Faraday and Maxwell gave to the field as polarized state of the ether. Of course they do not yet know the quantum vacuum with particle-antiparticle pairs, but simply imagined electromagnetic dipoles created by fields in the ether.

Of fundamental importance for the description of the electromagnetic fields are the famous Maxwell equations:

$$10) \quad \text{rot } H = J + \partial D / \partial t \qquad 11) \quad \text{rot } E = - \partial B / \partial t$$

$$12) \quad \text{Div } B = 0 \qquad 13) \quad \text{Div } E = \rho / \epsilon_0$$

Here we will discuss they very briefly. Let's start with two easiest.

The 12) follows from the fact that there are no magnetic monopoles. Integrating it we get that the flow of B through a closed surface will always be equal to zero.

The electric charges instead are separable, and in 13) ρ is the charge density. Integrating the equation 13) we get that the flow of the vector E through a closed surface is proportional to the charge contained within it.

In the equation 10) J is the material current density, generally produced by electrons.

In the vacuum, where the material current is zero, we have $J = 0$ and 10) becomes:

$$10a) \quad \text{rot } H = \partial D / \partial t.$$

In the second member of 10) and 10 a) $\partial D / \partial t$ is the famous displacement current; to be precise its density.

It also exists in a vacuum and it is defined by the partial derivative with respect to time of induction dielectric D .

In accordance with what is written above, it can be interpreted as a variation of the polarization of the virtual dipoles that are created in the vacuum. In other words: a variable electric field will induce a variable polarization of these virtual particles, generating in the vacuum a real movement of electric charges.

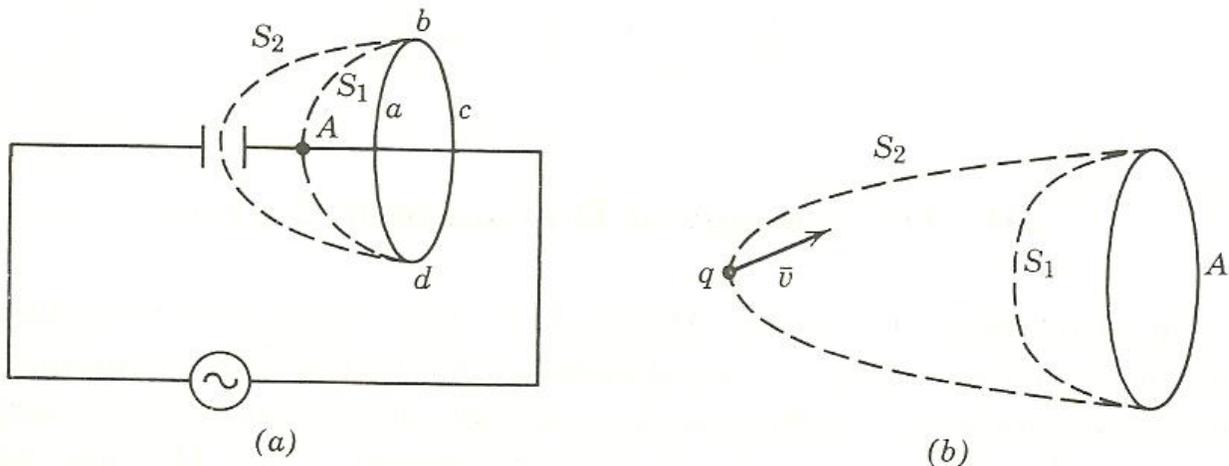


Fig Displacement current through S_2 (fig.a) and through S_1 (fig. b)

In fact, the displacement current has all the properties of a current material: it produces the magnetic field and gives continuity to the electron current, for example in a capacitor with vacuum between the plates, or with an antenna radio, satisfying Kirchhoff's current law.

We also remember that the displacement current can generate electrodynamic forces on the conductors that lead electronics current. And is of fundamental

importance for the propagation of electromagnetic waves.

Indeed the equation 10a) means that a variable electric field is surrounded by variable magnetic field rings. While 11) indicates that a variable magnetic field, in turn, is surrounded of variable electric field rings, and so on. The two fields trail each other and form concatenated perpendicular rings that propagate through space.

Maxwell gave a physical meaning to all terms contained in his equations, while modern Physics explains all this with pure mathematical formalism.

But we are convinced that all these electromagnetic phenomena highlighting the physical substantiality of space, without which they would not have physical sense.

Chapter two

Resurface of the ether

As you can see, with modern physics the concept of empty space, with the nothingness in it, loses more and more meaning and gradually emerges the physical substantiality of space.

Also the study of the infinitely large vacuum space clearly indicates that is not empty, because there are questions not yet resolved, as the dark matter and the dark energy of universe, and the cosmological universal constant.

There is also the temperature of the "vacuum". In fact the temperature of intergalactic space is 2.73° Kelvin.

The physical properties of the space are expressed by the following constants:

the dielectric constant of vacuum

the magnetic permeability of vacuum

the speed of light in vacuum

the impedance of vacuum

Newton's gravitational constant

Coulomb's constant

Probably also the Planck constant and the fine structure constant depend on the physical properties of space.

Descartes, Newton, Maxwell, Lorentz and others wanted to believe in the ether even though their models were contradictory.

Today, scientists do not want to believe in the ether even though there is a lot of evidence for the substantial physical property of space.

The postulates of relativity

Let us return to Einstein's theory of relativity.

In 1905 he enunciated what is considered the first postulate of relativity theory and that says: - It 'impossible to define a privileged, or absolute, reference frame, with respect to space -. (Looking only inside the laboratory).

However, this claim was already enunciated by Lorentz, some years earlier in "Principle of corresponding states".

It can also be said in other words: all inertial reference systems (also called Galilean) are equivalent. Statement made about three centuries before, precisely by Galileo, with famous examples of conceptual experiments made in the hold of the ship, showing that the observer does not notice any effect of its speed on the experiments that he performs, and that the laws of mechanics are the same in all reference systems in rectilinear and uniform motion.

Of course, we repeat, the first postulate is true only looking at the effects of the experiments inside the laboratories; because if instead the observer can look out, then it is applicable what we wrote in the section - Aberration of Light of stars, Doppler effect and background radiation - and the moving observer can evaluate his motion very well.

Even the observer of Galileo, looking out of the ship's hold, can see the water flowing along the sides of the ship, or the mainland, or another ship stopped at anchor, and can immediately assess his speed, not absolute, but relative to the mainland.

The modern observers, as we have already said, looking out of the laboratory, with the observation of the background radiation, the aberration of starlight and the Doppler effect, can evaluate his motion with respect to space.

Returning to the ether, always understood as a physical space with its physical properties, because it is still not observable, it is perfectly clear that it is impossible to define a reference system bound to it. So its existence does not contradict the first postulate of relativity theory. Instead this is often used to deny its existence. While it is the first postulate that comes from the fact that the motion respect space is not observable.

Einstein changed his mind about the ether after the General Relativity and from 1916 onwards proposed three models of ether to which you can't bind a reference system because they are unobservable. In his last model, material particles are imagined as an energy effect in the ether itself. Also in 1920 at the University of Leiden, and in 1935 to a physics conference in Vienna, Einstein clearly proposed a return to consider valid the existence of the ether, identified precisely with the physical substantiality of space.

In the already mentioned book: Einstein and the ether, Kostro author, with Einstein's original writings, stands the above written.

The second postulate of Einstein says: the speed of light in vacuum is a constant independent from the motion of the source and the observer, and it can not be exceeded.

And this is another physical property of the space.

Speed of light and ether

It 'important to recognize that also the speed of light is a property of the of physical quality of space, as it is clearly evidenced by the following equation:

$$c = \alpha / \sqrt{(\epsilon_0 * \mu_0)} \quad (c \text{ speed of light})$$

in the SI (International System) we have: $\alpha = 1$
and for ϵ_0 e μ_0 the already written values,

while in the CGS Gauss we have: $\alpha = c$ and $\epsilon_0 = 1$ $\mu_0 = 1$

Also the second postulate, however, seems favourable to the ether, for analogy with the sound. In fact, the sound is a perturbation of the medium, for example, air or water, which propagates in it with a typical speed depending on its physical characteristics, with constant velocity and independent from the speed of the source that produced sound waves.

So the light would seem an electromagnetic perturbation that propagates in the physical space and also its speeds is independent of the motion of the source that generated it.

Also the fact that the speed of light can not be surpassed by anybody seems favourable to existence of a medium in which the movement takes place.

In fact, if the movement happens in nothingness, a particle with nothing around it, appropriately accelerated, could reach a speed tending to infinite, or multiple of c . Since it does not interact with anything, there is nothing that could put an upper limit to its speed.

Regarding the independence of the speed of light by the motion of the observer, it should be noted that the observer in motion has a meters shorter and a clock that runs slower than the observer in rest (at rest with respect to the "fixed stars or to background radiation") according to the phenomena discovered and enunciated by Fitzgerald and Lorentz. The sum of the speed must be performed by the method of Lorentz formulas containing non-linear terms, so the relative velocity from light and the observer in motion remains the same.

Other consideration to support the ether

Let us now expose other concepts in support for the physical substantiality of space, which we can express with the word ether.

We now consider the Lorentz law, which expresses the increase in mass in function of speed:

$$2) m = m_0 / \sqrt{1 - \beta^2}$$

As we wrote, if we consider the particles as effects produced by the energy in the substantiality of space, then it is easy to justify the increase in mass, because increasing the speed increases the kinetic energy and therefore increases also the mass that corresponds to the energy and which it is generated by the energy.

Instead, if I consider the motion through empty space, as nothingness, and the particle as autonomous foreign object to space, how can I justify the increase in mass if there is nothing around it that might give the matter to the particle?

The same argument can be extended to the famous equation

$$E = mc^2$$

which leads to massive increases considered before. Increasing the energy to the first member, the second member increases the mass which, for the energy effect, is formed in the physical substantiality of space.

We know that virtual particles, but also photons, electrons and other particles appear from nothingness and in nothingness is annihilated, in other words disappear and then reappear at another point. If this happened in the ether, would be logical to imagine this particular substance that generates and reabsorbs the particles. While considering that they generate and annihilate into nothingness is much less rational and seems to belong more to the field of magic than to the field of physics.

By contrast, as mentioned before, the motion of a foreign body through the ether should meet the objective difficulty of viscous friction resulting in dissipation of kinetic energy, while the movements of the planets and all the bodies show that doesn't occurs.

In other words, for the object in motion should be the "wind ether", but that just does not exist.

The old models of ether considered objects as foreign bodies, so they were unsatisfactory and even contradictory. While the models proposed after 1916 by Einstein fully overcome these contradictions.

New Einstein's ether

We review the models proposed by Einstein from 1916 onwards and we see now to reconcile them with modern knowledge of physics.

Let us always remember that Einstein identifies the ether with physical space and its physical properties, and in these papers we follow his own line of thought.

So we will continue to use the words ether, space, space-time, physical space, with identical meaning.

For Einstein the matter is produced by energy in the ether itself, and is no longer a foreign body. In this way we no longer have the wind of ether and pass all other contradictions of previous models.

Einstein combined the concepts of electromagnetic field and the photon, in the sense as a quantum of energy produced by the electromagnetic field in space, to get the third concept: the quantum field, as a continuous medium that fills the vacuum space and forming particles with its states.

Writes A. Einstein - The particles are condensations of the local field, concentrations of energy produced by the quantum field. We consider the matter as a region of space-time where the field is extremely intense, which a very large amount of energy is concentrated in a very small portion of space-time. This node of energy, that is quite distinct from the rest of the field, propagates in it. This theory forces us to abandon the classical distinction between matter and vacuum ---.

Let us proceed with these ideas of Einstein.

We think about a particle in motion and the equivalence of mass and energy: according to the above ideas you can think the particle as a particular effect of energy in space.

In the physical substantiality of space, in some way (that we do not know yet), the particles are formed for an energy effect. They do not have an own motion with respect to space, but moves only the energy and the point where its concentration produces the particular physical state of space that creates the particle.

Around this particular point state, which constitutes the particle, it also produces the curvature of space. If the particle, in addition to the mass, also possesses the charge, we will also have the dielectric polarization of the ether. The curvature and the polarization are the states of ether to which are respectively associated the gravitational field and the electromagnetic field, with their respective energies.

Particles as effects of energy in the ether

We are accustomed to regard the mass and charge of objects as autonomous and independent from the space that surrounds them. In these pages instead they are defined as "effects" or "events" in the ether produced by the corresponding energies.

In other words, the primary cause is precisely the energy that created the particles.

The physical space (ether), as well as giving the logical meaning to extension spatial, as claimed by Descartes, now acquires the property of - Mother Substance - from which, for the energy effect, takes form each particle, each charge, each atom and all macroscopic objects, including ourselves.

Mass and energy are two states of the substantiality of the space that fully correspond the one with the other, in the sense that energy can create the mass and the mass can annihilate itself giving energy to space.

The particular status of the space, which constitutes the particle, moves with a very complex dynamic, following the variations of energy, with oscillatory, translational and rotary motions. It takes the form where the energy is such as to create the particle, that is where it has formed a "wave packet" of energy that exceeds a certain level, and annihilates where falls below that level, with release of a quantity equivalent of energy in the surrounding space.

So the relative motion of the particles relative to the ether would be only apparent. And for this reason the "wind of ether" does not exist.

Even the macroscopic objects formed by a multitude of atoms are no longer to be considered distinct from the space, like foreign bodies, but they are integral parts of physical space defined by its multiple states in a dynamic equilibrium between them.

Each particle acquires mass, charge, shape and existence in function of the energy that created it.

Now let us try to find a logical explanation to the three formulas Lorentz trying to reconcile with this theory.

First examine the increase of the mass and the length contraction of objects as a function of their speed.

They appear fully interpretable with previous assumptions. In fact, considering the body part of the space and defined by the local energy state, it is evident that by changing the speed also changes the kinetic energy and consequently the overall energy state that generates the mass and gives shape to the body. (This is taken up in Chapter 3).

And, as a result of the movement, the energy and spatial distribution of the field will be "squashed" or compressed, because energy can't translate with infinite speed, but only at speeds equal to c .

As a result of these changes qualitative and quantitative distribution of energy in the space will also change the shape and mass of the object.

Also the time dilation with the speed now acquires a logical sense: increasing the translation speed, the particles of the objects found a new dynamic equilibrium in the space with lower relative speed. For example, the electrons will move around their nucleons more slowly and, in general, the movements of all the particles will be slower.

At this point it is necessary to try to give some indication of how is the creation of particles in the substantiality of space. Although in reality it is not yet known; I can only propose hypotheses. On the web there are several: for example are proposed swirling motion around the points where the particles are formed, or local vibrations. But these are all dissipative phenomena, so highly unlikely. More realistic may be the hypothesis that the particle is formed in the substantiality of space as a local change of state, at the points where the energy density exceeds a certain level.

Analogy of the motion of a drop of water in the ice mass and others examples.

The following examples are useful to describe how it could be the motion of a particle within the substantiality of the space, and to highlight the corpuscular and wavelike nature of the particles.

Imagine a mass of ice that contains within it a drop of water and we make an analogy between ice and ether, and between drop and particle.

In the volume where there is the drop, thermal energy is higher than that of the surrounding ice. Greater is the amount of energy and greater will be the drop of water, just as happens between mass and energy.

Now we move this energy through the ice with a purely conceptual experiment . With an ideal heat pump we subtract heat from the drop and transfer it in another point of the ice. Will happen that where before there was water, it forms progressively compact ice and at the same time, the drop of water forms gradually in the place where the heat is transferred. The drop has not travel through the ice, but it is generated where the energy was moved and disappeared from the place where it is no longer present. Thus this is an apparent motion of our drop of water through the mass of ice, without the slightest obstacle to the motion.

In the ether the energy travels very well, also at the speed of light. As a result there is the motion of material particles: according to the fluctuations energy and taking shape at the points where the energy density exceeds a certain levels,

without meeting resistance from ether, and also jumping by one point to another without going through those intermediate, just the drop did. As the wave packet of energy moves in ether with undulatory motion, the particles that are generated by this energy, have the dual wave and corpuscular nature, well-evidenced by interference phenomena.

Taking another example of how can be the energy to move and produce effects at different points: imagine a concentrated beam of light, produced by a laser or a spotlight powerful enough; in the darkness through the air illuminating the water steam molecules encountered along its path and making themselves visible as a bright, straight trace. When the beam light moves in the space than illuminates other steam molecules, while those earlier have remained where they were and are no longer visible. Has moved only the light energy and now manifests itself in another place of space.

Another example would be the bright picture projected on a screen, it shows where the light hits the screen and moves with it (no illuminated points screen moving, of course).

Similarly, the particles are "energy effects" or "events" materialized by means of the energy in the substantiality of space, which move following his movements.

Forces at distance or interactions.

The fields that produce forces at distance are: the gravitational, the electromagnetic, and those associated with strong and weak nuclear forces. By many years the physicists are trying (unsuccessfully) to unify the forces produced by these fields.

Physic has always been in difficulties in explaining forces at distance, although many people believe that it is enough to exclaim: with the field. And draw two vectors on a sheet.

On some books sometimes it happens to read this beautiful explanation: the field gravitational exists because there is a gravitational force, and (on another page) the force of gravity exists because there is a gravitational field !?!

It is obvious that is a turn of words, but it is proposed and accepted often like a true explanation.

While we need to understand what is the field in space and how it exerts forces on objects. And these answers can't be found in the abstract concept of the field in the vacuum, because in the nothingness, nothing can act as physical support to the field.

There is also the well-known Newton's law: $F = G \frac{M_1 M_2}{d^2}$.

This formula, however, is only the mathematical formalism that allows us to

assess the intensity of force, and not the physical explanation.

Newton himself, in this regard, was very clear and prudent and wrote that the formula is only used to quantify the value of the force of gravity, but it is not the explanation of the force, and it doesn't give capacity to the masses to exert forces at a distance.

That capacity, according to Newton, is in the ether that permeates all space.

The theory of General Relativity has introduced the curvature of space-time.

Sure, but then how can I consider the space with the nothingness inside if it assumes different curvatures in function of the masses in the vicinity?

In other words, the curvature of nothingness proposed by current physics, is just a abstract concept, just a mathematic formalism.

And in which way this curved nothingness can interacts with the masses?

Returning to Newton, the Earth and Moon are average 400,000 kilometres away, and between them exercise mutual gravitational attraction which is easy to calculate with the Newton's formula. The result is: $F = 20 \cdot 10^{19}$ N, i.e. a force of 20 million of billion tons, approximately.

And also for this question many people believe that it is enough to exclaim: with the field! In other words they justify a huge force with the exclamation of an abstract concept as the field in the nothingness.

The question is: how the field is able to convey this force in the vacuum between the two bodies? But you can't find the answer in vacuum, because in the nothingness there aren't answers.

While the field in the nothingness is just an abstract idea into empty space, the force of gravity, instead, is very real and concrete and it requires a physical interpretation, not just a mathematical formalism.

It is clear that something is missing.

As we said, Newton had taken up the concept of the ether by the ancient Greek and argued that the forces were transmitted through this medium, although, very concretely, he wrote that he did not have the knowledge to explain how this happened, and wrote:- I don't pretend hypotheses-.

He stated that mutual forces of attraction between two masses were done by the medium interposed, respecting the volition of God.

Also all the other greats of science, including Maxwell and Lorentz, considered the ether the vehicle of the forces at a distance, some of them call into question the divine will, while others, like Laplace, claiming that he doesn't need this hypothesis.

Forces like tendency of the ether to assume the status of minimum potential energy.

We try to expose an explanation for the forces.

-- All particles and all charges are effects produced by the energy in the space with consequent perturbed local status resulting in the physical substantiality of space around them. ((The perturbed states are: the curvature of space around the masses, and the polarization around the electric charges, with the corresponding energies).

When there are two (or more) bodies, the two states perturbed overlap and the ether, then, tends to evolve towards the state of minimum potential energy varying its total condition.

This trend is the cause of all the forces at a distance. --

We try to explain in more detail by examining first the gravitational forces.

Think to a macroscopic object in space, far enough from all other bodies. As we have already written, we consider the particles of its mass like effect of energy in the ether (space).

For generate the particles the ether loses its uniformity. The overall result of the numerous particles of a body is a curvature of the ether, which is defined by the metric gravitational tensor, accentuated around the object, which extends to infinity attenuating with distance, and for all practical purposes becomes negligible beyond a certain distance.

To view this curvature we refer to classical representations of the curvature of space, now giving it the meaning of the actual distortion of the physical substantiality of space, which corresponds to a definite energetic state.

The ether tends to return to the state of rest or minimum potential energy changing its status, just like a compressed spring has the tendency to return to his extension of rest.

If we have just one body far away from other masses (strictly speaking, infinitely away) and at rest, the ether's status disturbed tends to remain stable at the same place, in fact, even if it moves it remains identical to itself. Then the particles that are formed by this energy, and make the object, tend to form in the same place and on the body does not act any forces.

Now we place another mass near the first, we have that the two curvatures of ether overlap with local variation of the total curvature and the energy distribution.

In this new situation, the substantiality of space (ether) can take a less disturbed status corresponding to a lower potential energy level. And if the two objects are initially at rest relative to each other, the two states curved tend to move along the axis joining the two centres of gravity, toward the inside. Of consequently, also shifts the energy associated with curvature.

Now we know that the two bodies are not foreign objects to the space, but their particles are local effects of energy, so if the energy tends to move, then the particles will tend to form in the new place where the energy tends to go.

All this occurs at a macroscopic level as the tendency to move bodies, i.e. as an external force, called gravity, which acts on them.

Of course we know that to have appreciable gravitational forces at least one of the two masses must be enormous.

An equivalent argument can be made to the Coulomb forces acting on the charged bodies. In fact, an electric charge produces around him dielectric polarization, which we consider as a real polarization of substantiality of space, which may be the polarization of the already known virtual particles, or other yet unknown virtual particles.

Now we have minimal curvature of the ether, because the bodies are small, but we have also polarization. However, since there is a change compared to the quiet state, we still have a spatial distribution of energy associated with the polarization of the ether and consequently tendency to assume a less perturbed configuration. With only one charged object, far away from all the other, even if it moves, its polarization will move too keeping the exact same spatial distribution and the same total energy value. Then its tendency to displacement is zero and on the object does not act any force.

Placing another charged object near the first, the two polarizations are overlap by changing the total energy. In this new configuration, the space may tend to assume a less perturbed condition. The two polarizations tend to move along the axis of conjunction, to the inside if the charges have opposite signs and to the outside if they have equal sign. The charged particles then tend to form in the new points occupied by the two polarizations. This tendency of the charge particles to take shape at different points from the previous, manifests itself with the Coulomb's forces.

We can extend the same reasoning to magnetic fields and to electromagnetic forces.

This theory of action at a distance is not inconsistent with the theory of exchange of the mediating particles, gravitons for gravitational forces and photons for electromagnetic, but only supplementing it overlaps.

Indeed, together electromagnetic fields we found the photons as their quanta. The same argument can be extended to two nuclear forces and their quanta.

Corpuscular and undulatory nature of particles

The energy thus appears as a perturbed state of ether compared to its quiet state. Since ether tends to return in the quiet state, it does not remain fixed in one point, but it participates in a dynamic equilibrium that is realized, typically, with rotational, translational and oscillators motions.

This state of general equilibrium in which they are involved and overlap many oscillations of energy, also with different frequencies, producing interference, non-stationary, but constantly moving. In the places where the constructive interference forms a wave packet whose density of energy exceeds a certain level, particles are formed, in some way not yet known, may be as thickenings of the ether, or most probably as changes of state.

As these wave packets are constantly moving, each particle also moves and when the energy falls below the quantum level they annihilates in the ether, with the resulting release of their residual energy in the space. Immediately after the particle is reformed and appear again at another point, always to the energy effect.

The proximity of two particles produces the superposition of oscillations, hence the interference.

This is also a reasonable interpretation of the wave and corpuscular nature of all subatomic particles, as evidenced by the phenomena of Interference of electrons and photons and expressed very well for photons by the famous phrase of De Broglie: - To condense the light on matter and vanish the matter on light -.

This strange aspect of particle was really a surprising discovery and it is explained only with mathematical formalism. In fact, it is not possible to give a rational physical explanation when one considers the particles as foreign bodies in motion through empty space.

The particles, once formed, are always composite objects, each type with its own structure and physical properties, and the concept of indivisible particle is completely wrong.

In fact, those who were considered indivisible years ago, now it is no longer. For example quarks. Now we know that within them there are "strings" vibrating, while for thirty or forty years they had been considered indivisible.

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