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THE ELECTROMAGNETIC ENERGY, MATERIAL AND GRAVITATIONAL

The basis of Synergic theory

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Engineer of the Higher School of Electricity, graduate of in-depth studies in electronic treatment of information, specialist in mathematical Logic, Rene Louis VALLEE is also prize winner of the Company of Research and Invention Encouragement, Engineer of the Higher School of Electricity, graduate in-depth studies of information electronic treatment and that officially crowns his various scientific work of a considerable range among which, in particular, is the discovery of the energy structure of space and jointly the electromagnetic origin of gravitation.

Since many years already - his first publications on the subject going up with 1956 - this dynamic author, with reputation as the avant-garde of contemporary Physics, has developed1 the inward conviction, like his predecessors: FARADAY, RUTHERFORD, DE BROGLIE, DIRAC, GAMOW and well of others, that united Physics could only be considered founded on a precise knowledge of the structure of the elementary particles and those are to be considered, according to EINSTEIN, also, as the singularities of a universal field.

Having looked further into the electromagnetic theory of MAXWELL and processing meticulously all of the relativistic models and quantum analysis, Rene Louis VALLEY discovered that the electric fields measure physical reality in the direction of E. MACH'S thinking what seemed well enough to explain the composition of universal field and its singularities which are dependant on a limiting value imposed by the natural laws; this could perfectly account for the existence and the behavior of the matter in concord with all the currently known experimental results.

This is precisely the objective step coming from fruitful, long and prestigious work of synthesis having led to the “synergic” theory, which René Louis VALLEE evokes for us in his study on” material and gravitational electromagnetic energy “.

THE ELECTROMAGNETIC ENERGY, MATERIAL AND GRAVITATIONAL

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The assumption of existence of the energy mediums with the value limits higher than electric field

by

René Louis VALLEE
Engineer E.S.E.

Manuscript deposed under fold sealed with the Academy of Science in December 1970

James Clerk MAXWELL (1831 - 1879)

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Appendix

Recall of the principals and basic concepts used in the text

INTRODUCTION

The advent of Relativity and that of quantum Mechanics were marked by the progressive abandonment of any concrete representation of the phenomena on a microscopic scale.

If the scientists had to resign themselves to such an abandonment, it was, neither without anxiety, nor without difficulties; but they were constrained there by the requirements of a Science in full expansion being based on the absolute power of a mathematical apparatus which, at the time, had to construct the representation concretes to ensure the scientific success and its progress, only. That still could be done without retreat, but with an imagined representation of the physical phenomena. The concrete model was seen thus gradually relegated to the museum of didactic antiquities. Admittedly, it is reasonable to recognize the value of the mathematical tool and be pleased to use its vast possibilities. But, it forces us to admit, however, that any mathematical solution could not reveal of physical result which was not already contained in the assumptions or laws that are pre-suggested like fundamental reasons of the demonstrations observed in the experiments.

A mathematical study of the law of Marriott, however thoroughly examined, cannot lead to the equation of Van Der Waals. So the transformations of Lorentz, resulting from the equations resting on the assumption of a universal time, cannot succeed, if one does not know which magic power makes that Lorentz's time, paradoxically, is not universal any more. The law of Coulomb, in its mathematical expression, does not imply the existence of centers of attraction of null radius where the fields are infinite. That product of a speed and of a time has the length dimension, but it does not authorize us to conclude that space and time are of comparable nature.

Some examples, among others, show us how much we must defy purely mathematical description of a phenomenon when we are unaware of its concrete support and, consequently, its physical limits of validity.

While wanting to be unaware of this fact, theoretical physics entered one era of distress because it lost the direction of the concrete discipline. Being purely theoretical, its aspect is not almost physical any more. We are at the point where largest among the physicists went too far in the ways of the abstraction, so losing up the control of the significance or even of words and formulas they use. Do not mention the 'climbing time', 'negative energy', 'quantified fields'!

It is not astonishing to note a certain sadness in following lines written by Louis de Broglie, evoking the probabilistic interpretation of the Wave mechanics: "*I thus saw disappearing, - he says -, in the fog of a correct, but obscure formalism, the concrete and precise images that I had hoped to obtain as coexistence of the waves and corpuscles*" [1]. Shouldn't one find, also, the cause of the anguish which attacks the researcher today? Whereas crushed by the weight of a hermetic mathematical system and often complicated, it seems well, alas! Why have we forgotten the fertile pragmatism of the theories of formerly ages?

The difficulties, for their greater part, result owing to the fact that all the physical laws are valid only inside one field which always admits a certain number of limits or discontinuities. On the other hand, the mathematical formulas which correspond to, often take on a continuous aspect which does not allow, except in extreme complications, to express directly the continuity solutions associated with the physical limits. These limits can be known only at the end of experimental measurement or in experiments controlled by assumption. If they are ignored, they will remain definitively absent from any equation, any formula, any relation using the mathematical expression of the corresponding law and it would be useless to claim to perforate there.

The science arrived at the stage of the almost known totality of the measurable phenomena, or direct findings, and there is a place for re-establishment of deterministic laws in whole like those of mechanics, thermodynamics or of the traditional electromagnetism.

Among the phenomena which cannot be directly measured any more, there are probably much of the unsuspected ones, but those which are known, still are imperfectly explored via incomplete statistical laws. The statistical law is by nature, incomplete, because it is subjected to exceptions in circumstances whose causes we are unaware of, but which we can associate with probability that according to the law of the great numbers specifies itself in experiments with the increase in the number of the cases observed. This leads to the mathematical laws of Poisson, then to the asymptotic law of Laplace-Gauss which isn't specifically describe phenomena, but partially help us to overcome our ignorance: from there arises the necessity to oppose probability idea with that of determinism.

We say, indeed, that a law is deterministic when we believe to know all the causes of the phenomena which obey to him. We say, on the other hand, that it is probable when we scientifically admit being unaware of some of his causes. It is not necessary, however, that this knowledge of the limits of our current knowledge is a renouncement.

The statistics concern a partial ignorance which is never reprehensible in oneself. What is serious, it is, when it appears, the refusal to pave further on the way of knowing, it is abdication in front of the effort and the servile acceptance of ignorance.

The absence of curiosity for the phenomena which are dissimulated under the misleading veil of the statistics is often the fact of a fatalistic indifference, which should be overcame, in order to avoid the pitfall of a sterile opposition to progress which inevitably results from it.

The vast field of knowledge took a considerable importance and capital which requires today, more than at any other time, the mobilization of all the means of scientific investigation, practical and theoretical, technical and intellectual, is placed at our disposal. In rejecting only one, even the most modest seemingly, can prove, thereafter, to be a serious error likely to compromise the future dangerously.

Many are those which became aware of this reality. The responsibility for each one is consequently committed and it would not be used for nothing if anyone wants to deny it.

Lost in a universe without limits, confused by the uncountable vastness of a field which remains to us unknown, unable to clearly distinguish our *raison d'être* as much as our destiny, we however have a priceless money, -- our reason -- which, associated with our knowledge, provides us means of managing to disentangle horse of the laws of a Nature which does not refuse but remains indifferent to our whims.

The flux exists in this Universe which, all at the same time, surrounds us and contains us, a certain rate/rhythm and a multitude of events and similar phenomena which, without having a total identity, are repeated or reproduce in a crowd of specimens.

There are billion and billion stars in our Galaxy. We could not count them exactly and several lives of man would not be enough there. But we know, however, to classify these stars according to their type. We know, in particular, that there are the numerous ones which resemble our sun, have the same aspect, the same components, the same spectrum and are of close dimensions.

When we preach, with conviction, the great philosophical principle of equality between the men, it is well because we also notify all the resemblances which link the human beings.

In truth, we shouldn't have Science without the fundamental similarities between the beings, the things, between the facts, whose reciprocal reports/ratios obey laws which appear never to be contradicted.
If the physical phenomena were not repetitive, if it were not possible to reproduce them, they would undoubtedly escape the experimental study and would remain to us hidden forever. Un contrary, the reality offers to us a rich testing-ground and today's Science is so vast, that no man could claim that caught it entirely.

By not even counting time that it is necessary to acquire for an essential general culture, many years of study are necessary to the possession of restricted knowledge of a specialize in any scientific discipline. The memory which is erased requires, moreover, the long hours of practice to preserve the whole of this knowledge and to acquire news of it.

The vertiginous rate of progress forces us to re-examine, organize, simplify… The dissemination of the knowledge could not escape these requirements and the true Science also should be maintained; that of Galileo, Ampere, Maxwell, Lorentz and Einstein. It is necessary to prohibit what is not transformed into a kind of esoteric religion. It is necessary to prevent that it does not become the property of a small number of initiates mislaid with the subsoil of the labyrinth of the paradoxes and confusion. It is necessary, for the good of each one, that it remains accessible and comprehensible to everybody, without requiring disproportionate efforts in regard to the anticipated results.

It is of our duty to defend the good direction, the probable one and to drive out the phantasms which darken the spirit of research, of the possible one, of reasonable and the useful one. The dream, imagination, the intuition are intermediaries of a great value, but the knowledge of reality remains the goal and one could "order to Nature only while obeying to her".

The concrete representation is the only and true link which connects us with reality. The existence of the energy mediums, that of a disruptive limit of the electric field, the law of materialization, are many expressions which bring us back to a concrete vision phenomena, the vision of which we kept nostalgia for a long time.

The theory of quantum electromagnetism does not destroy the knowledge acquired before. It specifies it and simplifies it, substituting the concrete physical explanation by mathematical description when the latter is failing, without being, however, in dissension with it. Its notorious merit is to lead us to the discovery of electromagnetic origin of Gravitation, lead us to reveal that the speed of light in the vacuum, in spite of weak variations, is not a universal constant as admitted it, *a priori*, the second postulate of relativity theory. The potentials of gravitation precisely have, for expression, the square of the propagation velocity of the light waves and the relation of equivalence, $\mathbf{E = mc^2}$**,** represents exactly the potential energy of gravitational mass **m**. The proof of it is given in the explicit way in Maxwell's equations too, which upon the assumption of energy mediums existence, provide, at the same time, the relation of matter-energy equivalence and the law of Newton.

In addition, expressed in the common engineer-technician language, Physics is to finally offer to us an objective and familiar face. It becomes thus accessible to comprehension from the greatest number of people which, modestly, without having a broad knowledge, maintain this curiosity and this desire to understand and to render comprehensible scientific knowledge which honors and enriches.

Brought back to traditional electromagnetism, thanks to the discovery of the law of materialization, Relativity and the Wave mechanics can finally find a harmony and unite; this assure us that Nature is not played of our good direction. Our eyes are discovering the dazing ballet of the photons and electrons on the bottom of a balance and order of Cosmos that it is given to us to appreciate, and we can finally enable ourselves to draw, by a clumsy hand, the still fuzzy images of an eminently probable reality.

N. D. L' A. ---- All calculations and all the relations are expressed in the system of rationalized M. K. S. A. units.

1

ENERGY MEDIUMS AND THE PRINCIPLE OF RELATIVITY

The empty geometrical spaces of any energy which mathematics describes do not have any real physical existence. The remote interactions, the presence of fields of various natures which results from it, imply necessarily the existence of energy mediums. That's what J.A. Wheeler made to say, perfectly conscious, among many others, of this inevitable existence: *Whatever violent one sees the Ocean, one should know that the geometry of space on a Planck's scale is even more violent. There is nowhere a zone of calms* [2].

To want to remove a medium or not of it to hold on the account is as stripped of physical direction as to want to imagine some of the absolute. The vacuum of energy could exist only if the whole universe disappears and we would be there to note only what would occur then.

To specify this elementary concept of medium, let us imagine, by acoustic analogy, an observer which carries out the sound velocity measurement inside a vehicle in uniform displacement. For example, under the normal conditions of air temperature and pressure, the observer would find, for this speed, inside the vehicle, an average value of 333 meters at the second. The same observer, measuring the speed of sound coming from a fixed source, external to the vehicle that transports it, would find also on average, under the normal conditions indicated, the same value of 333 meters at the second brought back to the surrounding air.

These results do not enable us to affirm that there is not any support to propagation of the sound, although this propagation is characterized by a null average value of the function Dalambertiene of the pressure $\mathbf{P}$, $\Box \mathbf{P} = \mathbf{0}$.

This average value does not seem to depend on the selected frame of reference and can give the illusion of an absolute invariant. We know, however, that the speed of sound is 333 meters at the second is compared to the medium defined by ambient at rest under the normal conditions. That amounts admitting the existence of a fixed reference frame, therefore privileged, related to air at rest. But what is at rest? - If not a cluster of innumerable molecules which are animated, each one, the most various speeds in amplitude and direction and which are agitated in all directions in the inconsistency of the Brownian movement.

Two conclusions are essential then, inevitably: first relates to the propagation and leads us to regard the speed of sound as an average statistical speed; the second is much more important and it makes us to discover the physical concept of propagation medium than we can define in a particular volume **xo** as attached to the reference frame in which the *vector volume integral of all the momentum of all the molecules is statistically equal to zero*.

$$\iiint_{\tau o} \mathbf{p \cdot v \cdot d\tau o = 0}$$

The feature which overcomes the integral indicates that it is about a statistical average value.

If in a reference frame R, this integral is not null, and we can define a speed - vo of relatively displacement to the reference frame associated with the medium, while writing:

$$\frac{\iiint_{v(t)} \mathbf{p \cdot v \cdot d\tau}}{\iiint_{v(t)} \mathbf{p \cdot d\tau}} = \mathbf{0}$$

we will say that the medium, defined in **τ(t)** volume, is with stationary inertia because we can write:

$$\iiint_{v(t)} \mathbf{p \cdot (v-vo) \cdot d\tau = 0}$$

In the reference frame Ro related to the medium, speeds are equal to v'= (v-vo). This medium is thus well defined by your null average statistics of the integral,

$$\iiint_{\tau o} \mathbf{p \cdot v' \cdot d\tau o = 0}$$

*We can thus define the reference frame relations of medium in **τo** volume, like the reference frame by ratio to which the vector sum of all the volume movements, in the interior of **τo** volume, chosen and fixed in this reference frame, remains constantly and statistically null.*

This actually defines only one relative average medium, since it depends primarily on the field of integration **τ** considered.

It is interesting to note that for the electromagnetic phenomena, the energy medium can be defined in a similar way. We indeed know that in any point of space, filled by electric and magnetic fields, it is possible to associate momentum to these fields by unit of volume, generally called 'impulse', which by magnetic induction corresponds to the vector product of the electric flux density:

$$\mathbf{Do \wedge Bo = po \cdot vo}, \quad \mathbf{Do = \varepsilon o E}, \quad \mathbf{Bo = \eta o H}$$

There is then also a particular reference frame which we can associate the medium related to volume R of integration for which, in this reference frame,

$$\iiint \mathbf{t}\ (\mathbf{p \cdot v + Do \wedge Bo})\ \mathbf{d\tau = 0}$$

In this equality**,** **p·v** must include, without any exception, all the volume momentum which would not be contained in electromagnetic form. as the expression **Do^Bo**. In fact, we will admit that quantity statement ***pv*** can be translated into electromagnetic terms and that allows us to write the equivalent form:

$$(\mathbf{p \cdot v + Do \wedge Bo}) = \mathbf{D \wedge B}$$

These considerations lead us to formulate the following assumption: *the laws of electromagnetism are statistically valid for the all fixed reference frames dependant on the medium which annuls the volume integral of total quantity of movements or of all the energies contained in the domain* ***τ*** *attached to referential understanding of the phenomena observed and observant himself, including so all the elements which play a part in measurement and the observation.*

The measured value of the speed of light is only one average statistics depending on the propagation medium; this medium can be also defined as that in which the electromagnetic wave propagation is isotropic.

Let us note that the general concept of medium, such as it has been just defined, was already contained, partly, on the assumption of sub quantum existence of the medium. This concept that was essentially justified by the existence of the barycentres in traditional mechanics, was to be specified, because it constitutes, in fact, hast of physical explanation of the quantum and wave theories and also of that of Relativity.

The transformations of Lorentz preserve, indeed, the form of the Maxwell's equations and, consequently, that of the laws of electromagnetism in a homogeneous medium. They thus have the advantage of taking account of the relative relationship between the phenomena and the medium and they make it possible to envisage the phenomena, such as they appear, when they are brought back in the middle of observation.

The laws established by Ampere and Faraday allowed Maxwell, thanks to the brilliant assumption of a displacement current which exists at the same time in absence of any load, to lead to the general formulation of the relations which, supplemented by H.A. Lorentz, govern the fields and inductions, electric and magnetic. These relations are currently written in analytical form:

$$\mathbf{rot\ E} = -\partial \mathbf{B}/\partial t, \qquad \mathbf{B} = \eta \mathbf{H}$$
$$\mathbf{rot\ H} = \partial \mathbf{D}/\partial t, \qquad \mathbf{D} = \varepsilon \mathbf{E}$$
$$\mathbf{div\ D} = p, \qquad \mathbf{div\ B} = 0$$

In the case of a medium macroscopically homogeneous and where, consequently, the permittivity E and the permeability ... can be looked like constants, Lorentz noted that a certain group of linear mathematical transformations, where intervenes a constant coefficient having dimensions of a displacement speed, preserve the equation forms of the system l. These Lorentz-Maxwell transformations, also attributed *relativistic,* because they originate from the restricted theory of relativity, are not, among a more broad whole of possible transformations, that of a particular case. This case was especially selected because it has the property to preserve the electric charge - *load that the theory of traditional electromagnetism considers, by definition, like a fundamental invariant*.

The conclusion that we can and must, without making the error, draw from these observations, is that the transformations of Lorentz provide, at every moment, the distribution and the value of the fields, electric and magnetic, related to loads uniformly moving through the medium macroscopically homogeneous and isotropic, with the proviso of knowing, at the beginning, of the relative distribution and value in an identical medium, in which the loads are at rest. The provided values are macroscopically deterministic and the transformations of Lorentz in no manner can inform us about the possible modifications of forms and structures at the microscopic level of the elementary particles. They are, on the other hand, usable on a macroscopic level, in any energy medium considered as homogeneous and isotropic and not only, as one could believe it, in the nonmaterial mediums.

2

INERTIAL MASS OF ENERGY MEDIUM

Let us consider a space where the energy which appears is supposed to be able to be translated, at each point, to electromagnetic form. We will admit, as we already stated, that it is possible to define, at any moment and in any point, one momentum density of $\partial \boldsymbol{p}/\partial \boldsymbol{\tau}$, such as:

$\partial \boldsymbol{p}/\partial \boldsymbol{\tau} = \mathbf{D \wedge B}$

The general moment that we can associate to a volume τ defined in reference frame **R** is obtained while calculating the integral:

$$\iiint_\tau (\mathbf{D \wedge B}) \cdot \mathbf{d\tau} = \mathbf{P}.$$

If there is a reference frame **Ro** associated with volume fixes $\boldsymbol{\tau}\mathbf{o}$, in which energy is stationary, we can write:

$$\iiint_{\tau o} (\mathbf{D \wedge B}) \cdot \mathbf{d\tau} = \mathbf{0}.$$

We will attach systematically to this equality the assumption that volume fixes $\boldsymbol{\tau o}$ *associated with the* ***Ro*** *reference frame, defines, in these conditions an isotropic medium for the electromagnetic wave propagation.*

Let us imagine, according to the assumptions and definitions posed, a decomposition of electromagnetic inductions according to two components: Do = D + ***d*** and Bo = B + ***b***. The medium integral is written, then:

$$\iiint_{\tau o} (\mathbf{Do \wedge Bo}) \cdot \mathbf{d\tau} = \iiint_{\tau o} \left| (\mathbf{D \wedge B}) + (\mathbf{D\ b}) + (\mathbf{d\ b}) \right| \cdot \mathbf{d\tau} = \mathbf{0},$$

that is to say:

$$\iiint_{\tau o} (\mathbf{Do \wedge Bo}) \cdot \mathbf{d\tau} + \iiint_{\tau o} (\mathbf{Do \wedge Bo})\ \mathbf{d \wedge b}) \cdot \mathbf{d\tau} =$$
$$\iiint_{\tau o} \left| (\mathbf{b \wedge D}) + (\mathbf{B \wedge d}) \right| \cdot \mathbf{d\tau}\ .$$

We note that the vector sum of the momentum, relating to each of the two mediums considered separately, is not equal to the total momentum of the supposed medium that consists of them both as reunited.

It is remarkable to note that the mediums interact between them, in each point of space, proportionally to electromagnetic inductions which can be associated to them, respectively.

Let us consider the area **τ** where the values of **d** and **b** remain negligible in front of those of **D** and **B**, and choose, on the other hand, the sufficiently vast volume of integration **τo** to be able to define a fixed reference frame **Ro**, containing in particular the observer and the system of observation. The application of the transformations of Lorentz enables us, in this case, to calculate simply and with a good approximation, momentum of the medium defined in volume **τ**, itself included in τo, when this medium **τ** is with stationary inertia and is animated by rate of uniform travel **v** that is compared to the isotropic reference frame **Ro**.

It appears legitimate that the medium in displacement, which is defined in a restrictive way in volume **τ**, is practically a medium with stationary inertia. That is expressed statistically by annulling the momentum that is brought back to the reference frame ***R***:

$$\iiint_{\tau} (\boldsymbol{R})\ (\mathbf{D} \wedge \mathbf{B}) \cdot d\boldsymbol{\tau} = \mathbf{0}.$$

By supposing the permittivity **ε** and the permeability η constants in the volume **τ**, we can write for R:

$$\iiint_{\tau}(\boldsymbol{R})\ (E \wedge H) \cdot d\tau = \mathbf{0}.$$

Let us choose two trihedral of reference O' xyz for ***R*** and OxoYoZo for ***Ro***, so that the axes **O'x** and **Oxo**, directed according to the relative speed **v** of displacement, are collinear.

The momentum, at a given moment of time, calculated in apparent volume **τ1** correspondent **toτ** but brought back to the trihedral **OxoYoZo** relating to ***Ro***, admits like projection on axis **Oxo**:

$$\mathbf{Poxo} = \iiint_{\tau 1} (Ro)\ (\mathbf{Do} \wedge \mathbf{Bo}) \cdot \mathbf{uo} \cdot d\tau 1 = \varepsilon o \eta o \iiint_{\tau 1} Ro\ (\mathbf{Eo} \wedge \mathbf{Ho}) \cdot \mathbf{uo} \cdot d\tau 1.$$

***uo* ……….**represents the vector unit of the axis **Oxo**.
Do = εoEo represents electric induction sight of ***Ro*** in **τ1**.
Bo = ηoHo represents magnetic induction sight equal to **Ro** in **τ1**.

The speed of the electromagnetic waves, by assumption, is being isotropic in the reference frame ***Ro***, like it is in the reference frame ***R***, so that the Lorentz's transformations are applicable what makes possible to write the following relations:

$$\mathbf{Eo}\quad \left| \begin{array}{l} \mathbf{Eoxo = Ex} \\ \mathbf{Eoxo = 1/ά\ (Ey + \eta ovHx)} \\ \mathbf{Eozo = 1/ά\ (Ez - \eta ovHy)} \end{array} \right. \qquad \mathbf{Ho}\quad \left| \begin{array}{l} \mathbf{Hovo = Hx} \\ \mathbf{Hoyo = 1/ά\ (Hy - \varepsilon vEx)} \\ \mathbf{Hozo = 1/ά\ (Hz + \varepsilon vEy)} \end{array} \right.$$

In these relations, $\mathbf{ά=\sqrt{1-\ ά o\eta o v^2}}$, but it is also necessary to calculate equalities of the ***d***vo=ά, ***d***yo=***d***y, ***d***zo=***d***z, which involve the transformations ***d***τ1=ά***d***τ.

We can thus carry out the calculation of Poxo in the reference frame ***R***:

$$\mathbf{Poxo = \varepsilon o\eta ov/ά \iiint\tau\ (\mathit{R})\ \left|\ \varepsilon o\ (E^2y+ E^2z) + \eta o) + (H^2y+H^2z)\ \right| d\tau\ +}$$

$$\mathbf{+\ \varepsilon o\eta o/ά\ (1+ \varepsilon o\eta o\, v^2)\iiint\tau\ (\mathit{R})\ (EyHz-EzHy) \cdot d\tau.}$$

The medium which was defined in volume τ(***R***) is being a medium with inertia, stationary; the second term of the second member of the preceding expression is null and we can write consequently:

$$\mathbf{Poxo = \varepsilon o\eta ov/ά \iiint\tau\ (\mathit{R})\ \left|\ \varepsilon o\ (E^2y+ E^2z) + \eta o) + (H^2y+H^2z)\ \right| d\tau.}$$

The part of this expression, related to sign of integration, is homogeneous with energy which we will call **Wo**. This energy, the characteristic of the medium attached to the ***R*** reference frame, is independent of the speed **v**.

Poxo is equal to the module of the momentum **mv** since we supposed the medium **τ (*R*)** in uniform motion following the direction of axis **Oxo** of ***Ro***; it makes possible to express the mass:

m =**εοηoWo/ά** .

When **v = 0** and **ά = 1**, we can associate the definite medium ***R***, stationary energy ***Wo*** as well as the mass of inertia **mo= εοηoWo. B**ut**,** 1/√ **εοηo = vo** represents the speed of propagation of the electromagnetic waves in the medium of observation ***Ro***. We can thus also write the relation **Wo=mov²o -**

The experience shows that the mass of inertia is, at first approximation, independent of the medium of reference, ***Ro*** whereas **Wo** depends on it via **εo** and **ηo**. It follows that when the density of energy of the definite isotropic medium is relative to the reference frame ***Ro*** it becomes increasingly low in the vicinity of the volume **τ** and usable energy grows and tightens towards $\mathbf{W=mov^2}$; **c** corresponds to the higher limit towards the speed tends, accordingly to $\mathbf{vo=1/\sqrt{\varepsilon o \eta o}}$, while density of energy matter of the observational medium, in the vicinity of the phenomenon observed, tends towards zero [3].

It would thus seem that the usable energy of mass, in the mediums where the propagation velocity of the electromagnetic waves equals **vo**, is limited to $\mathbf{Wo= movo^2(vo < c)}$; Let us point out that this speed **vo** represents an average value, itself affected by the more or less important energy concentration in the medium.

The known law, although very approximate, like the law of Gladstone, seems well to confirm this fact. It establishes, indeed, a proportionality between the relative variation of the propagation velocity **vo** and the specific mass $\mathbf{\partial m/\partial \tau}$ of the medium which is proportional to the density of energy matter. This law is written:

$$\mathbf{Rn\cdot\partial m/\partial\tau= (n-1)=c-vo/vo}$$

In the expression of the mass of inertia obtained previously, we note an increase in energy,

$$\mathbf{W=Wo/\sqrt{1- \varepsilon o\eta o v^2}=Wo/\sqrt{1-(v/vo)^2}.}$$

according to the speed **v** of the medium in displacement. This increase, confirmed by the experiment, shows that the contribution of energy **W** to the energy medium increases with the speed. It results from it, according to the preceding definitions, as driving part of the variable medium with the more or less large proximity of the zone in displacement; it's drive that direct measurements cannot highlight: - from there comes the failure of the experiments of Michelson and Morley and the success of the restricted Relativity theory. The transformations of Lorentz return the account, but in energy transfer at the constant speed and medium driving which results from it, one is to be very wise interpreting these transformations. They are only approximate. It is necessary to regard them as remarkably simple and convenient relations, which allows obtaining statistically valid results related to energy variations of electromagnetic fields distribution, seen outside and remote of the material bodies. They lead, in particular, to erroneous results as for pure energies of the mediums themselves.

We have found, indeed, for energy at rest of the medium attached to the reference frame ***R***, the expression:

$$\mathbf{Wo=\iiint\tau(\mathit{R})\ \left|\varepsilon(Ey^2+Ez^2)+\eta(Hy^2 + Hz^2)\right|\cdot \mathit{d\tau}}, \quad \mathbf{[4]}$$

whereas the laws of traditional electromagnetism provide a different expression for an energy which, in theory, should be the same one:

$$\mathbf{Wo=1/2\iiint\tau(\mathit{R})\ \left|\varepsilon(Ex^2+Ey^2+Ez^2)+\eta(Hx^2 + Hy^2 + Hz^2)\right|\cdot \mathit{d\tau}}.$$

This obvious contradiction confirms the imperfections and the limits of a mathematical theory which cannot entirely apprehend physical reality. It urges us to foresee the complexity of reality and leads us to discovery of an important gap in the whole of the known physical laws, the gap that cannot be filled up merely by mathematical speculation in a field which lengthily was already explored.

3

THE LAWS OF ELECTROMAGNETISM SUGGEST THE ASSUMPTION OF A UNIVERSAL LIMITING VALUE OF THE ELECTRIC FIELD

The Poisson's equation, $\Delta \mathbf{V} + \boldsymbol{p/\varepsilon o = 0}$, obtained while combining the two equalities, **E= - grad V** and div $\mathbf{E} = \boldsymbol{p/\varepsilon o}$, suppose one continuous distribution, in space, of the potential functions V and the density of charge electric ***p*** [5],

The experimental results show there is nothing of it on the atomic level where the distribution of the loads is definitely discontinuous.

Electricity arises under the aspect of seemingly identical elementary grains which occupy specific punctual zones of enormous load condensation. Whereas apart from these singular points, the equation of Laplace, $\Delta \mathbf{V} = \mathbf{0}$, **(E = -grad V, div E=0)** seems to govern electric fields as being continuous. Upon the consideration involved, the one who is responsible can find on this level a discontinuous or continuous electric field aspect.

When in the physical phenomena we take on a double aspect then the major difficulty lies in the application of the causality law.

--- Is this the load which creates the electric field?

--- Is this the field which creates the electric charge?

Or both are finally the two aspects of the fundamental one? And in this case, the question is to be posed to know if there is a possibility of recognizing the fact dissimulated under this double appearance.

When equipotent surfaces, **V =Cte,** are closed surfaces which are not presenting a singular point which corresponds to the practical cases, the equation of Laplace necessarily involves, in the interior of a volume limited by one of these surfaces, the existence of one or several areas of space where the divergence is not null any more. This equation, consequently, is not checked there further.

The field, **E = - grad V**, is always normal, in each point, on a surface **V =Cte**. According to the theorem of Green and Ostrogradsky, the flow,

$\iint \mathbf{V{=}Cte\ E} \cdot \boldsymbol{ds}$ is not null; it is equal to the volume integral,

$\iiint r \operatorname{div} \mathbf{E} \cdot d\tau$,

and it should be admitted that there are areas where the divergence inside volume τ is not null, but delimited by regular surface **V =Cte** .

To prevent that the charges cannot take infinite values in certain points of space, it must thus exist, in this space, a certain number of areas of finite size where these fields have an also finite divergence and not null.

There is habit, probably wrongly one, to consider that the electric charges are responsible for the fields which they create and of which, in return, they undergo the actions which result in forces that are, moreover, the only 'sizes' which are measurable directly. It is useful to recall on this subject *that a field is nothing else but the vector which has the same direction, magnitude and sense, it is nothing else than the force which would be exerted on a specific element of substance positive unit, placed at the point considered and which would be only passive.*

The Poisson's equation has, on this subject, an advantage which deserves to be announced. It does not imply the concept of substance or electric charge. To express the forces that result from the action of the electric fields, it is enough, indeed, to write the differential relation:

$d\mathbf{F} = \mathbf{E} \cdot \operatorname{div} \varepsilon_o \mathbf{E} \, d\tau.$

Let us suppose that this relation, which depends only on the field **E** and ε_o, is thus possible to bring back the electromagnetic phenomena to the initial cause that seems to design the electric field as it is. It is necessary, however, to assign it with the space of the particular physical properties related to a new assumption which concerns this field.

Since the electric field can indefinitely physically grow, at any time and in any point of space, we will admit, by assumption, that there exists, for this field, an absolute value limit, εd, which we will calculate thereafter… , This limiting value, that the electric field gradients never exceed, we shall call the disruptive gradient or disruptive field of space

This assumption involves certain notes:

- The first relates to the magnetic field which it is necessary to regard as the variable manifestation of the electric field, in time. Numerically, the Maxwell's equations make it possible to calculate the values of the magnetic field when those of the electric field are known, like its distribution and its variations. In the case of transverse electromagnetic waves, the magnetic field is equal, at most, with the electric field multiplied by the coefficient

$\sqrt{\varepsilon o / \eta o}$, thus exists, according to the medium, a limited magnetic field which satisfies the relation: $\chi d = \sqrt{\varepsilon o / \eta o} \cdot \varepsilon d$.

- The second remark to be made relates to the discontinuity introduced by the assumption of existence of the disruptive field **εd**.

What does it occur in extreme cases?

The answer is given to us by a fundamental law of Nature which doesn't resemble currently known physical laws.
We will name it the law of materialization because it specifies the way in which is carried out the energy conversion into matter.

This fundamental law, very important, can be stated as follows:

If it arrives, in an isotropic medium with stationary inertia, in the course of electromagnetic events, energy that concentrates in zones where the electric field achieves the value limits ***εd****, the properties of space there modify, and that occurs specifically in the zones limited to the elementary volumes* $\Delta\tau$ *, so that the divergence of the electric field takes there a non null value prohibiting any going beyond of value* ***εd****. It exists then, at least, two jointed microscopic volumes* $\Delta\tau o$ *and* $\Delta\tau 1$*, constituting, at last, the zone* ***H*** *, in which the integral limited by the electric induction divergence respectively provides the quantified values:* ***+qet-q, with q=1,60·10·10 (exp. -19)*** *Coulomb.*

When there are only two jointed microscopic volumes $\Delta\tau o$ and $\Delta\tau 1$, the equivalent particle is a photon and we can write the volume integrals:

$$\iiint_{\Delta\tau o} \operatorname{div} D \cdot d\tau = -q. \qquad \iiint_{\Delta\tau 1} \operatorname{div} D \cdot d\tau = +q,$$

with $\Delta\tau 1 + \Delta\tau o = \Delta\tau$.

It should be noted, however, that the average value of the divergence remains null in elementary volume $\Delta\tau$,

$$\mathrm{Divm}\, D = 1/\Delta\tau \iiint_{\Delta\tau} \operatorname{div} D \cdot d\tau = 0.$$

The Maxwell's equations then provide a solution approached, but acceptable, which describes the electromagnetic phenomena associated with the propagation of photons of elementary dimensions, physically evaluated in the quantitative expressions of the phenomena, but which are still large compared to those of microscopic volumes $\Delta\tau o$ and $\Delta\tau 1$, where the electric field keeps its disruptive limit.

Whatever costs, in this new law, we are to consider the electric charge as an area of space of which the structure is modified by the disruptive field that involves the appearance of a non null divergence of electric induction, div $\mathbf{D}\neq\mathbf{0}$. *If the divergence were null in this place, the value of the electric field could not be maintained on this side disruptive limit* $\varepsilon\mathbf{d}$.

A divergent zone of space **(div E≠0)** can be preserved if, along surface limits that are separating it from surrounding non-divergent space (D = 0), the electric field has a value equal to the disruptive value **εd**. This surface of separation behaves like perfect reflector and opposes an insuperable barrier to the electromagnetic waves which electric field would tend to be added to **εd**.

On the level of the elementary divergent zones there are no more forces of interaction, according to the usual sense of the term.

A divergent zone appears, is maintained or disappeared, according to whether the electric field, in the area considered, reaches, preserves or decreases its disruptive limiting value.

The appearance of the divergent zones, and consequently that of the matter, can be regarded as *a true phenomenon of electromagnetic cavity*. In consequence of the energy concentration, the physical properties of space are suddenly modified so that this energy is trapped, locally, by the presence of perfectly reflective microscopic surfaces which result from this modification. Thus is clarified the share of the mystery which disturbed J.A. Wheeler when he wrote: “A strange phenomenon must occur in this area. Or the Maxwell's equations are not valid any more. Or the area is filled with a special substance, an electric frost, a magic fluid beyond the explanations [**2**]”. The Maxwell's equations are always valid if considered on the elementary particles level, valid like average relations between the statistics of the fields. The true problems are the boundary conditions which the laws of Physics impose and which the linear structure of the current mathematical systems does not make it possible in simple form.

4

ELEMENTARY DEMONSTRATION OF THE ENERGY-MATTER, THE PHOTON, CORPUSCLE AND QUANTUM

With the gleam of the law of materialization, it is interesting to examine the behavior of an electromagnetic wave, which is propagated in a "non-divergent" (**1**) macroscopic space and which answers the laws expressed by the Maxwell's equations:

$$\mathbf{Rot\ E = -\ \partial B/\partial t, \quad rot\ H=\partial D/\partial t,\ div\ B=0,\ div\ D = 0.}$$

Let us suppose that the electric field **E** tends to exceed, locally and temporarily, the value **εd** in a given zone of space. In order to obey the law of materialization, it is reasonable to think that in the zone in question the Nature reveals a genuine microscopic capacitor (**fig.1**) which its own field **E** superimposes on the field **E**c. That results in module, $|\mathbf{Er}| = |\mathbf{E - Ec}|$, most equal to **εd**.

It is a simplified image of the phenomenon, but acceptable, which accompanies the space properties modification such as it appears indeed in agreement with the assumption suggested.

To use a model which concerns traditional electromagnetism, while taking account of the law of materialization, let us regard the divergent zones as localized microscopic circuits having a coil and a self capacitance.

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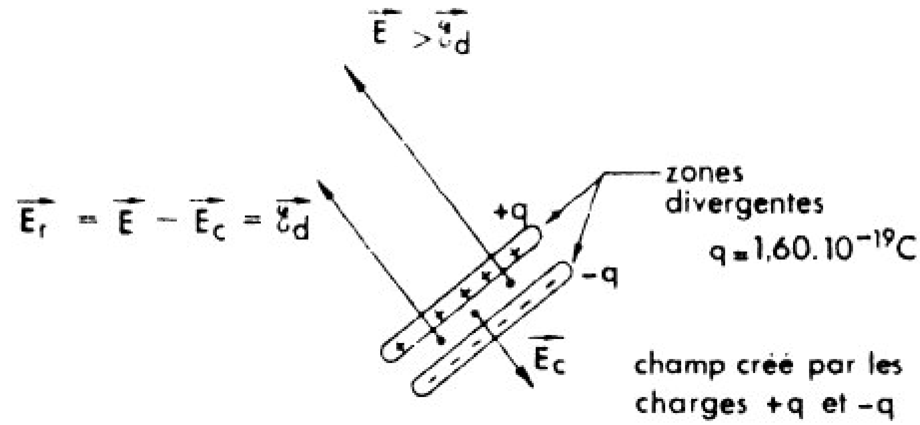
(1) We will call, by definition, "no divergent" space, the outer space in which div D = 0, in opposition to space "divergence" where div **D≠ 0**.



field created by the loads **+ q** and - q

Fig.1. --- The limitation of the electric field to the value

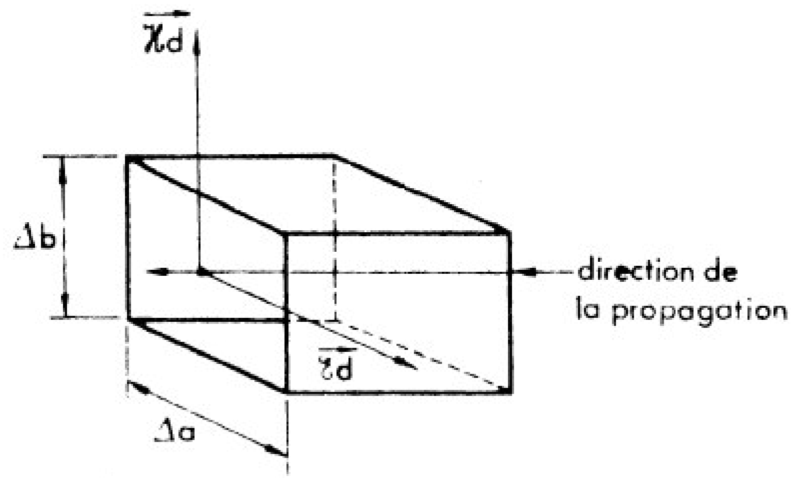
εd · │E-Ec│=│Er│= εd.

The study of the lines with constants distributed without losses shows, initially, that for dimensions given, the impedance characteristic of such a line depends only on the space configuration and the characteristics on the propagation medium. When the line is cut out, fictitiously, in basic cells of **L1** itself and capacity **C1**, the matrix of transfer of each cell, expressed in the operational formalism, can be written:

$$\mathbf{Tr} = \begin{Vmatrix} \mathrm{Ch}\sqrt{L1C1}\cdot p, & \sqrt{L1/C1}\cdot \mathrm{Sh}\sqrt{L1C1}\cdot p \\ \sqrt{C1/L1}\cdot \mathrm{Sh}\sqrt{L1C1}\cdot p, & \mathrm{Ch}\sqrt{L1C1}\cdot p \end{Vmatrix} \qquad [6]$$

Impedance characteristic of such a cell, identical to that line, in this case is equal to, **zo = √L1/C1**.

This characteristic impedance is in theory independent of the operational variable ***p*** and depends, consequently, neither of the form, neither of the frequency, nor of the intensity of the transmitted signals.
A guide of indefinite elementary wave has rectangular section, cut out in a homogeneous space satisfied by these conditions. To obtain simple relations, we will admit that each microscopic circuit, previously definite, is a basic cell belonging to a guide of rectilinear wave or to a very small rectangular section whose side Δ**a** length is normal with the magnetic field and the Δ**b** side is normal with the electric field (fig**. 2**).



direction of the propagation

Fig. 2. -- Equivalent cell associated to a divergent zone.

The characteristic impedance of such a wave guide is equal to

$$\mathbf{zo = \Delta a/\Delta b \cdot \sqrt{\eta o/\varepsilon o}\ ohm.}$$

We can thus admit that the divergent zones (**div $\mathbf{D \neq 0}$**), where the electric field reaches its disruptive limit within an electromagnetic wave brought back to a stationary medium, correspond to a whole of localized circuits forming the basic cells of a wave guide of which has an average coil **Lm** and an average capacity **Cm** such as the value of the characteristic impedance,

$$\mathbf{zo = \Delta a/\Delta b \cdot \sqrt{\eta o/\varepsilon o} = \sqrt{Lm/Cm},} \text{ remains constant.}$$

We can thus show, while referring to the Lenz's law, equivalent to the relation of Maxwell-Faraday,

$$\mathbf{rot\ E = -\ \partial B/\partial t.}$$

that, if a circuit of resistance r, **L** itself and capacity **C** are variable, it can freely become deformed by constraint of impedance, only $\mathbf{z=\sqrt{L/C}}$, constant, this circuit, when it undergoes the action of an electromagnetic wave of pulsation $\boldsymbol{\omega = 2\pi\nu}$, takes an average position such as it agrees with the exciting frequency $\boldsymbol{\nu = \omega/2\pi}$. In other words, it indicates, respectively, by **Lm** and **Cm**, the coil and the capacity averages taken by the circuit when it oscillates around its average position and one must have:

$$\mathbf{1/\sqrt{LmCm} = \omega = 2\pi\nu}.$$

Let us call **zm = rm + j·(Lmω - 1/Cmω)** the average impedance of the circuit and pose:

(Lmω - 1/Cmω)/rm (1) = tgφ.

To obtain the module **│zm│= rm (1)/cosφ**, we will suppose that induction, **B=Bo · cos ωt**, is uniform in the area of space occupied by the circuit.

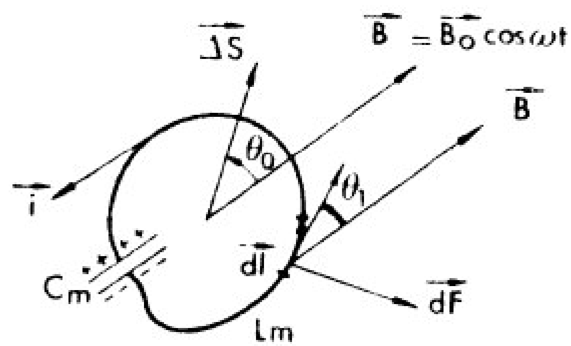


Fig.3. --- Circuit equivalent to an elementary divergent zone.

By adopting the positive sense indicated on figure 3, current ***i*** is equal, in algebraic value, to:

***i*=U/│zm│= - ΔS · cos0o/│zm│· ∂B/∂t (ωt - φ),**

(**1);** N.B. -- Resistance ***rm***, in the case of the propagation of an electromagnetic wave, without absorption or defection in homogeneity, can be only one resistance of radiation and we can write, ***rm=zo.***

----

that is to say: ***i*** **= ΔS · cos 0o · Boω cosφ/rm · sin (ωt - φ).**

The elementary force ***d*F** which acts on an element of length of circuit, ***d*F= i· dl ^B**, gives an algebraic value for the equality:

***d*F= i · *dl*·sin 01 · B**
d*F= cos 0o · sin θ1ΔSBo² ω/rm · cos φ · cos ωt · sin (ωt - φ)·*dl.

The average elementary force calculated over one period **T=2π/ω** is worth in algebraic value:

$$d\mathbf{Fm} = 1/T \int_{o}^{T} d\mathbf{F} \cdot dt = - \Delta S \cdot \cos \theta o \cdot \theta 1 \cdot Bo^2\, \omega / 4rm \cdot \sin 2\varphi \cdot dl.$$

This average elementary force is null for **$\varphi=0$,** that is to say

$Lm\omega - 1/Cm\omega = 0$.

Because, **$\omega=1/\sqrt{LmCm}$**, the circuit can then be regarded as subjected to mechanical oscillations around an average position of balance.

Taking into account the positive directions adopted, **$\varphi < 0$** involves (**$Lm\omega - 1/Cm\omega$**) **‹ 0**, and, ***d*Fm › 0**. The loop of the circuit tends to widen, increasing itself to **Lm** as well as the capacity **Cm** because of what we supposed **$zo=\sqrt{Lm/Cm}=Cte$.**

The value of impedance **$Lm\omega - 1/Cm\omega$** grows then to approach zero and the circuit returns to its average balance position. In the case where **$\omega > 0$, there** is, (**$Lm\omega - 1/Cm\omega$**) **› 0,** and, ***d*Fm ‹ 0**; the loop decreases as coil does itself, and the capacity and the forces return towards the position of average balance. The basic circuit thus oscillates at the frequency **$\nu=\omega/2\pi$** around the average position.

With these results, which call only rely upon the traditional electromagnetic laws, let us associate the law of materialization which imposes on the electric fields a limit involving the appearance of the divergent microscopic areas **$\Delta\tau o$** and **$\Delta\tau 1$**, such as:

$$\iiint_{\Delta\tau o} \operatorname{div} D \cdot d\tau o = - q, \text{ and } \iiint_{\Delta\tau 1} \operatorname{div} D \cdot d\tau 1 = +q$$

with **$\Delta\tau o + \Delta\tau i = \Delta\tau$** and **$q = 1,60 \cdot 10 \cdot$ (exp. -19)** Coulomb.

The basic circuits that correspond, in this case, have doublets consisted of two divergent volumes **$\Delta\tau o$ and $\Delta\tau 1$**. These microscopic doublets are made of loads **+ *q*** and **- *q*** which appear and disappear at the concentration points according to disruptive electric fields, while agreeing on the exiting frequency.

We will admit, as it is shown, that the coil movement **Lm** and the capacity movement **Cm**, associated, each form a doublet, what can be checked in the next two relations:

$\sqrt{Lm/Cm}=zo=Cte$, and, $1/\sqrt{LmCm}=2\pi\nu$.

The maximum energy transmitted per period and per doublet would be worth, in presumably sinusoidal mode:

$$W = (q^2/2Co + Loi^2/2). \qquad /7/$$

We admitted that in the electromagnetic wave exists the magnetic field limits correspondent to **Ed**, such as

$$\sqrt{\varepsilon o}Ed=\sqrt{\eta o}\chi d.$$

The electric energies $q^2/2Co = \varepsilon Ed^2/2 \cdot \Delta t$, and magnetic $Loi^2=\eta o\chi d^2/\Delta\tau$, are thus equal, and consequently, $W=q^2/Co$. The load **q** being constant, while alone **C** varies.

The energy **W** is maximal when **Co** represents the minimum capacity of the doublet. We can write, in sinusoidal mode, the relation,
$C=Co/\sin^2 \omega t$; what makes it possible to calculate the average value **Cm** of this capacity:

$$1/Cm=1/T \cdot \int_o^\tau \sin^2 \omega t/Co \cdot dt - 1/2Co.$$

We obtain then $w=2q^2/Cm$.

It is enough to take account of the previously allowed relations to calculate the value of **1/Cm** according to the impedance characteristic **Zo** and of frequency **ν** of exiting wave:

$$1/Cm = \sqrt{Lm/Cm} \cdot 1/\sqrt{Lm/Cm} = 2\pi zo\nu,$$

from where:

$$\boxed{w = 4\pi \cdot zo \cdot q^2 \cdot \nu}$$

The coefficient $4\pi\tau oq^2$ *which depends on the characteristic medium impedance,* $zo = ko\sqrt{\eta o/\varepsilon o}$*, expresses the energy quantification as the frequency function on the level of the divergence zones.*

Contrary to the usual theoretical methods, it is necessary to call only upon elementary concepts to obtain a result which requires, however, several assumptions, a physical reasoning and a constant effort of evaluation of the possibilities of reality. This effort precisely finds a happy outcome in re-establishment of a concrete model of the phenomenon "photon" and in the revelations of a range, undoubtedly considerable, which this model finally brings.

--- The first important observation relates to the quantum aspect of the phenomena. A photon appears only if the disruptive value ***Ed*** , of the electric field, is reached. It thus exists, whatever is the frequency of the electromagnetic waves admitting, the continuous distribution governed by the Maxwell's equations, even at the microscopic level, which, consequently, do not contain any photon. *They are neither the wavelengths, nor the frequencies which originate of the divergent areas where the quanta of energy are localized. That depends primarily on the electromagnetic waves* *emitting source. It is certain that Max Planck had already suspected this fact when he wrote: "We badly owe good liking to accept that these quanta of light have a real existence**, at least at the moment of their production.**"*

If the disruptive limit of the electric field, indeed, is reached with remission, which is the case, as we will further see it, when an electron undergoes an action sudden and short, divergent zones appear. These divergent zones are limited by disruptive layers which behave like perfect conductors and constitute temporarily, in a point of space, the insuperable walls, that are perfectly reflective, because of the evanescent guiding wave.

Most of energy is then concentrated in successive points distributed in the statistically homogeneous medium along a practically rectilinear trajectory, giving to an observer the impression of the individualized particle displacement.

The photons constitute the borderline case where energy still hesitates between the two aspects of its demonstrations, material and intangible.

Let us note that if remission is made without the electric field reaching its disruptive limiting value, energy does not have any more reason to be maintained in quantified form and it diffuses in the surrounding medium. If the value of this energy is of the same order of magnitude as that of a photon for example, it can be evident by the energy balance, only. The implementation of the average physical detection usually adapted to the localized particles evokes the almost insurmountable difficulties, if "photoelectric effect" is absent. These difficulties of interaction make it possible to explain, finally, without being in contradiction with the experiment, the most probably hypothetical "neutrino ": a simple dematerialization of energy in its diffuse electromagnetic form which appears during the separation of the loads.

Generally, the simultaneous transfer of electromagnetic energy in variable proportions, according to the case, present its double aspect, quantum and continuous.

--- The second observation that we can make relates to the Planck's constant. It would be trying to write that the coefficient that we have just calculated, $\mathbf{4\pi z_o q^2}$, which we can write, $\mathbf{4\pi k_o\sqrt{\eta_o/\varepsilon_o} \cdot \mathit{q}^2}$, is equal to constant **h**. On one hand, **h** is the universal constant independent of the propagation medium, but, on the other hand, *the energy of a photon is being spread out over a wavelength, so that two opposite maxima of the electric field must exist and therefore two divergent areas which constitute the same photon.*

It is necessary to note, however, as in the case of the propagation velocity of the electromagnetic waves which admits for limit **C**, that the coefficient of quantification will also tighten towards a limit which within the framework of the put forth assumptions must be equal to the half of the Planck's constant.

We can thus write under these conditions:

$\mathbf{h/2=4\pi ko\sqrt{\eta o/\varepsilon o}\cdot q^2}$, with $\mathbf{1/\sqrt{\varepsilon\eta} = c}$,

This result is identically found, although **ko** is not clarified, in the expression of the constant of fine structure,

$\mathbf{\chi o=q^2/2\varepsilon\cdot h\cdot c}$,

that provides the equivalent expression:

$\mathbf{h = q^2/2\varepsilon\cdot \acute{\alpha} o\cdot c = 1/2\acute{\alpha} o\sqrt{\eta/\varepsilon}\cdot q^2}$.

This equivalence leads to the calculation of the numerical value of the coefficient **ko**:

$\mathbf{ko = 1/16\pi\acute{\alpha} o \approx 2,725}$.

Note: It is very strange to note that in the limits of a relative error of 3°/oo that we can allot to the measurements, **ko** is equal to the number,

e =2,718…, logarithm bases.

"One of the most improbable things, as Paul Kirchberger wrote it, is the coincidence of two numbers which should be independent, and it adds more that one incredible consequence, plus that its checking will be convincing for the theory from which it rises" [8].

Indeed, such a pure coincidence is very highly improbable.

We see that a photon does not have any individuality. Its energy cannot correspond to a pure frequency, in spite of the simplified assumption of the relation of quantification, because it's not possible, in the case of sinusoidal waves that the distribution indefinitely continues. It is thus non-sinusoidal discontinuous aspect of photon which results in establishing the relation of uncertainty. The discontinuous photon aspect on the level of the divergent microscopic areas is the consequence of the disruptive limiting field existence and of the correlative modification of the physical properties of space.

The traditional laws of electromagnetism, applied to photon, suggest us the image of electromagnetic energy which propagates in wave guide of insuperable walls that are equivalent to probable lamellate loads of **+q** and **-q** **(q=1,60 · 10 exp -19 Coulomb),** which appears and disappears gradually while following the wave which creates them; and that one opposes the diffusion and maintains captive energy along its trajectory of propagation (fig.4).

The characteristic impedance **zo** of such a guide of wave is equal to $\mathbf{ko = \sqrt{\eta o/\varepsilon o}}$ and when the matter density of the medium decreases and tends towards zero, this impedance grows and tends towards the limiting value:

$\mathbf{zo= h/8\pi q^2=ko/\varepsilon c \approx 1{,}025}$ ohms.

Nothing prohibits us to give still a rational theoretical explanation of it or to pose by hypotheses that **k** is equal to **e = 2,71828**…

The expression of the coefficient of quantification we then write:

$\mathbf{ho=8\pi e\sqrt{\eta o/\varepsilon o} \cdot \mathit{q}^2.}$

and that of Planck's constant:

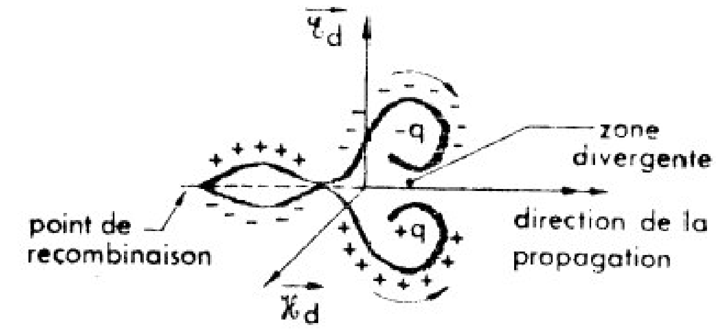
$\mathbf{h=8\pi e\sqrt{\eta/\varepsilon} \cdot \mathit{q}^2,}$ or again, $\mathbf{h=8\pi e\cdot q^2/\varepsilon c}$.

The fine structure constant becomes a remarkable number:

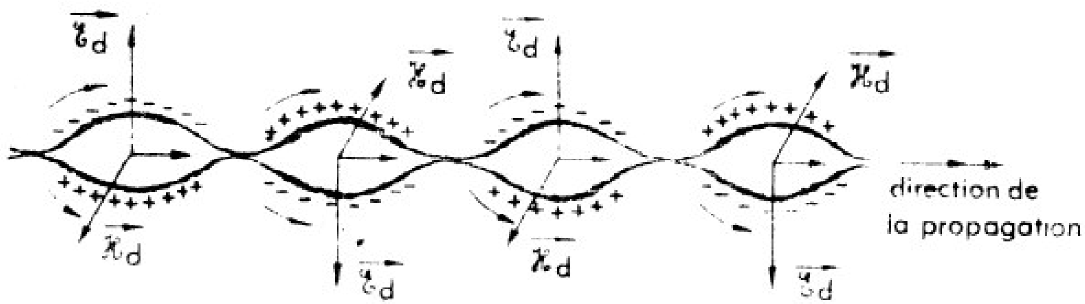
$\mathbf{\acute{\alpha} o = 1/16\pi e}$.

These results partly reveal the intimate nature of the photons and inform us about the way in which they are propagated.

The photon thus admits, in the vacuum, an impedance characteristic of approximately **I = 0, 25 ohms**,



a



b

- the divergent zone
- the point of recombination
- the direction of propagation

Fig. 4. -- the images of photons such as the law of materialization make it possible to imagine them

a) Probable aspect of the divergence zones of an insulated photon (photon ***y***)
b) Probable aspect of a train of photons (photons of visible light).

By calling $\Delta\tau$ elementary volume in which reign the disruptive fields electric E***d*** and magnetic ***χd***, we can write the corresponding expression of the momentum:

$\Delta p = (\varepsilon o Ed \wedge \eta o \chi d) \cdot \Delta\tau$. **(look at the p. 9)**

For the photon, these fields were supposed to be perpendicular, as between them is $\sqrt{\varepsilon o}\,|\,Ed\,| = \sqrt{\eta o}\,|\,\chi d\,|$ Appealing the vector ***u*** of the vector product **Ed ^ χd**, in the direction of the propagation, we can write:

$\Delta p = \sqrt{\varepsilon o \eta o} \cdot (\varepsilon o \cdot Ed^2) \cdot u \cdot \Delta\tau.$

By taking account of the relation $\varepsilon Ed^2 \cdot \Delta\tau = \Delta W = ho\nu$, and in posing, $\nu o = 1/\sqrt{\varepsilon o \eta o}$, we obtain finally:

$\Delta p = h_o \nu / v_o \cdot u = h_o \nu / v^2_o = m v_o$.

We can thus allow to the photon a mass, $m = h_o \nu / v^2_o$, as well as a momentum which is worth, in module $h_o \nu / v_o = 8\pi k_o \eta_o q^2 \cdot \nu$.

These experimental evidences of the energy quantification and of the existence of the photons are sufficiently abundant so that it is not useful to be further delayed there.

The energy of a quantum can vary in two different ways according to the cases involved; it is by variation of frequency **v** when the medium is related to the photon wavelength and is not seen by it in a homogeneous way (Compton effect), or, in the contrary case, the photons are dependant on the coefficient **ho** variation and the mediums relatively preserve a homogeneous aspect at the photons wavelengths. The laws of Descartes are an interesting and simple proof of the variation of the coefficient of quantification according to the characteristics of the mediums.

These laws, like we know them, are related to trains of luminous photons to which we can statistically apply the traditional laws of mechanics that rest on the principles of moments and energy conservation.

Let us imagine two mediums of different characteristics, **R** $(\varepsilon_o \eta_o)$, and **R** $(\varepsilon_1 \eta_1)$, delimited by the separation surface **S**. The coefficients of quantification **ho** and **h1**, have respectively, in these two mediums, the values $8\pi k_o q^2 \sqrt{\eta_o / \varepsilon_o}$ and $8\pi k_o q^2 \sqrt{\eta_1 / \varepsilon_1}$. In posing $v_o = 1/\sqrt{\varepsilon_o \eta_o}$ and $v_1 = 1/\sqrt{\varepsilon_1 \eta_1}$, we can express the ratio of these coefficients,
$h_o / h_1 = \sqrt{\varepsilon_1 \eta_o / \varepsilon_o \eta_1} = \eta_o / \eta_1 \cdot v_o / v_1$.

Let us suppose that monochromatic brush of light contains **no** initial photons of frequency **v** in the medium **Ro**, arrives on surface S (fig. 5). Let us call ***n*** the number of the reflected photons, ***n1***, the number of the refracted photons, ***i*** the angle of incidence, ***i'*** the angle of reflection and ***r*** the angle of refraction. Let us choose the reference plan the ***xOy*** which contains the brush of incidental photons that are normal to the surface of separation S.

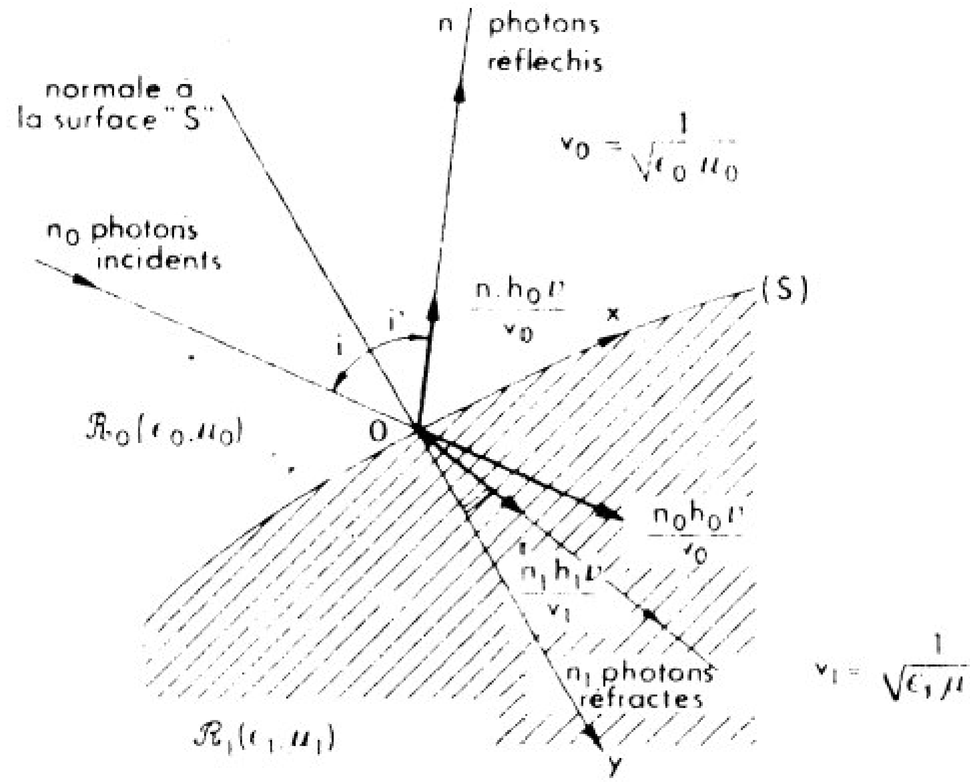


Fig. 5. - Reflection and refraction of photons on the surface of separation of the medium with different characteristics.

The relations of conservation of the ‘quantity of motion’ (or ‘momentum’) as that of conservation of energy are written:

nohov/vo sin *i* = n1h1v/v1sin *r* + nhov/vo sin i’
nohov/vo cos *i* = n1h1v/v1 cos *r* - nhov/vo cos i’
nohov = nhov + n1h1v

If the two mediums at frequency ***v*** appear statistically homogeneous, this frequency practically does not vary, and the preceding relations are simplified as:

noho/vo sin *i* = n1h1/v1sin *r* + nho/vo sin i’
noho/vo cos *i*= n1h1/v1 cos *r* - nho/vo cosi’
noho = nho + n1h1

The laws of the reflection impose to us ***i* = *i'***, the equality compatible with the written equations. We can then draw relation:
sin *i* = (n1/no-n) · h1/ho · vo/v1 sin *r*, and by using the third equality, **(n1/no-n) · h1/ho = 1,** we obtain finally:

$$\boxed{\sin i = vo/v1 \cdot \sin r}$$

This known result, in agreement with the laws of Descartes, conduit to the following general conclusions:

The divergent areas which correspond to the photons, obey the same laws of propagation as the electromagnetic waves which accompany them.

For the same frequency and the same energy brought back in the middle of propagation, the number of photons is all the more large as the propagation velocity is lower.

*The photons, as we already saw, do not have any individuality: they are indistinguishable and will be subjected, on the plane of statistical calculation, to the of Bose-Einstein's law. Their number varies because of the course and random fluctuations of the electric fields in the vicinity of disruptive limiting value **Ed**.*

It is necessary to specify that the written equations hold account only the energies and trajectories; they are thus incomplete because the directions of the fields do not appear there. We cannot, consequently, envisage and calculate any effect of polarization and even less to highlight, for example, the particular case of refraction which would correspond to Brewster's incidence.

The Maxwell's equations, always valid, come then to our assistance.

In the case which we considered previously, the coefficient of reflection is equal to **n/no=sin (*i* - *r*)/sin (*i* + *r*),** and corresponds, according to the Maxwell's equations, with polarized photons, so that the electric fields remain parallel to the tangent plan on the surface of separation of the two mediums and are annulled there. In the other cases, the conservation equations of the momentum show that the surface of separation reacts tangentially on the refracted photons. Under incidence of Brewster, in particular, the Poynting vectors of incidental and refracted photons have indeed different directions.

We may already conclude that the behavior of the photons is in full agreement with the laws of quantum mechanics and those of traditional electromagnetism.

The existence of the disruptive field explains this agreement clearly and removes all contradictions of principle which weighed down the comprehension of the phenomena. But, it is necessary to consider from now on, that a luminous radius, even when it contains photons in great number, also includes electromagnetic waves of the traditional low amplitude type.

The suggested theory obliges us to admit the two possibilities which are not discerned and which, by the existence of the disruptive limit of the electric field **E*d*** and its photoelectric reflection, translate to the experiments one of the physical consequences most convincing.

5

ACTION OF THE ELECTRIC AND MAGNETIC FIELDS ON THE DIVERGENT ZONES. THE ELECTRON AND THE WAVE MECHANICS

The laws which control the phenomena within divergent spaces are still unknown. These spaces that are limited to reduced volumes make energy more important: generally, they have the dimensions of an extreme smallness compared with the distances which extend between them.

These divergent zones are in perpetual agitation. They become deformed and vibrate by undergoing energy action of the medium which contains them and so they constitute the sight.

None of the average physiques placed at our disposal has, for the moment, the extreme smoothness necessary to the examination of these subtle sanctuaries where are jealously maintained the ultimate secrecies of the Universe.

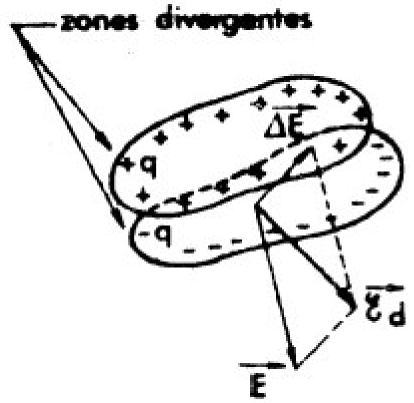
To understand better, there does not really exist the another possibility to imagine and erect the assumptions, according to a certain logic, by hoping that an indirectly controlled experiment will be able to provide a plausible checking of it. The hypotheses itself is likely to lead to the rational comprehension of the phenomena which remain inaccessible to the direct experimentation.

We will try to study, in this spirit, the action of the electric and magnetic fields on the microscopic capacitors which constitute, according to the initial assumption, the *elements of the wave guides associated with the divergent zones.*

The principle of materialization leads us to admit that the value of the electric field, in the space ranging between the reinforcements of these tiny capacitors, is close to the disruptive value ***Ed*,** which is reached indeed on the level responsible for their existence. That is to say that in this space, the vector sum of the field **E** due to the loads located on the reinforcements of the associated capacitor, and due to the field of a surrounding medium **ΔE,** creates at the same point, the ***Ed***.

That is to say: **E + ΔE =** ***Ed***.

The knowledge of the external sphere of activity **ΔE** thus makes it possible to determine, within the divergent zone, the field **E** created by the disruptive layers. (fig. 6).



(fig.6. --- Probable vector composition of the fields within a divergent zone **E** is the field created by the disruptive layers, and Δ**E** is the field due to the external medium.

We may suppose, at first approximation, that the electromagnetic wave captives of the disruptive layers is transverse and which the magnetic field ***χd*** is related to the field ***Ed*** by the equation: $\sqrt{\eta}\,|\chi d| = \sqrt{\varepsilon}\,|Ed|$.

In the volume Δτ where it is concentrated the near-total energy **w,** we have, for the expression:

$$\mathbf{w} = \tfrac{1}{2}(\varepsilon Ed^2 + \eta\chi d^2)\cdot\Delta\tau = \varepsilon\cdot Ed^2\cdot\Delta\tau.$$

The presence of field Δ**E** that is created by the surrounding medium involves, necessarily, the energy variation. Initially,
$wo = \tfrac{1}{2}(\varepsilon Ed^2 + \eta\chi d^2)\cdot\Delta\tau o$, and the variation is related to the modification of volume **Δτ** since the fields in the divergent zones preserve the value extremely close to the disruptive value. We must then admit, in accordance with the conservation principle, that the share of the initial energy, brought by the electromagnetic wave, which is trapped before the intervention of field ΔE, remains the same in quantity; what is to say by equality:

$$\tfrac{1}{2}(\varepsilon Ed^2 + \eta\chi d^2)\cdot\Delta\tau = wo = \tfrac{1}{2}\,|\varepsilon(Ed - \Delta E)^2 + \eta\chi d^2)|\,\cdot\Delta\tau,$$

and that should be verified.

We can thus calculate the energy variation:

$$\Delta w = (w - wo) = \varepsilon\cdot|Ed\cdot\Delta E - (\Delta E)^2/2|\cdot\Delta\tau$$

Under the action of field ΔE being exerted in the presumably homogeneous medium with constant characteristics, a photon must undergo, consequently, a relative variation of energy and provided frequency, at every moment, by the relation:

$$\Delta w/w = \Delta \nu/\nu = \left| Ed \cdot \Delta E - (\Delta E)^2/2 \right| / (Ed)^2$$

The study of the action of a magnetic field **ΔH** on a divergent zone of energy, $W = h\nu$, led to a completely similar expression which results from the same energy considerations:

$$\Delta w/w = \Delta \nu/\nu = \left| \chi d \Delta H - (\Delta H)^2 \right| / (\chi d)^2$$

When the values of interaction fields **ΔE** and **ΔH** are negligible compared with those of the fields limits ***Ed*** and χd that are, for their part, extremely high, we can write:

$\Delta \nu/\nu \approx Ed \cdot \Delta E/(Ed)^2$, in the electric case, and,

$\Delta \nu/\nu \approx \chi d \cdot \Delta H/(\chi d)^2$, in the magnetic case.

If, moreover, these fields of interaction and the disruptive fields are being collinear, we are then led to the following very simple expressions:

$\Delta \nu/\nu \approx \pm |\Delta E| / |Ed|$ **and,** $\Delta \nu/\nu \approx \pm |\Delta H| / |\chi d|$.

The double sign indicates that the fields **ΔE** and ***Ed*** can be of the same direction or of opposite directions.

Let us note that these variations represent exchanges with the surrounding medium which is according to the given definition often made up by the closest zones of concentration of energy, i.e. the closest particles.

At the microscopic level, due to the existence of the disruptive fields, these exchanges are done following quantum laws. But the relations that just have been established make it possible to us to specify this mechanism of exchange in connection with the laws of traditional electromagnetism. According to the way in which the photon undergoes the action of an electric or magnetic field, one must observe a spreading out of the spectrum around frequency **ν**, (exchange not quantified),or the appearance of lines due to electromagnetic resonances responsible for the quantification (quantified exchange).

The highest fields that we know to produce in laboratory are well too weak compared to $|Ed|$ and $|\chi d|$.so that this phenomenon can be directly observed. On the other hand, the fields that are higher, if compared to those which reign in the vicinity of atomic nuclei might have an observable action at the time of the photon emission. If the photon acquires or yields the complement of energy **hν**, this complement necessarily is provided to him by the medium or is taken from the particle with which the exchange is carried out… Without entering into details of the obtained results, we know that when the energy exchanges are quantified, quantum mechanics makes it possible to calculate the spectral lines which result from it and thus we know the value of the interaction fields. (**Zeemann Effect**, for example).

Thanks to the knowledge of the disruptive field which translates a solution of continuity to the space properties, the laws of electromagnetism finally bring an essential vector complement to quantum mechanics, which had been rejected because of its apparently contradictory continuous character. Let us remind again and in particular of the traditional expression of the electric field associated to an electron supposed at rest:

$$\mathbf{E} = -q/4\pi\varepsilon r^2 \cdot \mathrm{grad}\ \mathbf{r}, \text{ for } \mathbf{r} > \mathbf{a}.$$

The law of materialization is opposed to the conception of an indefinite increase in this electric field, and in the case of the assumption of a distribution having a spherical symmetry, we must admit that the limit ***Ed***, that is reached for **r=a,** has supposed radius of the electron, with:

$$a^2 = q / 4\pi\varepsilon |Ed| \text{ where } q = 1,6 \cdot 10 \text{ (exp -19).}$$

In cases where there is a movement, the Lorentz's transformations provide, in theory, the values and the distribution of the fields in non-divergent surrounding space of the medium when the electron is supposed to move at a uniform speed **v**.

We will direct this speed along axis **Oz** of a trihedral of reference in order to be able to write the components of the fields.

Simple calculation makes it possible to write the following expressions:

$$\text{Ev/m} \left| \begin{array}{l} Ex = -q/4\pi\varepsilon o \cdot x/\acute{\alpha} r1(\exp 3) \\ Ey = -q/4\pi\varepsilon o \cdot y/\acute{\alpha} r1(\exp 3) \\ Ex = -q/4\pi\varepsilon o \cdot (z-vt)/\acute{\alpha} r1(\exp 3) \end{array} \right. \quad \text{HA/m} \left| \begin{array}{l} Hx = qv/4\pi \cdot y/\acute{\alpha} r1(\exp 3) \\ Hy = -qv/4\pi \cdot x/\acute{\alpha} r1(\exp 3) \\ Hz = 0 \end{array} \right.$$

$$\acute{\alpha}\sqrt{1-v^2/vo^2}, \text{ and } r1 = \sqrt{|x^2+y^2+(z-vt)^2/\acute{\alpha}^2|} \qquad /5/$$

As long as it was not taken account of the disruptive limiting field, it seemed that the sphere of ***a*** radius had to undergo, in the transformation, a longitudinal contraction along axis **Oz** and to become, in theory, an ellipsoid of the revolution equation:

$$x^2+y^2+(z-vt)^2/\acute{\alpha}^2 = a^2.$$

Along this ellipsoid, for $(z - vt) = \acute{\alpha}a$, the longitudinal electric field thus appeared to remain equal in module to ***Ed***, while the transverse field, for $x^2+y^2=a^2$, took the maximum value:

$$|Et| = 1/\acute{\alpha} \cdot q/4\pi\varepsilon o a^2 = Ed/\acute{\alpha} > Ed.$$

*This result, which provides for the electric field a value higher than the disruptive limit **Ed**, is physically aberrant.*

The mistake in interpretation of the restricted Relativity, which consists in denying the existence of a support medium of propagation, appears thus clearly. The Lorentz's transformations which are on average valid when applied in a non-divergent area of space, by supposing a partial drive of the medium of reference, are not it any more, and due to that fact, they are also invalid in the vicinity of discontinuities which characterize the divergent zones.

The medium reacts to modify the fields. This reaction of the medium appears, in certain points, in a discontinuous way, so that in these points electric field cannot, any case, to exceed the value limit ***Ed.***

The question arises then of knowing if this medium action can be calculated of the made assumptions and of the relations that we established.

If the medium is opposed, as we must admit it, with the going beyond of limit ***Ed*** and by modifying locally the properties of space, (appearance of the divergent zones), *it is it which, by reaction, is also responsible for the variations of the electric and magnetic fields that are noted in the experiments with the loads displacements courses.*

We can then conclude that the field in surplus, obtained in starting from Lorentz's transformations,

$|\Delta \mathbf{E}| = |\mathbf{Et}| - |\boldsymbol{Ed}| = |\boldsymbol{Ed}|\,(1/\acute{\alpha}-1)$

is not the act of the particle itself, but the result of the medium reaction of the which is physically opposed to the going beyond of the value limit ***Ed***.

If the electron corresponds indeed to the presence of located divergent zones, as we made the assumption of it, we can use the relation, shown previously, which translates the action of the electric fields on the divergent zones. In this case we work with, the fields $\Delta \mathbf{E} = \mathbf{Et} - \boldsymbol{Ed}$ and ***Ed*** are collinear and of the same direction; and when $\Delta \mathbf{E}$ is negligible, compared with ***Ed***, we can write:

$\Delta v/v = |\Delta \mathbf{E}| / |\boldsymbol{Ed}| = [\,|\mathbf{Et}| - |\boldsymbol{Ed}|\,] / |\boldsymbol{Ed}| = (1/\acute{\alpha}-1)$

since, $\mathbf{Et} = \boldsymbol{Ed}/\acute{\alpha}$.

So generally, $\mathbf{Eo}/\acute{\alpha}1$ represents, in the transverse plan containing the electric charge, the maximum field corresponding
at the speed $v1[\acute{\alpha}1 = \sqrt{1-(v1/vo)^2},\quad vo = 1/\sqrt{\varepsilon o \eta o}]$, the transformations of Lorentz then make it possible to calculate the field which would correspond to it, $\mathbf{Et} = \mathbf{Eo}/\acute{\alpha}$, at an unspecified speed $\mathbf{v}$, with $\acute{\alpha} = \sqrt{1-(v/vo)^2}$.

The variation of field, imposed by the medium, would be equal,
in this case, to $\mathbf{Eo}/\acute{\alpha} - \mathbf{Eo}/\acute{\alpha}1 = \Delta \mathbf{E}$.

Let us suppose that for speed $\boldsymbol{v1}$, **$Eo/ά1$,** the value is equal, in the point considered, to the value limit ***Ed***; we obtain then: **$\Delta E = Ed\ (ά1/ά-1)$,** and consequently, the relative variation of frequency is:

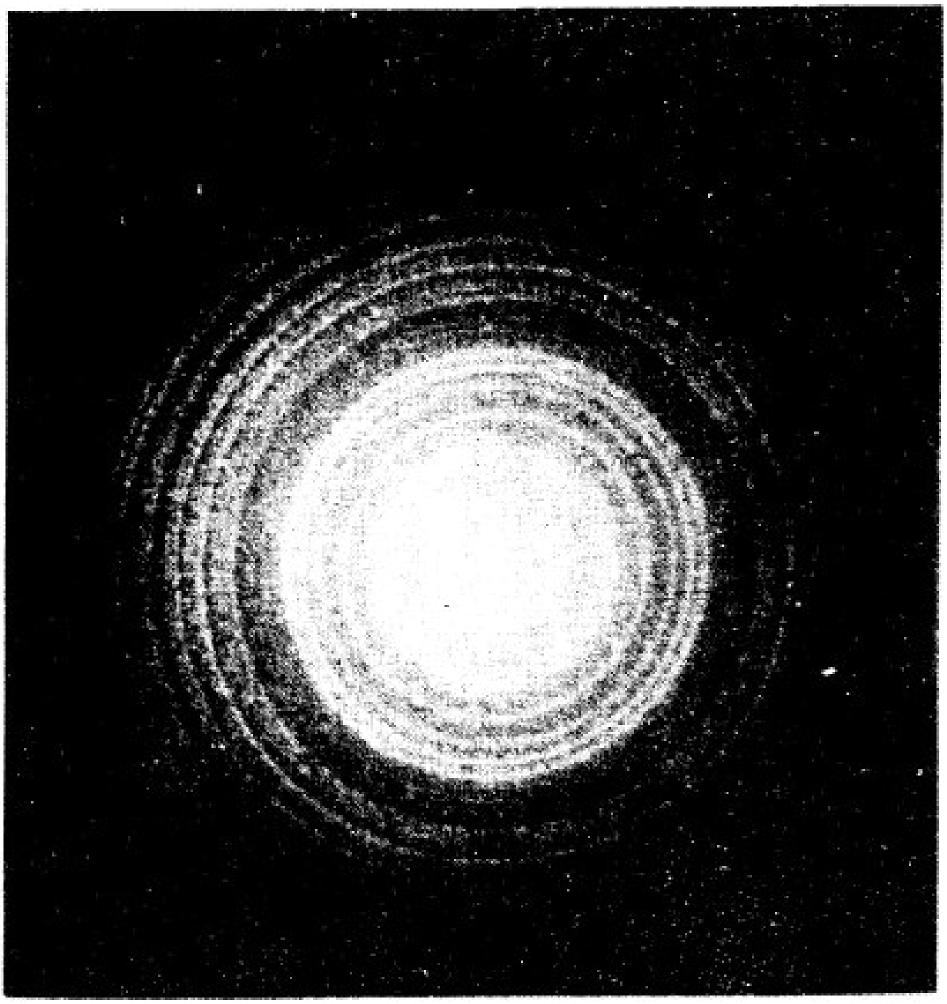
$$\Delta\nu/\nu1 = |\Delta E| / |Ed| = (ά1/ά - 1).$$

By taking as origin the at-rest state, **$v1=0$, $ά1=1$, $\nu1=\nu o$**, and by calling **$\Delta\nu c$** the variation of frequency due to the kinetic effect, we obtain the relation:

$$\Delta\nu c = \nu o\ [1/\sqrt{(v/vo)^2} - 1].$$

In a non-material energy medium, **$vo=c$**, energy you rest **wo** is equal to **$h\nu o$**. *By multiplying by constant **h** the two members of the preceding equality, we note the full one agreement of this expression with the fundamental law of the wave mechanics which is thus shown.*

$$h\Delta\nu c = wo\cdot(1/\sqrt{1} - v^2/c^2 - 1)$$



P1. I. --- Rings of diffraction obtained by dispersion of electrons using zinc oxide in confirmation of the wave mechanics.

By taking account of equivalence of 'mass-energy', $\mathbf{wo = moc^2}$, we know that this relation still can be written:

$$\mathbf{h\Delta vc = moc^2 \cdot (1/\sqrt{1- v^2/c^2} - 1)}$$

It leads, when speeds **v** is negligible compared to the speed limit of propagation c, to the traditional but approximate relation:

$\mathbf{h\Delta vc= 1/2\ mov^2}$.

The assumption of the existence of the electric field universal limit ***Ed***, as the law of materialization allows, clarifies not only the coefficient of quantification and its Planck's constant like coefficient limit, but also contributes to determination of the fundamental law of the Wave mechanics, which is certainly not negligible.

The definition of privileged barycentric reference frames that are related to statistically average mediums, obey the physical laws to which all the determinists are referring: so to say, asymptotic statistical laws allow us not only to eliminate a certain counting error that appears in interpretation from the equations of restricted Relativity, but also to supplement those by introducing the quantum terms which are the results of experimental measurements. That urges us, consequently, to seek the concrete behavior interpretation of the elementary matter, by regarding it as simply made up of electromagnetic energies extremely concentrated and trapped by disruptive zones which must appear while following the thin and fugacious areas where electric fields are equal or slightly lower than the limit ***Ed.***

The electron is not, which can suggest an incomplete and simplistic design of electromagnetism, a spherical concentrated electric matter particle which, if that were, should be diluted in surrounding space and disappear under the effect of the electrostatic pressures. Besides that, in this conception the force and pressure lose their direction on an elementary particle scale. Only the discontinuities remain which affect the properties of space according to the limiting value, reached or not, by the electric fields.

The electromagnetic waves can generate disruptive layers on their trajectory of propagation of which they are reflected completely. Along these layers, the electric field remains, in module, equal to the value limits ***Ed*** and in their vicinity, the energy concentration density εEd^2, via the permittivity E, depends there of its own.

The electron, the proton and undoubtedly the neutron must thus be presented as electromagnetic systems of waves stationed with high density of energy, which are reflected inside one or several microscopic disruptive surfaces. These surfaces can express their existence only at the places where the electric fields reach, indeed, the value limits ***Ed*** and that explains the quite relative stability of a particle in the absence of external action.

An external field indeed acts on a disruptive layer in order to make the divergent zones disappear at the points where the external field and the disruptive field are in opposition, but reveals, on the other hand, the new divergent zones at the places where the two fields are added (fig. 7).

For an electron, for example, the action of an electric field will have as a consequence a discontinuous displacement in the direction opposed to the direction of the active field; what is in conformity with the experimental results.

Area of divergent zone disappearance

Area of divergent zones appearance

(the resulting electric field becomes lower in ***Ed***)

(the resulting electric field tends to exceed ***Ed***)
------
apparent movement of the electron

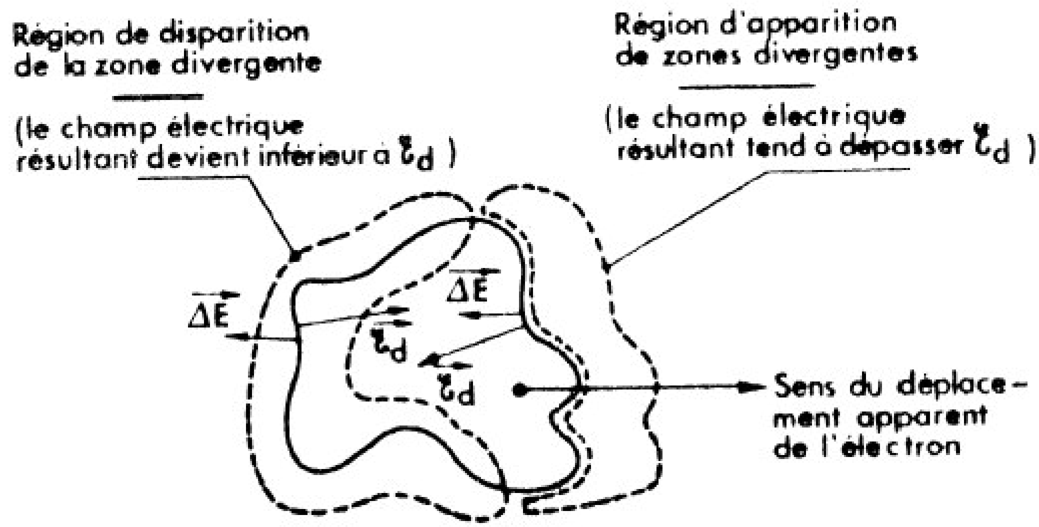


Fig. 7. --- Action of an external field Δ**E** on the electron.

On the atomic scale, we should not consider the electron any more, in its displacement, like a simple material point. It disappears from a place to further reappear and the law of materialization necessarily implies, so that the phenomenon can occur in agreement with the principle of conservation of the load and energy, and in the presence of at least two additional divergent zones charged **+ q** and **- q**.

Very schematically, the displacement can be represented according to the successive phases of figure 8 (on the right).

The electron can be regarded as accompanied by a photon, i.e. electromagnetic wave accompaniment being propagated as in a guide of wave while being reflected on disruptive surfaces involved.

The electric and magnetic fields associated with this Broglienne wave [1] are extremely weak, apart from the divergent zones, where they take very high values which are in the vicinity of the values limits ***Ed*** and ***χd*** to the level of the disruptive layers… In not-divergent space, what is called 'the external' prevails over the fields of Lorentz-Maxwell that are with the continuous distribution. Let us note that the coefficient of quantification **ho** relates always to the total energy of the particle, **W = Wi + We**, where **Wi** represents energy within the divergent zones and **We** the energy distributed in external not-divergent space. It must be also held account the energies of interaction with the medium, energies kinetic and potential.

The very diagrammatic drawings of figure 8 (on the right) show that there exists, strictly speaking, neither photon, nor electron, but on average three divergent zones (- **q, + q, - q)** which disappear and reappear with turn of role, gradually, giving coarsely in first analysis, the impression of the continuous displacement of a single load **- q.**

The electron thus seems to move, but its displacement is, actually, only one transfer of electromagnetic wave energy being propagated by successive reflections along a guide of wave whose walls are created and disappear progressively with the wave propagation.

Total energy **hv** is equal to the sum of energy at rest **hvo** and the kinetic energy **hΔvc**:

h·v=h·(vo+Δvc).

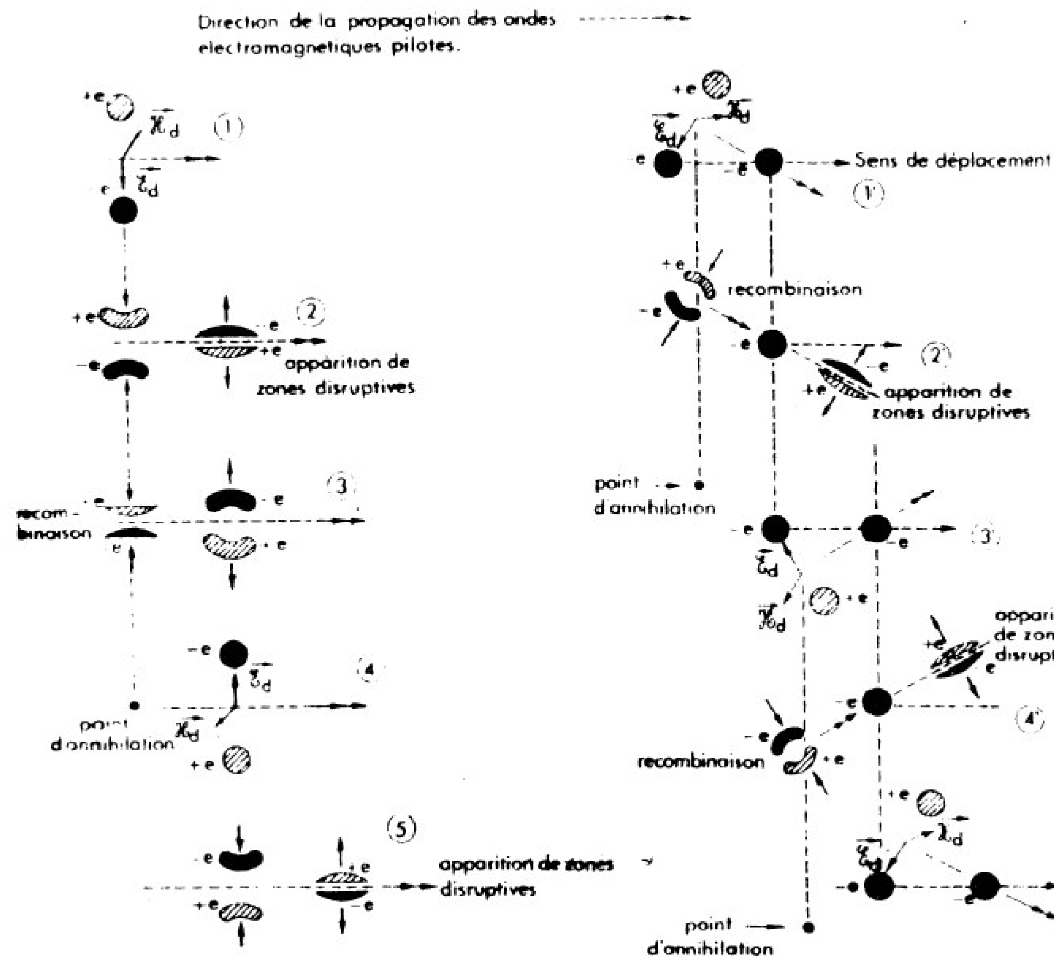


Fig. 8. - the compared diagrammatic representation of the photon and the electron displacements to show that there is no fundamental difference between the two phenomena.
On the left: Diagrammatic representation of the displacement of a high energy photon

On the right: Diagrammatic representation of the displacement of an electron.

We have showed previously that, in a nonmaterial medium with low density of energy-matter, we could write the equality:

$\Delta\nu c=\nu o\cdot$**[(1/√1 - v^2/c^2) - 1]**.

This equality allows the calculation of frequency **v** as function of **vo:**

$\Delta\nu c+\nu o=\nu o/\sqrt{1-v^2c^2}=0$.

From it we deduce the total energy:

$\mathbf{h\nu = h\nu o/\sqrt{1 - v^2/c^2}}$, that is to say $\mathbf{w=wo/\sqrt{1 - v^2/c^2}}$.

The electron thus has a mass, $\mathbf{m=w/c^2}$ which at rest becomes, $\mathbf{mo= wo/c^2=h\nu o/c^2}$. We thus find, on the divergent zones level, the result completely in agreement with that which we had obtained in the case of the energy of mediums moving uniformly (§ 2, p. 16).

We find also the value of the mass, $m\mathbf{=mo/\sqrt{1 - v^2/c^2}}$. which corresponds to a physical reality in known experiments as it is also theoretically established [10].

We take conscience thus, without contradictions with the gained experience and knowledge, in the way in which appear, on a microscopic scale, the phenomena in the vicinity of the divergent zones.

All the results obtained in the study of the wave guides, concerned with traditional electromagnetism, thus could be extended to the movement of the electrons.

The figure 9 provides a simple model of configuration which accounts for the behavior of these associated wave guides.

It is thus necessary to expect that the obtained interferences came from the same coherent beam of mono-energetic electrons, after introduction of differences in functioning that resulted in de-phasing; it allows us, by the measurement of the variation produced by interference rings, to determine the phase wavelength:

$$\boldsymbol{\lambda\varphi=1/\nu\cdot c/\cos\varphi}$$

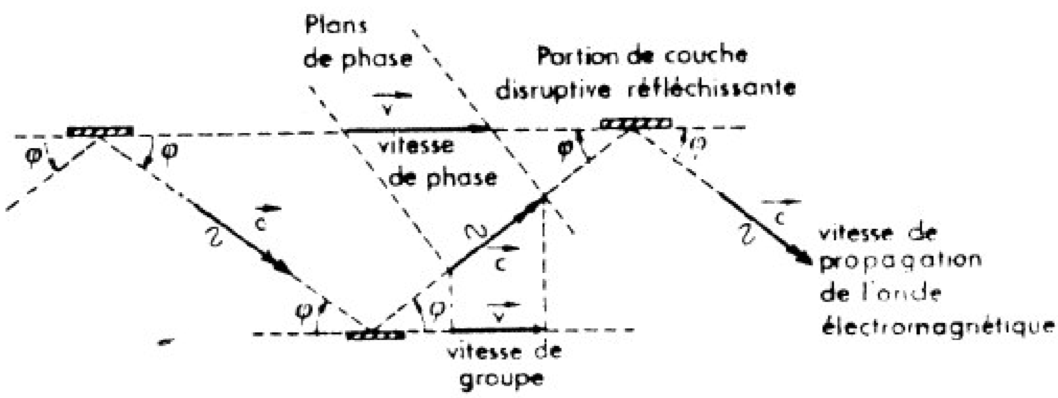


Fig. 9. --- The simplified diagram, showing by analogy with the wave guides, the way followed by pilot wave that is associated with an electron, as well as the phase and group distribution of propagation velocities.

The connecting speed of an electron displacement **v** is necessarily equal at the electromagnetic waves group speed: $\mathbf{v=c \cdot \cos\varphi}$: what makes it possible to express $\mathbf{\cos\varphi}$:

$\cos\boldsymbol{\varphi}\mathbf{=v/c}$

We can calculate the momentum of an electron:

$\mathbf{mv=h\nu/c^2 \cdot v= h\nu\cos\varphi/c=h/\lambda\varphi;}$

what provides another possible expression of the phase wavelength:

$\mathbf{\lambda\varphi=h/m \cdot v}$ /9/

These fundamental results are known but their concrete interpretation had always remained rather obscure [**1**].

Although being unaware of the propagation mediums existence, restricted Relativity allowed, for its part and within the limits of validity of its equations, to calculate successfully the variations of the mass and those of the particles frequencies according to their speed measured in the observation reference frame. The results obtained are correct since this reference frame of observation is practically always confused with the stationary reference frame of medium (see **§ 1, p. 10**).

It has to be noted, however, that the relation $\mathbf{\nu=\nu o/\sqrt{(1-v^2/c^2)}}$**,** previously established, can also be written, $\mathbf{To=T/\sqrt{(1-v^2/c^2)}}$**,**, and in function to the respective periods. $\mathbf{T=1/\nu}$**,** and $\mathbf{To=1/\nu o}$. This relation returns count of an effective modification of the frequency with the speed **v** in the medium with stationary inertia and of low matter density, which results in the reintegration of all the moments that were previously distributed in the surrounding space.

Within the framework of the old relativistic designs, this relation cannot be interpreted differently than by the existence of a contraction of time in the reference frame of the particle, by observation ratio:

$\mathbf{T= To\sqrt{1/(1-v^2/c^2)}}$.

This interpretation is certainly unacceptable at least for two reasons. *The first is fundamental.* -- It is impossible, except coarse error that a mathematical relation between physical sizes is in contradiction with the definition even of any of these sizes.

We should not forget that time was defined like identical to itself in all the points of space, whatever lineament of these points and whatever is the state of the space in their places… It is in accord with this definition, which was generally established, with the laws of physics and in particular with the Maxwell's equations [5].

The unit of time thus can, in any formula, to only remain identical to itself and if this unit varied, we would not have, by principle, any physique to give an account of it, since the unit of time remains with itself its own reference.

To speak about contraction concerning the measuring unit, because it is well of the unit that it acts, is if not absurd, at least contrary with any concept of relationship between the measurable physical sizes.

- *The second reason* lies in the relativistic transformations which are symmetrical and which, according to the choice of the origin of time in one or the other referential system, provide too:
$\mathbf{T=To\cdot\sqrt{1\text{-}v^2/c^2}}$, that the reciprocal relation, $\mathbf{To=T\cdot\sqrt{1\text{-}v^2/c^2}}$.

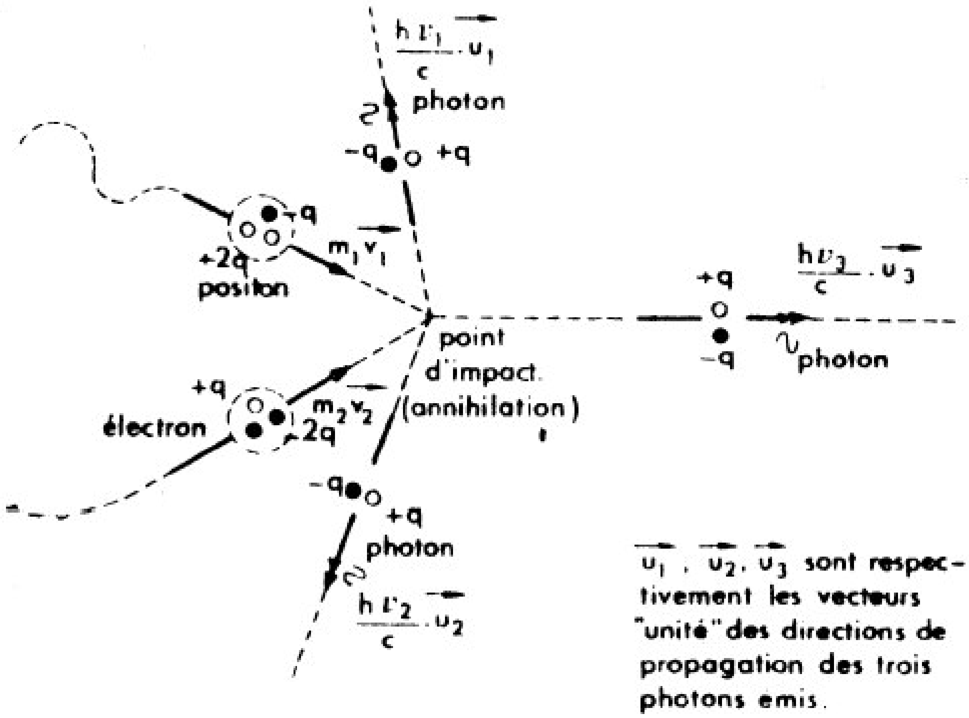
To try to solve the case of the obvious contradiction that arises when instantaneous propagation of light, (**v/c=o),** is supposed, Relativity introduces the ***concept of space-time*** and that is what in return, by posing the velocity **C** universal constant, finally **connects the unit of time to the unit of length**. In this way the contradiction is deferred and interpretation game becomes sufficiently subtle so that one by using the mathematical apparatus that is the only left at its disposal can find the majority of the theoretical cases in good agreement with the experimental results.

The existence of the energy mediums, confirmed by the Wave mechanics, comes at the right moment to specify the limits to relativistic transformations validity and to put a term at a usually taught error… Thus we must from now on, good liking badly liking, as we will see it thereafter, to cease definitively granting any credit to the "legend of the relativistic contractions", that finally appear as useless and empty.

If it is exact, in addition, that electron movement composes on average of at least three loads, (**- q, + q, - q),** whose algebraic sum is equal to **- q**, by reason of symmetry we must admit that the positron movement must, on average, to be also composed of three loads (**+ q, - q, + q),** but of which algebraic sum is worth **+ q** . It is thus necessary to expect that the meeting of an electron and a positron results in the cancellation of the resulting load by associating, two to two, the divergent zones of contrary sign. Qualitatively, the interaction that is usually named 'annihilation' must thus on average provide, when it occurs, three distinct photons, (**see fig. 10**).

The experience gives us confirmation [**11**] of that forecast and, from the quantitative point of view, the scalar relation of energy conservation and that of the vector relation of conservation of the momentum are both verified; it returns us to the barycentric reference frame of the medium:

$$\mathbf{m1c^2 + m2c^2 = hv1 + hv2 + hv3}$$
$$\mathbf{m1v1 + m2v2 = hv1/c \cdot \mathit{u1} + hv2/c \cdot \mathit{u2} + hv3/c \cdot \mathit{u3}}$$
with $\mathbf{m1 = mo1\sqrt{(1-v^2/c^2)}}$ and $\mathbf{m2 = mo2\sqrt{(1-v^2/c^2)}}$



→ → →
u1, u2 and u3 are, respectively, the vectors of the propagation directions 'unity' of the three emitted photons.

Fig.10. --- The electron and the positron can be regarded as triplets and provide, while being destroyed, three photons.

Really it is not a question, as we see it, of a phenomenon of annihilation, since the photons are material particles which are distinguished from the electrons only by the number of divergent zones which constitutes them.

When the interaction takes place with weak kinetic energies of the positron and of electron -- what is often the case and occurs when the two particles are heated -- the two of the photons have an energy close to **511 keV** and the third has nothing any more but the very low energy which, when it is not detected, results in thinking that annihilation produces only two photons **y**.

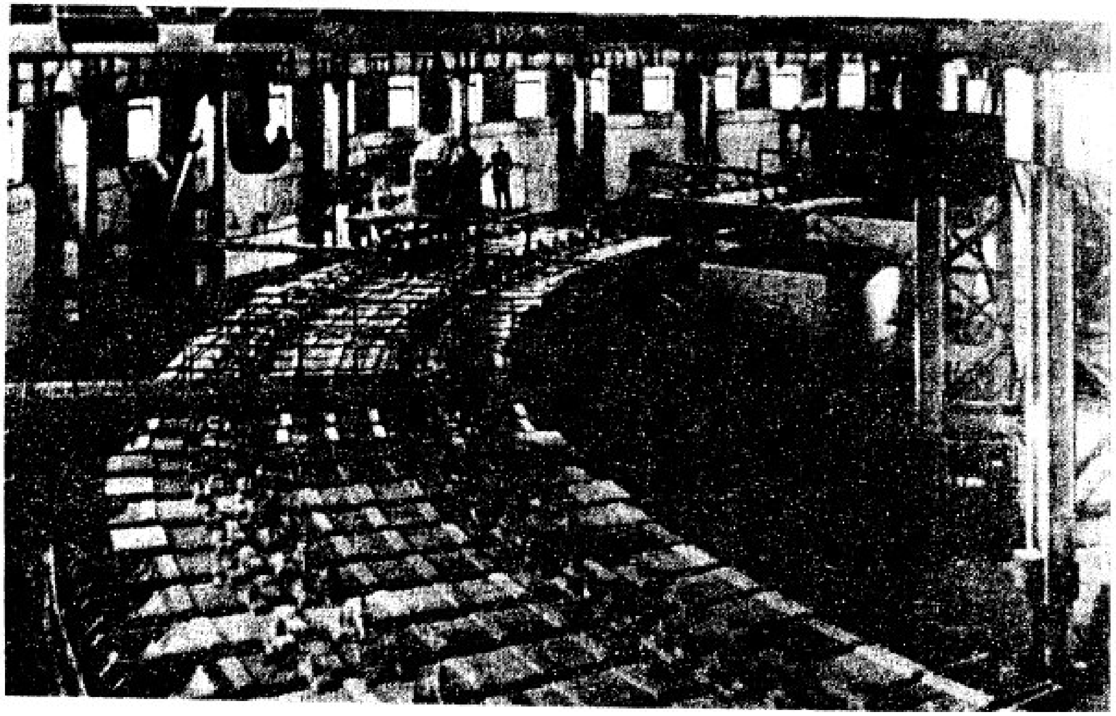
This new conception of the electron movement, which comes from a concrete and rational physical interpretation of the Wave mechanics, involves a certain number of extremely important consequences that we will try to specify and to discuss in order to progress further.

The electron seems primarily made up of an electromagnetic energy of wave nature, very dense, trapped, when there are movement, by three disruptive zones, **- *q*, + *q*, - *q*,** (***q* =1,6 exp.-19 coulomb**), concentrated in microscopic domains of space.

This electron, seemingly single, manifest itself by an electromagnetic field with very low energy density which is distributed in a way that it is contained in non-divergent external space, (space of Maxwell-Lorentz), and which constitutes the support of "energy exchange'' with the other divergent areas that are in fact the surrounding particles. It progresses in a discontinuous way to kind of the successive "quantum" jumps. It thus cannot be considered any more, at the elementary level, as a simple material point. A brutal braking, in its displacements, can involve the emission of a photon (**doublet +q,-q**) which is carrying on the whole or the part of the initial kinetic energy (emission of x-rays). On the other hand, when braking is slower and progressive, the energy is being dissipated by a simple electromagnetic radiation with continuous distribution, without the effect of materialization of photon (waves of tele-transmission). *As we had the occasion to realize, all that is dependant on the electric field, according to the case, reaches or not its disruptive limit at the emission time*.

Reciprocally, an electron can be progressively involved by an electromagnetic wave with continues distribution (particle accelerator) or accelerated brutally by a photon which yields to him whole or part of its energy in kinetic form (**Compton Effect**).

Let us notice, finally, that the electrons, just like the photons, are indistinguishable particles which do not have any individuality. If the photons obey, however, the Bose-Einstein's statistical law, it may sometimes happen to them to interpenetrate and confuse their energies in the same point of space; the situation is quite different of the electrons which, as they are closer and because of their residual loads, exert between them all the more intense repulsive actions. Not being able to interpenetrate at the low temperatures, they satisfy the "principle of exclusion" of Pauli and obey, consequently, the statistical law of distribution of Fermi-Dirac [12].



P1. II --- The large synchrophasotron of DOUBNA (the U.S.S.R.) makes it possible to communicate, with charged particles, a kinetic energy of 10 GeV that is equivalent to the energy which would correspond, appreciably, with the mass of N. Bohr's atom at rest.

6

HOW THE PHENOMENON OF PAIR CREATION HOLDS FOR THE ELECTRON ACCORDING TO THE SWIRLING CYLINDRICAL MODEL THAT ALLOWS THE CALCULATION OF THE DISRUPTIVE LIMITING FIELD *Ed* AND EXPLAINES THE EXISTENCE OF THE "SPIN"

The calculation and the information that the experiment provides we are to consider with the greatest attention in order to discover and specify the essential assumptions which are still lacking in the correct description of the known phenomena.

Having in mind that mathematical steps often betray the physical aspect of a phenomenon, we will try, according to concrete results, to imagine reasonable reality, rather than to calculate it. The goal that we fix to ourselves to seek, within the limits of the electromagnetic theory, is a logically conceivable valid electron model as well remote, as near to divergent areas. This model should be able to be the bases of a more general design that is likely to explain, as simply as possible, the most probable structure of the elementary particles.

It is by the study of the constitution of the photon that we will begin since it seems well that the electron is already present potentially in a grain of light.

A first approach can be considered by evaluating the evolution of the forms and dimensions of a photon according to its energy. For that we have the important information provided by etude of the diffusion and that of reflection of the "pair creation". It would be undoubtedly righter to use the word of "separation" rather than that of "creation", since all seems to prove that the doublet electron-positron is materialized already at the beginning, in the initial photon ***y***. Creation occurs, in fact, at the moment of emission, and that is while following the law of materialization, as stated in the precedent paragraph **3**.

In the field of energies of the X-radiation, J.J. Thomson had noted that the coefficient of diffusion **δ** preserved a constant value until approximately **0, 1 Angstrom (123 keV), [13]**.

--- For rays ***y*** of a great energy this coefficient there decreases, but on the other hand, it increases in frequency, so that Compton was led to give an account of this decrease, to propose like expression: $\delta = \delta o \cdot 1/1+\acute{\alpha}$;
expression in which $\acute{\alpha}$ is equal to: $h \cdot \nu / wo$, where **wo** is representing the appropriate energy of the electron at rest. By introducing the relativistic interpretation of Dirac, Klein and Nishina, we have calculated a more general expression that also implies a value which decreases when the frequency increases [13].

If one admits, which seems perfectly probable, that this coefficient of diffusion must be almost linearly related to dimensions of the divergent zones, we then have the means which are enabling us to evaluate the order of the magnitude of distances which can separate the disruptive layers **+ q** and **- q** so constituting the photon, at the place where energy ***hv*** is with its maximum of concentration.

For very weak frequencies, energy must, as a whole, be more largely distributed and the permittivity εo is approaching its limit **E** in the matter void. The photon can be practically absorbed by a plane capacitor of capacity ***Co*** whose reinforcements of surface ***S*** correspond to the disruptive layers and are distant of ***d***. We can write under these conditions: $h \cdot \nu = q^2/Co$,
as well as the corresponding expression of the capacity ***Co***:

$$Co = \varepsilon o \cdot S/d = q^2/h \cdot \nu.$$

Knowing that energy $h \cdot \nu$ is also equal to $\varepsilon o E d^2 \Delta\tau = \varepsilon o E d^2 \cdot d$,
we can calculate ***d***:

$$\boxed{d = h \cdot \nu / qEd = hc/qEd \cdot 1/\lambda},$$

and ***S***,

$$\boxed{S = q/\varepsilon o E d}.$$

If is the width of the microscopic capacitor associated the photon, we know that the characteristic impedance ***zc*** corresponding wave guide is roughly equal to:

$$d/l \cdot \sqrt{\eta o/\varepsilon o} = ko \cdot \sqrt{\eta o/\varepsilon o} \qquad \text{(Par.4, p.32)}$$

By taking account of the value of ***h***, $h = 8\pi ko \cdot \sqrt{\eta o/\varepsilon o} \cdot q^2$,
we may calculate $l = d/ko = hc/koqEd \cdot 1/\lambda = 8\pi q/\varepsilon o E d \cdot 1/\lambda$,
where: $l = 8\pi q/\varepsilon o E d \cdot 1/\lambda$.

Finally, we find parallel to the direction of propagation for **L=S/*l*** approximate length supposed of associated capacitor, the value: **L= λ/8π** (average value).

It is heard that these results should not be looked like exact values, but like very approximate orders of magnitude, for weak frequencies and within the limits of the made assumptions. We then note, in this case, that the distance ***d*** and the width should vary in a way appreciably proportional to frequency ***v***; i.e., conversely proportional to the wavelength ***y***. The average length ***L*** seems, for its part, to remain very roughly proportional to ***λ*** in the ratio equal to 1**/8π**.

The experiment shows, however, that if the increase in frequency remains proportional to the total increase in energy, the latter concentrates more and more and its density grows as it approaches the divergent zones. This increase in density is necessarily accompanied by an increase of the permittivity **εo** in the areas with high energy concentration, as suggested in the study of mediums with stationary inertia, made in paragraph **2**.

It is certain that, when the disruptive field is reached, the density of energy is, at first approximation, proportional to the permittivity of the divergent medium and is practically limited to interior space of the disruptive layers, since, in this medium, the electric field cannot vary any more.

It is necessary to admit, however, that the field is very slightly lower than ***Ed***, except on the level of the disruptive layers themselves where is the length of which we know that this value is actually reached.

The main difficulty which we will meet in studying the case of high energies results from our current ignorance of the law that in each point of a medium certainly associates its permittivity **εo** with its energy density … For this reason it is preferable to support us on the experimental results which are at our disposal in the study of the diffusion places. We will see that these results are finally comparable with those which the Maxwell's equations make it possible to provide in the case of the high frequencies.

It is indeed well-known that parallel conducting doublets -
having the length close to the half-length of wave, ***λ/2*** - align in a plan and produce an effect of focusing on the electromagnetic waves with the frequency **ν = vo/λ, vo = 1/√εoηo.**

Such doublets, thus laid out, constitute a genuine selective wave guide for the wavelength **λ**.

If we admit that high energized photons precisely behave like conducting doublets of this kind, we must conclude whereas the divergent zones **+ *q*** and **- *q*** separate and concentrate being clearly different before they recombine due to the passing of the electromagnetic wave (fig. 8).

The maximum value reached by separation distance must then vary, in practice, proportionally with the wavelength, i.e. contrary to the frequency; this time, it seems to be in concord with the evolution of the diffusion coefficient to the high energies.

Thus, with the energy increase, the shape of the photons must gradually evolve from a wave guide spread over disruptive surfaces, to the selective wave guide made up of doublets **+ *q***, **- *q***, where the loads are concentrated and definitely separated at maximal distance.

We can then propose a simple model of the photon phenomenon (fig. 11) presenting no contradiction with the experimental results.

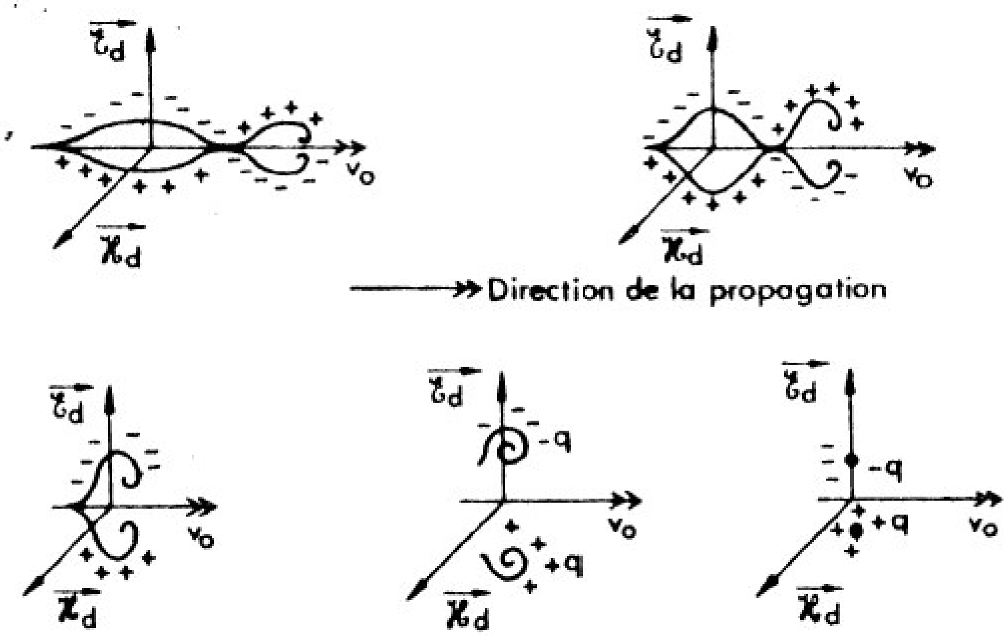


Fig.11. - The supposed evolution, according to the distribution frequency and the relative position of the disruptive layers which characterize a photon.

This model accounts for materialization of energy and leads us to consider, according to the frequency, the variation of the average distance **d** between disruptive zones, in conformity with the representative curve of **figure 12**.

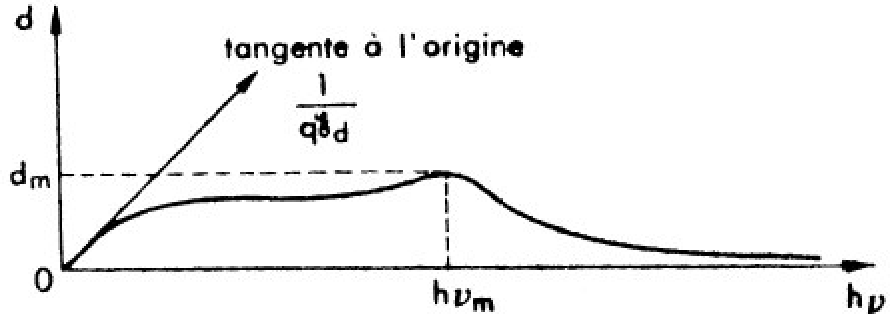


Fig.12. - Probable variation of the average distance ***d*** between disruptive layers according to energy ***hv*** of the corresponding photon.

The distance ***d*** grows with the energy increase and then decreases after having passed by a maximum which corresponds to a frequency that, for the moment, we will call ***Vm***. With this frequency, the disruptive layers separate in two loads, **+ *q*** and **- *q*,** whose reciprocal electromagnetic action is minimal since the distance which separates them has reached, in this case, its amplitude maximum.

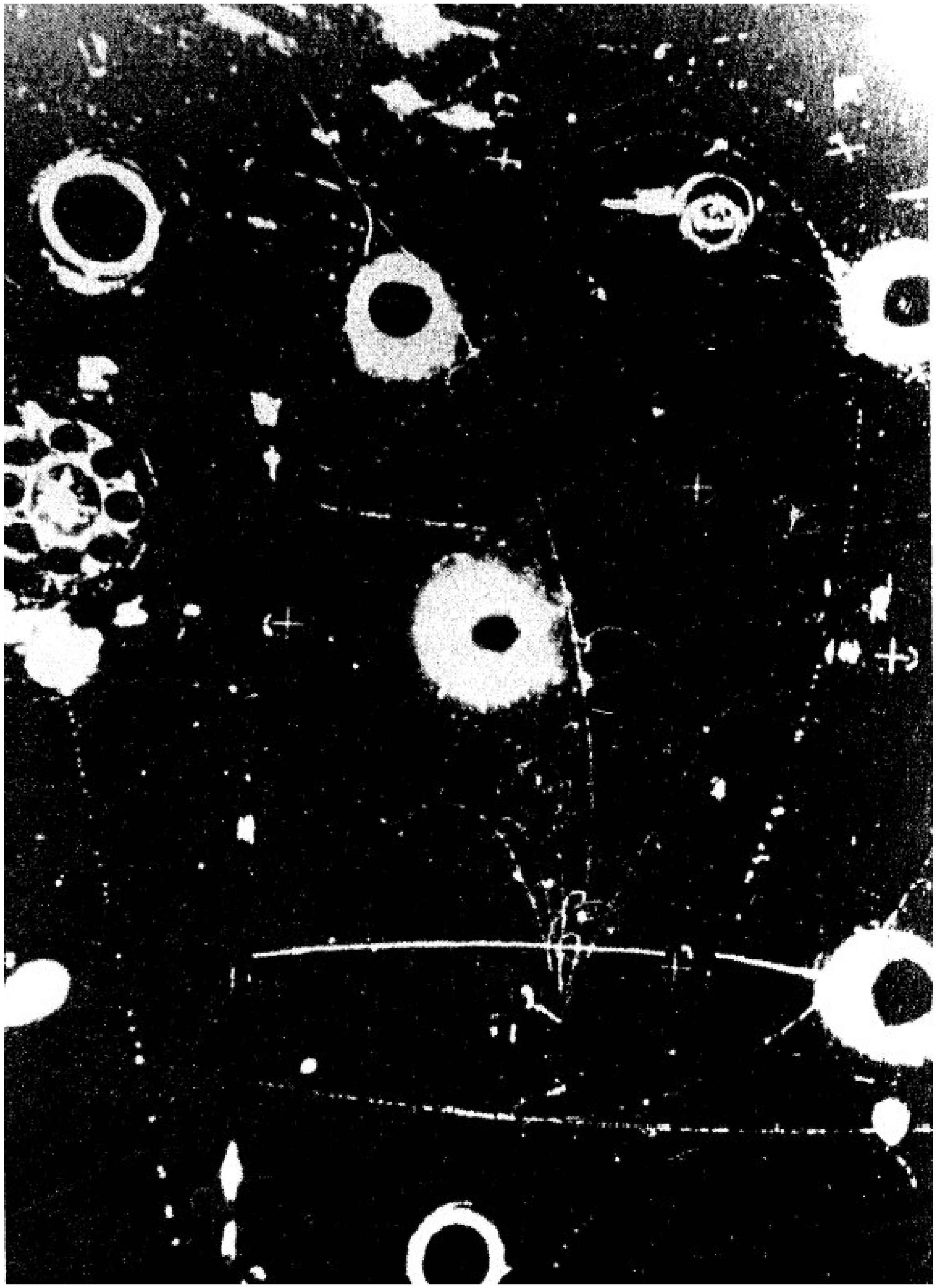
Having the energy **hvm**, a photon is being subjected to an intense electric field as are those which reign near the strongly charged cores; consequently it arises in atomic number and seems to be materialized by rupture of the consecutive recombination-separation forces of the electron and the positron of which the photon initial structure was constituted. This well known phenomenon of pair creation provides the experimental value of **1,022 MeV** for the energy **hvm**. The frequency of corresponding resonance ***Vm*** is equal to **25 ·10 (exp.10) GHz**: and that is in nonmaterial medium the wavelength of **0,012 Angstroms**.

The principle of energy conservation and the symmetry role that the electron and the positron play there enable us to calculate for each one of them the suitable energy, which is then: **1022/2=511 keV [12].** Let us extend on these perfectly known results in order to comprehend how an electron can be born in the way to detain its form and its behavior when it appears in the form of insulated particle.

It appears essential to initially specify the physical concepts which stick to the concept of permeability **η**o, on the one hand, and with that of permittivity **εd**, on the other hand; although in the formal mathematical expressions, these two coefficients appear, a priori, to play of the symmetrical roles - one magnetic, the other electric one. The physical properties which characterize them show fundamental differences which it is important to highlight.

The magnetic permeability seems related --- in all the known experimental cases within the medium considered --- to the existence of the magnetic doublets that are seemingly corresponding with electrical currents which follow closed courses.

Like Ampere suggested, by the study of the magnetic shells, these elementary doublets are directed under the action of the field of excitation ***H*** and magnetic induction **B=ηoH** and result from the superposition of their own field to the field of excitation.



P1. III. --- The separations of “electron-positron” pairs obtained in the large bubble chamber of C.E.R.N. starting from the rays “gamma” that are produced by interaction with the diffuse medium (neutrino-mu).

At the microscopic level, the magnetic masses seem not to correspond to physical reality.

In any point of a space close to an elementary particle there are only magnetic fields with the permeability **ηo**, that are locally the same as those which are measured in a nonmaterial medium:

$$\eta o = \eta = 4\pi \cdot 10 \text{ (exp.-7) M. K. S. A.}$$

The permittivity **εo** results, on the other hand, from the assumption of conservation of the load in the law of Coulomb:

$$f = q \cdot q' / 4\pi\varepsilon o r^2 \cdot \text{grad (r)}. \qquad /5/$$

The force of interaction ***f*** is seen there imposing dependency on the characteristic **εo** of the medium, even when the phenomena are considered at the microscopic level. It is admitted, indeed, that on this level the electric charges exist physically and correspond to disruptive layers. The made assumption of their real existence and their conservation is certainly not arbitrary since it results from the laws of Dalton, Faraday and especially of the convincing experiment of Milliken relating to the electron charge; from there we shall continue the front study, by formulating two essential assumptions.

The First Assumption

Taking into account its formation, the disruptive surface which retains the energy of the electron can not be spherically arranged without difficulties.

In the exceptional case when, during a short moment, the electron is temporarily motionless in a given point of the energy medium, its surface must take on the very approximate aspect of a cylinder which cross-section radius ***ro*** is in the apparent rotation around the cylinder axis (fig. 13).

We will admit, however, that the development of this cylindrical surface is equal to that of a spherical surface of the same radius, what gives for the cylinder a height equalizes with ***2ro***.

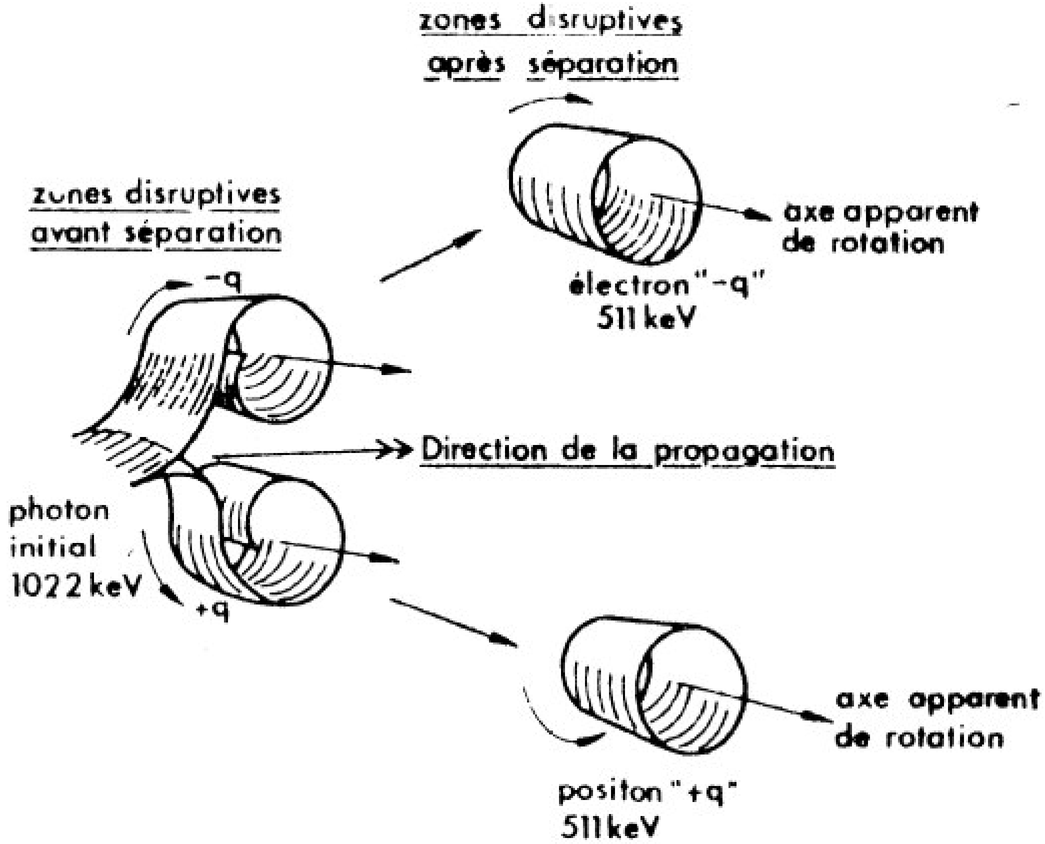


Fig.13. --- The existence of disruptive surfaces, which separates an electron from a positron, results in allotting to these particles a swirling cylindrical form.

The Second ¸Assumption

To be in agreement with quantum mechanics, we will admit, on the one hand, that electromagnetic wave which is trapped in the interior of disruptive surface is propagated along this surface, by infinitely close successive reflections, at the speed $\mathbf{vo=1/\sqrt{\varepsilon o \eta o}}$, and that it is necessary, in addition, that the circumference of the cylinder is equal, for this speed ***vo,*** to the wave length of the initial photon; i.e. with half of the wavelength corresponding to the photon frequency, the whole proper energy of the electron can be associated with it (fig.14):

$$\mathbf{2\pi ro=\lambda o/2,\ \ \lambda o=vo/\nu o,\ h\nu o=moc^2}.$$

It is reasonable to think that the traditional laws of electromagnetism, with the value close to **εo** which depends on the density of energy, are usable in non-divergent space, even in the vicinity of the disruptive layers. It is not so, perhaps, in divergent medium, where the properties of space are modified by the excessive concentration of energy responsible for the appearance of the electric field value limit ***Ed***. We will thus use these laws in the immediate external vicinity of the electron, without prejudging what occurs as soon as one penetrates inside the disruptive layer.

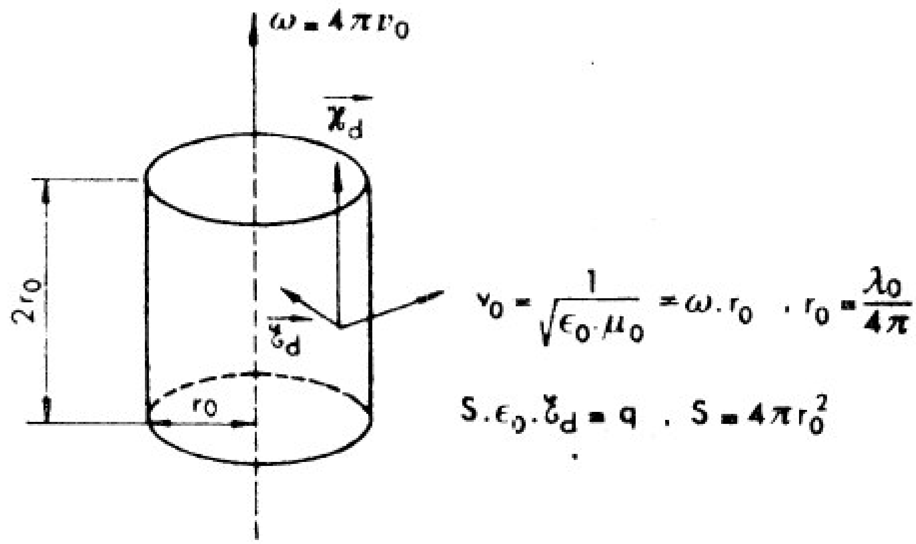


Fig.14. - *The disruptive cylinder to which, by assumption, is to associate an electron at rest.*

The permittivity ***εo***, in this zone with high density of energy, is certainly higher than that of the matter void and in principal remains the unknown factor of the problem.

According to the made assumptions, the surface of the cylinder which constitutes the limiting layer of the electron is equal to **$4\pi ro^2$**. That enables us to calculate the disruptive field ***Ed***.

$Ed=q/\varepsilon oS=q/4\pi\varepsilon o\cdot ro^2$, but,

$ro=\lambda o/4\pi=vo/4\pi\nu o=1/4\pi\nu o\sqrt{\varepsilon\eta}$.

So, we deduce:

$Ed=4\pi\eta ov o^2q$.

For the calculation of ***Ed***, we will use the expression of energy at rest, ***wo = hvo***, corresponding to **511 keV** for the electron, and the fact that **ηo=η=4π·10 (exp.-7).** From there we draw:

$Ed=4\pi\eta \cdot wo^2/h^2 \cdot q(q=1{,}602 \cdot 10exp.-19\ C)$

Within the limits of the made assumptions, we obtain then, for ***Ed,*** the following numerical value:

Ed=38, 67…10exp.15 V/m

In extreme cases of the disruptive layer, the trapped electromagnetic wave moves at the propagation velocity ***vo*** while followed by successive reflection circles of the right section of the cylinder (fig.14). We can admit that the electric and magnetic fields are still bounded on this level, in module, by relation $\sqrt{\varepsilon o}\,|Ed| = \sqrt{\eta o}\,|\chi d|$ and are perpendicular between them.

We will admit that the theorem of the cloths of current is still applicable and we know that, in this case, the magnetic field can be regarded as created by load density **δ** in displacement along the surface, at the speed ***vo;*** it is of such kind that one has the equality: $\chi d = vo \wedge \delta (vo=1/\sqrt{\varepsilon o \eta o})\cdot\delta$, so that it must have the same direction as ***Ed***, that is perpendicular to ***vo***, and we can write, in module:

$|\chi d| = |vo|\cdot|\ \delta\ | = 1/\sqrt{\varepsilon o \eta o}\cdot\delta.$

As $|\chi d|$ is equal to $\sqrt{\varepsilon o \eta o}\,|Ed|$, we obtain:

$\delta = \varepsilon o \cdot Ed$.

If the magnetic field **χd** is thus identical to that created by the load, $S\cdot\varepsilon o\cdot Ed=4\pi\varepsilon o\cdot Edro^2$ and is distributed uniformly on the surface of the cylinder, it would animate an angular velocity of rotation

$vo/ro=4\pi vo/\lambda o=4\pi vo$.

The all that occurs is seen under the angle of the electromagnetic fields as if the electron charge is actuated by an apparent rotation, whereas the magnetic field detected outside the divergent area, informs us, actually, of the presence of an electromagnetic energy which is propagated and agitated, although locked up inside its microscopic disruptive prison.

Thus the loads and the currents are, ultimately, the only manifestations of energy. We find what we already knew: that there isn't basically exist, in all the points of non-divergent space, the essential difference between the effects of the electromagnetic wave propagation and those of the moving electric charges. It would be, however, extremely interesting to be able to carry out measurements in the immediate vicinity of the divergent zones, to inform ourselves on the value of the permittivity ***Eo***, in order to determine the most probable radius of the electron swirl.

The variation of ***εo*** indeed involves an apparent distortion of dimensions without modifying neither the value of the electric charges nor that of the disruptive field.

Seen from a sufficiently distant point, in a medium with low energy density, therefore with the weak permittivity, **ε=10exp.-9/36π M.K.S.A.**, the electron appears to have a radius ***r,*** such as $Ed = q/4\pi\varepsilon r^2$.

Since there is no variation of energy, the frequency ***νo*** does not change and we must note, at this very point distant from observation, the same magnetic effects as if the electron were replaced by an elementary doublet directed according to the rotation axis and which would have magnetic moment, $M = v \cdot q \cdot r$, with $v = \omega r = 4\pi\nu o r$ and $r^2 = q/4\pi\varepsilon Ed$.

We deduce some:

$$M = \nu o q^2/\varepsilon Ed.$$

We have also calculated, in addition, the value of ***Ed***, $Ed = 4\pi\eta\nu o^2 q$; that involves: $M = q/4\pi\varepsilon\eta\nu o$. If we multiply now the numerator and the denominator of this expression by constant ***h***, by taking account of the relation: $h\nu o = moc^2 = mo/\eta$, we obtain:

$$M = h/4\pi \cdot q/mo.$$

II is not useful to specify more before we are perfectly aware of the important result defined by the N.Bohr's 'magneton' which explains the existence of the electron spin [5].

We will not insist, either, on the happy consequences which resulted, these last years, of the experimental confirmation of the spin existence, in particular in nuclear physics and for magnetism.

What it is especially necessary to retain is that the magnetic moment of the electron does not resemble with a real rotation of the particle, but with the electromagnetic wave propagation, and that in a kind of surface snaking along the disruptive layers.

It would be unreasonable, indeed, to imagine matter which is animated by the surrounding medium with stationary inertia to a speed equal to that of the light in this medium.

7

SCHROEDINGER'S EQUATION QUANTITATIVELY TRANSLATED INTO THE CONSEQUENCES OF THE MATERIALISATION LAW WHAT MAKES IT POSSIBLE TO CALCULATE THE LIMIT *Ed* OF THE ELECTRIC FIELD

The concepts of mechanists, which had governed the traditional development of electromagnetism, could not lead to the materialization law discovery because the energy and matter were regarded there as two principles of different nature. Since then, Relativity showed that there was an equivalence energy-matter. But, the confusion introduced between the mathematical formalism and experimental reality that also involved the interpretation of the Lorentz-Maxwell's transformations is due to the impasse created by a very abstract concept of space-time which hopelessly condemned any possibility of imagining better solutions and, apart from the light speed universal constant, it has also put the other limits to oppose indefinite increase of any of physical parameters present in the theory.

Wave mechanics, on the other hand, formalized by the equation of Schrödinger, forever ceased suggesting us the existence of two possibilities of manifestation of energy and, consequently, that of a limit marking the border of separation between these two possibilities.

The problems raised by the double solution, the continuous one and the discontinuous one, the pilot wave and the corpuscle, energy matter and diffuse energy, divergent and not-divergent spaces, cannot, be indeed solved in a satisfactory way, which if we admit that there really exists, by the solution of a continuous border on both sides, since it is generally accepted that the physical laws must show the precise differences.

In seizing the significance well, we will remake, step by step the development which, on the basis of the experimental results, led to the equation of Schrödinger. Let us recall that the author of this equation had especially fixed to himself, like essential goal, to establish a simple and practical mathematical relation operating the synthesis of the fundamental laws of traditional optics and those of the Wave mechanics. It is clear that it forever alleged to give and not to try to seek, a physical explanation of concrete phenomena described quantitatively by this relation.

The selected starting base is the well-known fundamental equation of physical optics: (general equation of propagation of vibratory movements),

$\Delta\psi - 1/u^2 \cdot \partial^2\psi/\partial r^2 = 0$, which is to be considered as expressing the principle of Fermat. But, we note that the function ψ is, in fact, unspecified as for its physical significance. All its partial derivatives are continuous $\psi 1 = \partial^n\psi/\partial p^n$ of ψ by ratio of an unspecified parameter p, and all the functions $\psi 2$ obtained by multiplying ψ by an unspecified constant a, with or without dimension, have indeed solutions of the preceding equation. This equation informs us, finally, only about the distribution which must have, in space, the function ψ so that the propagation of the phenomenon which it represents makes that at an isotropic speed and constant in module. One can, as that was done, to regard ψ as a potential which checks the system of vector equations:

$$\left| \begin{array}{l} p\mathbf{v} = -\mathrm{grad}\ \psi \\ \mathrm{div}\, p\mathbf{v} = -1/u^2 \cdot \partial^2\psi/\partial t^2. \end{array} \right.$$

The $p\mathbf{v}$ represents a volume momentum, or volume action, and $\partial\psi/\partial t = w$, the energy density. That joined an assumption suggested by M. Madelung. But, it is as much possible to regard ψ as one of the components of a magnetic field or of the electric being propagated in a medium where the product $\varepsilon o \eta o$ is equal to $1/u^2$. We also can, like that is usually done, to give to ψ^2 the significance of one density of probability which varies according to time and is propagated at the speed u.

It is thus well showed that there forever will be some discussion about giving to ψ a precise physical significance, whenever it is envisaged to use equation of Schrödinger.

In order to be able to introduce into the fundamental equation, $\Delta\psi - 1/u^2 \cdot \partial^2\psi/\partial t^2 = 0$, essential quantum relations, one caries out the decomposition of ψ in sinusoidal terms $\psi = \sum \psi i\ (x, y, z) \cdot e(\exp.\ 2\pi j v t)$. And in the case of the study of a particle of energy $W = hv$, for example, one poses $\psi = \sum \psi o\ (x, y, z) \cdot e(\exp.\ 2\pi j v t)$. The function of wave ψo must check the relation:

$$\Delta\psi o(x, y, z) + 4\pi^2 v^2/u^2 \cdot \psi o\ (x, y, z) = 0.$$

It is enough then to replace v^2/u^2 by $1/\lambda\varphi^2$, where $\lambda\varphi$ represents the length represents the phase wave length of the particle; i.e. $\lambda\varphi = h/mv$. When the speed v is sufficiently low compared to speed limits c in an intangible medium of low energy density, we can write

$$\lambda\varphi \approx h/\sqrt{|2m(mv^2/2)|} = h/\sqrt{2m \cdot Wk},$$

where Wk represents the kinetic energy of the particle. If Wp represents its potential energy, $Wk = W - Wp$, we obtain the wavelength

$$\lambda\varphi = h/\sqrt{2m\ (W - Wp)};$$

this was introduced into the preceding relation [**12**], what leads us finally to the equation of Schrödinger:

$$\Delta\psi o(x, y, z) + 8\pi^2 m/h^2 (W-W_p) \cdot \psi o (x, y, z) = 0.$$

Why to recall this, (?), if not to show that independently of the indetermination which sticks to the physical significance of the function of the wave **ψo**, there exist the two approximations of preceding calculation which are important to announce,

--- The first, perfectly known, that corresponds to the case where the speed v is considered lower than c (not-relativistic case). That should be written $\lambda\varphi = h/\sqrt{2mWk}$, whereas by taking account of the exact expression,

$$Wk = moc^2 \left| 1/\sqrt{(1-v^2/c^2)} - 1 \right| = mc^2 \left| 1-\sqrt{(1-v^2/c^2)} \right|,$$

it would be necessary to write:

$$\lambda\varphi = h/\sqrt{(2m - Wk/c^2)Wk}\ .$$

--- The second approximation concerns an entirely physical concept and must be even highlighted in the law, $W = hv$, the base of quantum and wave theories. As we already noted (**§ 4, p. 32**), it is not physically conceivable to associate a simple sinusoidal wave, having a single frequency v, with a particle taken separately. Such a sinusoidal wave, by supposing that the propagation is done according to the axis Ox of a trihedral of reference, is written in general:

$$\psi o = Ao \sin 2\pi/T\ (t-h/v) + Bo \cos 2\pi/T(t-h/v).$$

Ψo then takes the same values, at a given moment, for all the points of the plans parallel with $x = 0$, located from $-\infty$ to $+\infty$, having for equation $x-xo/v - k1T=0$, whatever is $|k1|$, entirety as large as one wants. Along the same plan of equation, $x=xo$, **ψo** we again take, in addition, the values identical to the moments $t = k2T$, whatever is the $k2$ value, from $-\infty$ to $+\infty$. It is not useful to insist to realize only one such function, which is able of periodical reproduction in all the space and at any moment, since it could not be reasonably associated with a physical phenomenon which, at a given moment, *must be, in its near total, circumscribed in a limited field of space; the particle equation should be able to correspond indeed to the definition of a particle.*

The law of materialization and the existence of localized divergent zones which are succeed, on the basis of traditional electromagnetism, with the law of quantification $w=8\pi zoq^2$, show well that, in the materialization law, ***v** should not be regarded a pure frequency, but as the average statistical value of the frequencies composing the spectrum associated with the described particle.* The spreading out of this spectrum depends on the surrounding medium. It is logical to admit that the more there will be particles grouped in the wave train which the distribution will approach a sinusoidal form, the closer will be the average frequency $\boldsymbol{v}$ to appear as a pure one. *But, on the other hand, more one wish to study a particle separately, more the entailment of the spectrum of frequencies will intervene in measurements. It is this physical aspect of the Wave mechanics which involves relations of the 'uncertainty principle of Heisenberg'*, and not an obscure reason which mysteriously seems to be opposed to the precise measurement of the phenomenon parameters on a particle scale, as we hear currently. This confused interpretation comes owing to the fact that the starting law, $\boldsymbol{W = hv}$, is usually introduced by considering perfectly sinusoidal phenomena. And that is in contradiction with the experience.

Within the limits of the two approximations which we have just announced and of the made reserves, the equation of Schrödinger makes it possible to successfully complete those of mechanical laws relevant for elementary particles. Contrary to Relativity, the Wave Mechanics, in its current form, proposes formalism adapted rather well to the law of materialization and its measurable consequences.

Although it was never a question of discontinuity zones where the electric field reaches a disruptive limit, the existence of these zones is implicitly contained in the discontinuous expression of the phenomena as in quantum or Wave Mechanics.

The equation of Schrödinger in particular correctly translates the ceaseless exchanges of energy which are happening within the atoms where the electromagnetic waves intermingle and rebound on the disruptive cloths which are formed as soon as the electric field tries to exceed the value limits $\boldsymbol{Ed}$.

If we look at that more closely, we shall admit that the electronic orbits of an atom are not of diffuse clouds, but of genuine wave guides curved under the action of the fields developed by the core. These guiding waves are closed again on themselves and that can be maintained, according to the classical theory, as long time as electromagnetic waves which are propagated there are found in phase after each complete revolution. That imposes on the average circumference, of an orbit $\mathbf{2\pi a}$, the radius to be equal to an integer times the wavelength of phase:

$$2\pi a = n\lambda\varphi = nh/mv.$$

We deduce from it the quantities for the momentum:

$$mv = nh/2\pi a.$$

In the case of the hydrogen atom, if one supposes that the core acts on the electron only via its electrostatic field, we may conclude that there is equality between the centrifugal force and the attraction force:

$\mathbf{mv^2/}a\mathbf{= q^2/4\pi\varepsilon}a^2$ is $\mathbf{mv^2= q^2/4\pi\varepsilon}a$.

Knowing ***mv*** and ***mv2*** we can calculate the ratio ***v/c***:

$\mathbf{v/c=1/c\cdot mv^2/mv=1/n\cdot}q^2\mathbf{/2\varepsilon hc}$, with integer ***n*** .

We know, on the one hand, that the $q^2\mathbf{/2\varepsilon hc}$ ratio is equal to the fine structure constant $q^2\mathbf{/2\varepsilon hc=1/16\pi ko=\acute{\alpha}o}$ and we also know, on the other hand, that energy of the electron on its orbit is equal, except for a constant, with the difference:

$\mathbf{\Delta Wn = Wo - Wv = moc^2/\sqrt{1- (v/c)^2}}$.

By replacing the ratio ***v/c*** by its various possible values **άo**/n, we obtain a first expression of the quantified levels of energy of the hydrogen atom.

$$\mathbf{\Delta Wn=- moc^2\,\left|\,1/\sqrt{(1-\acute{\alpha}o^2/n^2)}-1\,\right|}.$$

If we hold account owing to the fact that $\mathbf{\acute{\alpha}o^2/n^2}$ is always ***lower*** than **10(exp. -14),** we can develop the expression,

$\mathbf{\left|\,1/\sqrt{(1-\acute{\alpha}o^2/n^2)}-1\,\right| = \acute{\alpha}o^2/\ 2n^2+ 3/8 \cdot \acute{\alpha}o(exp.4)/n(exp.4)+\ldots}$,

and we obtain then:

$$\mathbf{\Delta Wn \approx -1/n^2 \cdot moc^2\acute{\alpha}o^2/2}.$$

This expression is not other than the traditional result obtained, in the non-relativistic case, while writing, $\mathbf{\Delta Wn=-mv^2/2}$, and in generally known form:

$\mathbf{\Delta Wn \approx -1/n^2 \cdot mo}q\mathbf{(exp.4)/8\varepsilon^2h^2 \cdot (}q\ =1{,}6\cdot 10exp\ -19\mathbf{)}$ /12/

For the fundamental level (***n = 1***) the orbit is stable and we will admit that **ΔWn** corresponds to an energy which is entirely exchanged, per vibratory periods, between the hydrogen core and the electron which is dependant on it. We can, in this case, to use the relation established in the paragraph 5 (p. 39) that is correspondent with electric fields action on the divergent zones, $\mathbf{(\Delta v/vo =\pm \left|\,\Delta E\,\right| / Ed)}$.

Because of the double sign which alters the field of the electron in motion, the total variation of frequency is **2Av**. That makes it possible to write:

$\mathbf{\left|\,\Delta W1\,\right| = moc^2\acute{\alpha}o^2/2 = 2h\Delta v}$.

$$|\Delta W1|/Wo = 2\cdot|\Delta E|/E\mathit{d}.$$

with $|\Delta E| = q/4\pi\varepsilon a^2$, $Wo = moc^2$, $a = h/2\pi\acute{\alpha}omoc.$

We can thus calculate the limit ***Ed*** of the electric field:

$$E\mathit{d} = 2 \cdot Wo|\Delta E|/|\Delta W1| = 4\pi movo\mathit{q}/\varepsilon h = 4\pi\eta v^2\mathit{q}.$$

We find well, for this limit, the same expression as we had calculated in the case of the isolated electron (p. 67).

8

STUDY OF RESTRICTED RELATIVITY MODIFIED USING SYMBOLISM PROPOSED BY HEAVISIDE

In a medium of homogeneous permittivity ***Ed*** and of homogeneous permeability η which contains no loads, Heaviside showed, while posing $\mathbf{Q}=\sqrt{\varepsilon}\mathbf{E} + \mathbf{j}\sqrt{\eta}\mathbf{H}$ (complex electromagnetic vector) and $\mathbf{T} = \mathbf{j} \cdot \mathbf{t}/\sqrt{\eta}\mathbf{H}$ (complex variable of space-time), that the Maxwell's equations could be very simply written:

$$\left|\begin{array}{l} \text{rot } Q + \partial Q/\partial T = 0 \\ \text{div } Q = 0. \end{array}\right.$$

(See Appendix 5, p. 129).

When a complex linear relation, noted between physical sizes of the same dimension, induce such simplicity, it is likely that it also leads to further simplifications in the mathematical treatment. From there it follows for the complex field of Maxwell-Heaviside:

$$\textbf{rot rot } \mathbf{Q} = \textbf{grad (div } \mathbf{Q}) - \Delta\mathbf{Q} = - \Delta\mathbf{Q},$$

but also,

$$\textbf{rot rot } \mathbf{Q} = - \partial/\partial\mathbf{T} \textbf{ rot } \mathbf{Q} = \partial^2\mathbf{Q}/\partial\mathbf{T}^2,$$

and that is:

$$\Delta Q + \partial^2\mathbf{Q}/\partial\mathbf{T}^2 = \square\mathbf{Q} = \mathbf{0},$$

Dalembertien $\square\mathbf{Q}$ is expressed by a symmetrical relation in ***x, y, z*** and ***T***: (see Appendix 4, p. 128).

$$\square\mathbf{Q} = \partial^2\mathbf{Q}/\partial\mathbf{x}^2 + \partial^2\mathbf{Q}/\partial\mathbf{y}^2 + \partial^2\mathbf{Q}/\partial\mathbf{z}^2 + \partial^2\mathbf{Q}/\partial\mathbf{T}^2 = \mathbf{0}$$

We know that any change of reference axes, like any multiplication of the co-ordinates or of the components by the same scalar, preserve the zero value of Dalembertien, $\square\mathbf{Q} = \mathbf{0}$.

By reason of symmetry and extension, any transformation of the type hereafter, will have as a property to preserve the form of the equations of Maxwell-Heaviside:

$$\left|\begin{array}{l} x = a x1 \\ y = a y1 \\ z = a z1 \cos 0 + a T1 \sin 0 \\ T = a T1 \cos 0 - a z1 \sin 0 \end{array}\right. \qquad \left|\begin{array}{l} Q1x1 = b(Qx \cos 0 - Qy \sin 0) \\ Q1y1 = b(Qy \cos 0 + Qx \sin 0) \\ Q1z1 = bQz \end{array}\right.$$

These transformations involve the reciprocal implication:

(rot Q + ∂Q/∂T =0, div Q=0) ↔ (rot Q + ∂Q1/∂T1 =0, div Q1=0)

To be able to separate the real and imaginary parts which physically correspond to the electric and magnetic fields expressed in the units of Maxwell, we are led to give to ***0*** the value **jφ**. From there: cos **0 == Chφ**; and **sin 0 = j Shφ**; what leads to the transformations:

x=*a*x1	**Q1x1=bChφ(Qx-jQy thφ)**
y=*a*y1	**Q1y1=bChφ(Qy+jQy thφ)**
z= *a*Chφ (z1-t1/√εη · thφ)	**Q1x1=bQz**
t= *a*Chφ (t1- z1√εη · thφ)	

If the whole of ∑***q*** loads is at-rest per ratio with reference frame of medium, the magnetic field is null and the theorem of Gauss allows us, for a closed surface ***S*** containing all the loads, to write the following relation:

∬s (Exdydz +Eydzdx +Ezdxdz) = ∑ q/ε.

To express the fields of which the loads are created when they are uniformly moving through the medium at the speed ***v*** , we can use, like reference, the preceding transformation taking its motionless state, ***H = 0.***.

From where:

x= *a*x1	**E1x1=bChφ·Ex**
y= *a*y1	**E1y1= bChφ·Ey**
z= *a*Chφ · (z1-vt1)	**E1z1=bEz**
t= *a*Chφ · (r1 -εηvz1)	

H1x1= - bChφ· vεEy
H1x1= bChφ· vεEx
H1z1= 0

If the result of these transformations has a physical direction, the loads are necessarily preserved and then one has:

∬s (E1x1dydz1' + E1y1dz'dx1 + E1z1dx1dy1) = ∑ q/ε.

While posing **z1'= (z1- vt1),** we can write:

dx= *ad*x1	**E1x1=bChφ·Ex**
dy= *ad*y1	**E1y1=bChφ·Ey**
dz= aChφ·dz	**E1x1=bEz**

We draw some:

$$\iint_s (E1x1dy1dz1' + E1y1dz'dx1 + E1z1dx1dy1) =$$
$$= (b/a^2) \cdot \iint_s (Exdydz + Eydzdx + Ezdxdy).$$

So that the loads are preserved, it is necessary to make:

$$\boxed{(b/a^2) = 1.}$$

We discover that the relativistic transformations which have the properties essential to preserve the form of the Maxwell's equations and also the electric charges, represent the only one particular case of a more general group of transformations having the same properties, and that can be written, if displacement is effected according to axis ***Oz***:

$$\left|\begin{array}{l} x=a(v)x1 \\ y=a(v)y1 \\ z=a(v)/\acute{\alpha}\ (z1- vt1) \\ t= a(v)/\acute{\alpha}\ (t1- \varepsilon\eta vz1) \end{array}\right. \qquad \left|\begin{array}{l} E1x1 = a^2(v)/\acute{\alpha}\ [Ex + \eta vHy] \\ E1x1 = a^2(v)/\acute{\alpha}\ [Ey - \eta vHx] \\ E1x1 = a^2(v)Ez \end{array}\right.$$

$$\left|\begin{array}{l} H1x1 = a^2(v)/\acute{\alpha}\ [Hx - \varepsilon vEy] \\ H1x1 = a^2(v)/\acute{\alpha}\ [Hy + \varepsilon vEx] \\ H1z1 = a^2(v)Hz, \text{ with } \acute{\alpha} = \sqrt{1-\varepsilon\eta v^2}. \end{array}\right.$$

So that these transformations answer conditions of continuity when speed ***v*** is null, it is necessary that the coefficient ***a(v)*** tends towards ***L*** when this speed ***v*** tends towards zero. Let us note whereas the calculation of the momentum such as made in **paragraph 2 (p. 15**) would provide an expression form, $mv=a(v)\varepsilon\eta Wov/\acute{\alpha}$.

From this expression we can draw ***mass-energy equivalence***, $mv=a(v)\varepsilon\eta Wo/\acute{\alpha}$, which always leads to the same relation:

$Wo=mo/\varepsilon\eta$, when $v=0$.

Two important conclusions are essential then:

--- Firstly, the existence of a parameter ***a(v)*** is variable according to the speed ***v*** which is dependant on the co-ordinates **x, y, z**. Within the limits of the currently known physical laws, it shows clearly as the relativistic transformations corresponding to ***a (v) = 1***, are restrictive. They make to disappear a significant parameter that is in connection with the local value of the permittivity ***E***, which by itself is the function of the energy density while its kinetic component necessarily varies with the speed ***v***.

--- We note, in the second place, that the existence of this arbitrary parameter ***(v)*** with the relativistic transformations removes any possibility of concrete physical interpretation. These transformations thus find their true significance in this role of simple but purely mathematical operators that, finally, they never ceased playing.

The application to the uniform displacement of an isolated electric charge, makes it possible to control the group of transformations utilizing the parameter ***a(v)***; it provides indeed, for the distribution and the value of the electric and magnetic fields associated, the single result independent of ***a(v).*** This parameter can be unspecified and we do not lay out, for the moment, of any experimental result which authorizes us to specify its expression. It is thus not very reasonable to speak about contraction lengths and time, bus if we take, for example, $a(v)=\acute{\alpha}=\sqrt{1-\varepsilon\eta v^2}$, which remains compatible with the conservation of the loads and that of the isotropy of the propagation velocity, we would obtain:

$$\left|\begin{array}{l} x=\acute{\alpha}x1 \\ y=\acute{\alpha}y1 \\ z=z1-vt1 \\ t=t1-\varepsilon\eta vz1 \end{array}\right. \qquad \left|\begin{array}{l} E1x1=\acute{\alpha}\,[Ex+\eta vHy] \\ E1y1=\acute{\alpha}\,[Ey+\eta vHx] \\ E1z1=\acute{\alpha}^2\,Ez \end{array}\right.$$

$$\left|\begin{array}{l} H1x1=\acute{\alpha}\,[Hx+\varepsilon vEy] \\ H1x1=\acute{\alpha}\,[Hy+\varepsilon vEx] \\ H1x1=\acute{\alpha}^2\,Hz. \end{array}\right.$$

Such a transformation, *interpreted like a dilation lengths in transverse directions, would be absurd.*

Let us note that the negation of the existence of the energy mediums of propagation, conduits to allot the value constant unit to the parameter ***a(v)***, whatever the relative speed ***v***. It clearly concerns the relativistic physical assumption and not the experimental results which, in the cases that we specified in quantum Mechanics, formally contradict this assumption.

In short, we may say, without large risk of error, that the transformations of Lorentz-Maxwell are simple mathematical operators which allow us, with a very good approximation, to calculate, in a medium with stationary inertia and presumably homogeneous, the distribution of the electric and magnetic fields created by loads moving uniformly to this medium; at the condition when the medium in displacement, which contains these loads and is mainly defined by their presence, remains sufficiently far away from the medium at rest.

If we again take the relativity theory on the valid basis and in conformity with known realities, it will indicate the usage of Heaviside's symbolism because this it is adapted to the description of the phenomena in physical spaces with three dimensions relating to homogeneous mediums with stationary inertia, and also, because it allots the exclusively mathematical role to the introduced complex expressions. We will always use it if the divergence is null, because of the existence of the electric field value limit ***Ed*** which, on a microscopic scale, cancels the homogeneity condition of the medium. The phenomena on this scale answer the laws of the Wave mechanics. Finally, the equations of Maxwell-Heaviside, as we saw, are written very simply:

$$\mathbf{rot\ Q} + \partial \mathbf{Q}/\partial \mathbf{T} = 0, \quad \mathbf{div\ Q} = 0.$$

They already allow, for homogeneous mediums, to deal simply with the problems of electromagnetic waves propagation in the case of antennas, wave guides and cavity resonators. But, they also lead, within the limit of the stated assumptions, to the group of Lorenz's transformation which, sometimes, can take a complex form. When $\mathbf{v} > 1/\sqrt{\varepsilon\eta}$, one obtains the distribution and the perfectly acceptable values of the electric and magnetic fields in non-divergent medium. Let us quote, for example, the case of the effect "Cerenkov" which corresponds to the complex transformation:

$$\left|\begin{array}{l} x = x1 \\ y = y1 \\ z = j/\sqrt{(v^2/vo^2 - 1)} \cdot (z1 - vt1) \\ t = j/\sqrt{(v^2/vo^2 - 1)} \cdot (t1 - v/vo^2 \cdot z1) \end{array}\right.$$

The equations of Maxwell-Heaviside can be put in a remarkable particular form which allows the separation of wave surfaces and the determination of the propagation rays. This form is obtained starting from the intrinsic expressions of the partial differentials, the rotational one and the one of the divergence, what brought us back to surfaces ***Si (x, y, z,t),*** and functions of space and time.

We may write indeed:

$$\left|\begin{array}{l} \mathrm{rot}\ Q = \sum^n \mathrm{grad}\ si \wedge \partial Q/\partial si \\ \mathrm{div}\ Q = \sum^n \mathrm{grad}\ si \cdot \partial Q/\partial si \\ \partial Q/\partial T = \sum^n \partial Q/\partial si \cdot \partial si/\partial T \end{array}\right.$$

$$i=1$$

(see Appendix 1,2 and 3, p.127 and 128).

These relations lead then, for the equations of Maxwell-Heaviside, to the following form:

$$\left|\begin{array}{l} \sum_{i=1}^{n} (\text{grad } si \wedge \boldsymbol{\partial Q/\partial si + \partial Q/\partial si \cdot \partial si/\partial T) = 0} \\ \sum_{i=1}^{n} \text{grad } si \cdot \boldsymbol{\partial Q/\partial si = 0} \end{array}\right.$$

The decomposition according to surfaces ***Si (x, y, z, t)*** is arbitrary. It is thus possible to fix the choice of these surfaces so that each one of them can satisfy the relations separately:

$$\left|\begin{array}{l} \text{grad } si \boldsymbol{\wedge \partial Q/\partial si + \partial Q/\partial si \cdot \partial si/\partial T) = 0}. \\ \text{grad } si \cdot \boldsymbol{\partial Q/\partial si = 0} \end{array}\right.$$

These relations are compatible with the preceding ones and make it possible to express the conditions which the functions ***si*** must meet so that such decomposition can be done.

It is necessary, in particular, that the vectors $\boldsymbol{\sqrt{\varepsilon}\cdot\partial E/\partial si}$ and $\boldsymbol{\sqrt{\eta}\cdot\partial H/\partial si}$ are perpendicular between them, equal in module and perpendicular to grad s***i.*** II is necessary, in addition that the module of ***grad si*** is equal to $\boldsymbol{|\partial si/\partial T|}$, (grad si)² + $(\boldsymbol{\partial si/\partial T})^2$ which implies that surfaces s***i=Cte*** are parallel surfaces so that we can choose that the gradient, **grad *si*** is the resultant vector. One obtains, in short, (see appendix 6, p. 129 to 135):

$\boldsymbol{(\text{grad } si)^2 = 1;\ \partial si/\partial T = \pm j}$, that is to say, $\boldsymbol{si(x,y,z) \pm jT = Cte.}$

$$\left|\begin{array}{l} \boldsymbol{\text{grad } si \wedge \sqrt{\varepsilon}\, \partial E/\partial si = \sqrt{\eta}\, \partial H/\partial si} \\ \boldsymbol{\text{grad } si \wedge \sqrt{\eta}\, \partial H/\partial si = -\sqrt{\varepsilon}\, \partial E/\partial si} \end{array}\right.$$

Each point of a surface **si=Cte** moves then according to the normal on this surface with a constant speed equalizes $\boldsymbol{1/\sqrt{\varepsilon\eta}}$. By extension, although the functions ***Si*** are not specified, corresponding surfaces can be named "the wave surfaces".

Thanks to this particular decomposition, we will be able to proceed to the study of mediums of stationary inertia and to the vacuum itself, so that nothing prohibits us to suppose that they are made up of a very great number of electromagnetic waves which intermingle in all directions forming a noise: the basic diffusion that undoubtedly represents an important energy.

This assumption had been considered by Mr. Tommasina [15] who had already imagined that "the ether", at the time when scientists still spoke about it, was traversed in all the directions by electromagnetic waves coming from all the points of space. The error was to believe, however, that the gravity actions were due to the pressure of radiation exerted by these waves - design cancelled by the principles of thermodynamics. A pressure represents, indeed, a force per area unit, generally caused by kinetic shocks, whereas the gravitation field adds to a matter potential acceleration which can act on each atom constituting a mass. Acceleration and a pressure have different dimensions and are of different physical nature which it is not reasonably possible, so that it confuses their respective concrete aspects. Let us note, on this subject, that the thermodynamics tends, in many cases, not to take account of the energy mediums and, consequently, potential energy which corresponds to them, because it was rather conceived to express pressures, momentum and kinetic energies.

The concept of potential, in thermodynamics, remains pretty vague. Thus in the absence of concrete physical significance it may paradoxically lead us to negative energies that even Dirac [**12**] did not hesitate to regard as realities. We always have to keep on mind that the pressure, as much as the temperature, are mechanistic concepts related to the existence of material particles.

The temperature is proportional to the average kinetic energy of gas molecules, $\mathbf{\frac{1}{2}M \cdot v^2 = 3/2kT}$. It cannot provide us any information on the density of diffuse energy, nor on the energy of the masses. As for the pressure, the given statistical definition is meaningless in the absence of a sufficient number of particles.

There exists, consequently, a fundamental difference, which it is important to note, between the term of energy in thermodynamics and electromagnetism.

A thermometer can measure only kinetic energies indeed. Placed between the plates of a capacitor, it will not show any difference in temperature, or if the capacitor is charged or not. Except the losses by Joule effect, it is being unsuitable and unsuited to the detection of any diffuse electromagnetic energy. This is why thermodynamics, in spite of its unquestionable utility in the mechanical heat engine and motion study, was unaware, until now, of even the existence of this energy and that why it was necessary, in order to remain in agreement with the principles posed, to introduce the concept of usable energy of "Maxwell" [7]. As it was difficult, in addition, to reject the existence of the fields of forces that support the remote interactions obviously implied by experience, *it was admitted, by principle, that these fields could not be responsible for the presence of loads and masses - being thus material -but responsible for the noted energies,* *only*. The energy density, allotted to the fields, is thus to be considered under penalty of running up against the principles and the reality itself, to be considered more like the facility of a pure calculation deprived of any physical significance. It is certain that this petition of principle had very heavy consequences on the evolution of Physics. It led, in particular, many physicists to refuse to admit that fields can, in certain cases, to transmit energy remotely without it being necessary to suppose the presence of material particles intended to ensure transport of it.

This refusal, at the origin, of the apparently free assumption of the existence of ***gravitons***, we add to better understanding of the failure of the various attempts to quantify the fields.

We already saw that all becomes clearer if matter is considered a consequence of the existence of the electric fields of which it only translates the singularities. The definition of the energy mediums allowed us, on the basis of the Maxwell's equations, to demonstrate the law of equivalence of the mass, material or not, and of energy, ***w = mc2***. In the same manner we will be able to explain the Gravitation and to show the electromagnetic origin of it, without calling upon the complicated four dimensional space-time geometry of which the assumption, like it is the relativity principle, seems neither useful, nor desirable.

9

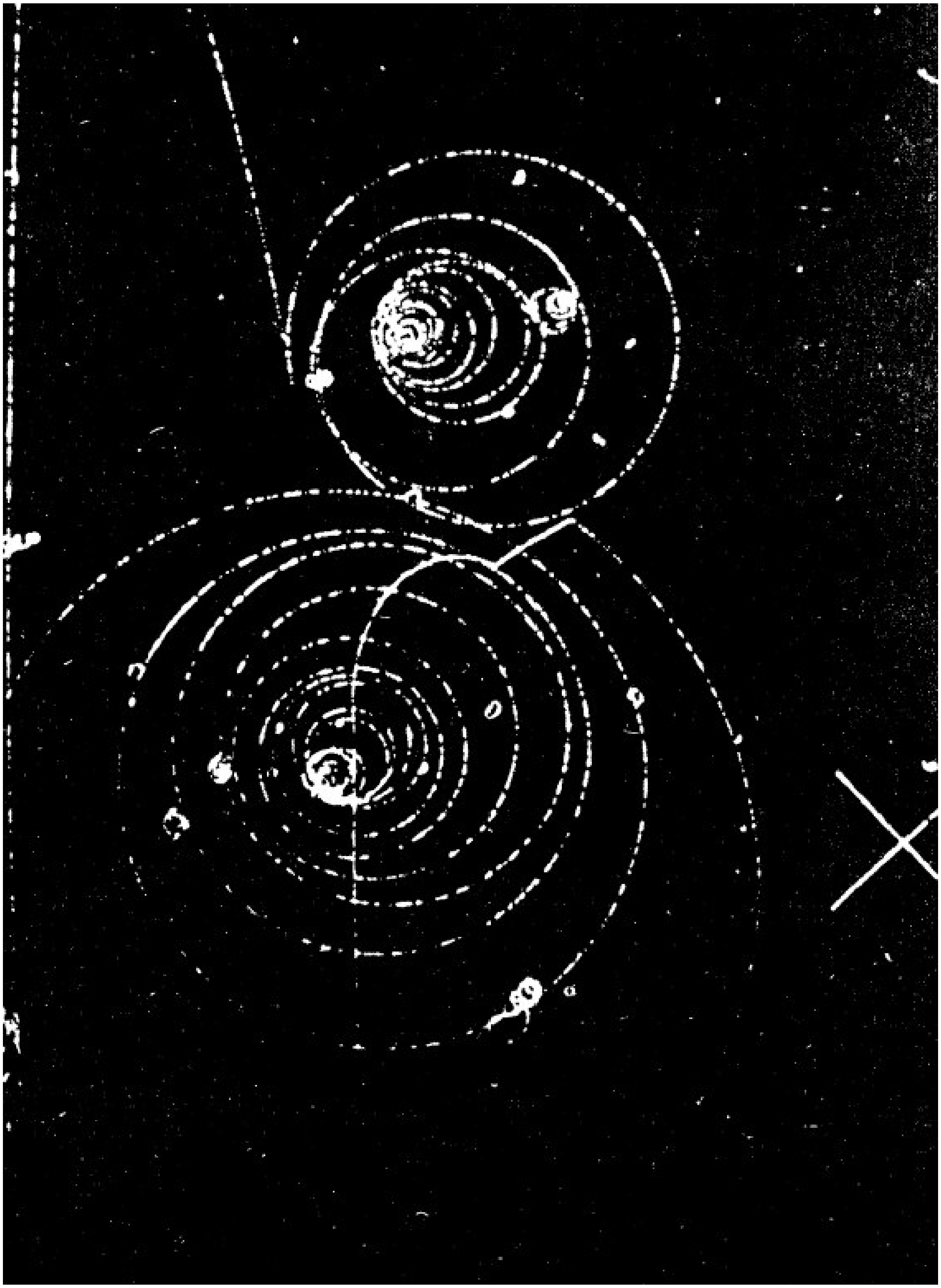
GRAVITATION AND THE COSMIC RADIATION FIND THE COMMON ORIGIN IN DIFFUSE ELECTROMAGNETIC ENERGY

It appears interesting to us to show how the diffuse cosmic radiation, the surprising behavior of the neutrinos as well as the existence of the forces of gravitation, can find a satisfactory explanation within the framework of the assumption of the energy mediums and the law of materialization.

We saw (**§ 2**) that the relation of mass-energy equivalence had been established by the ***restricted Relativity***, paradoxically, as the law rather absolute than relativistic, because this theory could not consider applying the Lorentz-Maxwell's transformations to the homogeneous mediums where $\mathbf{vo = 1\sqrt{\varepsilon o \eta o}}$ the speed is different from the limit ***c*** considered, a priori, like a universal constant.

We showed, indeed, that the laws of the electromagnetism lead us to admit, for the energy of mass available, a value which depends on the propagation velocity of the electromagnetic waves in the medium considered, $\mathbf{wo = movo^2 < moc^2}$**.** This inequality shows clearly that the energy of mass increases when the average energy density of matter is reduced, or, which returns to same, when displacements are carried out towards areas where the density of matter is lower. That occurs, in particular, when one moves away from the material bodies which represent a gigantic concentration of energy. The difference of the squares of propagation velocities can then be regarded as the equivalent of a gravitation potential difference. *This equivalence that we will further show, on the basis of the Maxwell's equations, makes it possible to write:*

$$\mathbf{v1^2 - v2^2 = \Delta W/mo = Vg1 - Vgo.}$$



P1. IV - Traces of particles charged in the bubble chamber with C.E.R.N. Due to the load, the trajectories are rolled up in spirals under the action of the magnetic fields.

The sign of this difference emphasizes the general tendency of energy-matter to be concentrated; let us foresee, already, the origin of the gravitation forces.

A difficulty emerges, however, when the following experimental fact is considered: apart from the resultant of the pressures exerted on its external surface, a solid body has a weight which does not appear to depend on the surrounding material medium. No matter, if it is in the air or in the vacuum, the weight of a given body, measured to the surface of the ground, does not show any difference. It is thus necessary that the speed ***vo*** is taken into account and that is the speed of the electromagnetic waves within the diffuse medium which extends between the divergent zones constituting the matter.

The difference **c - vo** by which the speed ***c*** enters the intersidereal vacuum, as well as the speed ***vo*** existing in the matter void on the surface of the ground, must then be able to be calculated easily since one knows the correspondent gravity potential difference. This difference is equal to ***9, 81 Ri (M. K.S.),*** where ***Ri*** represents the radius of the ground:

9, 81 · 6, 37 · 10 (exp. 6) = c^2 - vo^2 ≈ 2c · (c-vo), where:
c-vo =9, 81 · 6, 37/6 · 10 (exp. -2) = 0, 10 m/s.

Such a difference, for a speed ***c*** appreciably equal to **3 · 10 (exp. 8) m/s**, is ridiculously small and its experimental measuring in contemporary physique remains out of question.

As surprising as that can appear, it is this negligible difference in speed which seems responsible for the existence of the gravity potentials. *And one then understands the failure of the theories which wanted to explain the gravitation by regarding the speed of the light in the vacuum as a universal constant.*

There are other known results which militate in favor of the diffuse energy mediums existence that are responsible for gravitational interactions. Let us remember again of indeed the elementary law of Newton
f = - kmm'/r^2·grad r, with **k = 6, 7 · 10 (exp.-11), (M.K.S.).**
We note that this law involves the same formal consequences for the fields, the potentials and the energies, as it does the law of Coulomb in electrostatics; *with the close difference, the two masses of comparable nature exert between them forces of attraction, whereas two electric charges of comparable nature have a repulsive action.* Let us recall that the field of gravitation ***G*** derives from one potential ***V, G = - grad V,*** with **V= km/r + Cte.**

Inside a medium of the mass volume $p = \partial m/\partial \tau$, the divergence for its expression is, **div G = -4πk*p***.

For any elementary displacement ***dl*** of a punctual mass ***m*** in a field ***G***, the elementary work provided by this mass is equal to:

$$dG = f \cdot dl = - m \cdot gradV \cdot dl = - m \cdot dV.$$

If we say that ***W1*** is the initial energy of a given system and ***W2*** its final energy, after passage from the state (**1**) to the state (**2**), we can write:

$$W1 - W2 = \int_1^2 dG = - \int_1^2 m \cdot dV = m(V1 - V2).$$

Let us consider a finished solid limited to a non-deformable volume ***ro*** of density ***p (x, y, z)*** and of total mass ***m***, brought back to three axes of co-ordinates which are associated for him.

Let us suppose that this solid is subjected to a field of gravitation deriving from the potential ***V1 (x, y, z);*** during the translation **Δ/(Δx,Δy,Δz),** the function potential ***V1***, brought back to the axes of the solid, becomes ***V2 (x, y, z)*** and satisfies the equality:

$$V2(x-\Delta x, y-\Delta y, z-\Delta z) = V1(x,y,z).$$

If this function is defined in any point of space, the energy which the solid in its translation provides can be calculated by the integral sum of the **τo** volume which limits it and of the energies provided by each elementary volume ***dτ***:

$$W1 - W2 = \iiint_{\tau o} (V1-V2) \cdot p \cdot d\tau.$$

By calling ***Go*** the Δfield created by the solid itself, by utilizing the relation ***p*= div G/4πk** and by noting that **Go=0** with the exterior of the solid, we can extend the integral to all the space while writing:

$$W1 - W2 = - 1/4\pi k \iiint (V1-V2) \cdot div\ Go \cdot d\tau.$$

By using the relation:

$$div\ (V1-V2)Go = (V1-V2) div\ Go + grad\ (V1-V2) \cdot Go,$$

and applying the theorem of Green and Ostrogradsky, we obtain:

$$W1 - W2 = - 1/4\pi k \iint_s (V1-V2) Go \cdot dS + 1/4\pi k \iiint grad\ (V1-V2) \cdot Go \cdot d\tau.$$

If it is a closed surface which it is necessary to tend towards infinity since the integral extends to the entire space.

Under these conditions, if ***(V1 - V2)*** tends towards zero, which is the case if we suppose that the potential ***V***, due to masses located remotely finite, is integrated along surface **S**, as $\iint_S$ **(V1-V2)Go·dS** and is annulled, since, $\iint_S$ **Go·dS = - 4πkmo**, and, in addition, takes the finite value. (Theorem of Gauss).

We can write consequently:

$$W1-W2= 1/4\pi k \iiint \mathrm{grad}\,(V1-V2)\cdot Go \cdot d\tau,$$

and that is to say:

$$W1-W2= - 1/4\pi k \iiint \mathrm{grad}\,(G1-G2)\cdot Go \cdot d\tau.$$

We note that ***G2*** results from ***G*** by the translation Δl and that we thus have for the all space:

$$\iiint (G2)^2 \cdot d\tau = \iiint (G1)^2 \cdot d\tau$$

and that involves:

$$W1-W2= - 1/8\pi k\left[\iiint (Go+G1)^2 \cdot d\tau - \iiint (Go+G2)^2 \cdot d\tau\right].$$

We deduce some:

$$\partial W1/\partial\tau = po-1/8\pi k \cdot (Go+G2)^2.$$

Go + G1 represents the total field of gravitation which existed in space before the translation and also ***Go + G1*** which remains after the translation is completed. We thus obtain the energy equivalence of the gravitation fields:

$$\partial W1/\partial\tau = po-1/8\pi k \cdot (\gamma)^2$$

γ represents, in this relation, the field of gravitation and ***po*** the density of diffuse energy. To consider ***po=0*** is an error which leads, for $\partial W1/\partial\tau$**,** to a negative energy, in obvious contradiction to the principle of energy conservation.

This error, which results from the lapse of memory of a considerable complementary term, nevertheless was made in general Relativity [14].

We are thus constrained to admit that the matter vacuum must contain, actually, an important quantity of diffuse energy having a finished density p0 in interstellar space. A simple calculation shows, indeed, that one cubic meter of empty matter space on the surface of the ground contains, in the form of energy diffuses **57.000 Mega joules** less than one cubic meter of interstellar space. It is thus well necessary that this energy exists, whether it is in this form or another!

The energy of gravitation is every day reality. We know to measure it, to calculate it, and to use it. We also know that it results from the presence of the matter in the universe, therefore of that of the material masses and if, as we admitted, these masses are equivalent to the electromagnetic energies locally imprisoned within divergent zones, there must be, necessarily, a close relationship between the gravitation and electromagnetism, the ratio for a long time suspected, likely to explain the experimentally noted effects.

We refer to the decomposition of the diffuse electromagnetic waves and their elementary transverse components, under consideration at the end of the precedent paragraph 8.(p. 84). This decomposition enables us, after integration, to write for each independent surface Si, the following relations:

$$\partial \boldsymbol{p}\mathbf{i}/\partial\tau = \varepsilon Ei \wedge \eta Hi = 1/c^2(Ei \wedge Hi), \quad \varepsilon(Ei)^2 = \eta(Hi)^2, \quad Ei \cdot Hi = 0.$$

The theorem of Poynting, in addition, makes it possible to obtain:

$$\text{div}\,(\partial \boldsymbol{p}\mathbf{i}/\partial\tau) = 1/c^2 \cdot \partial/\partial t[\varepsilon(Ei\partial^2 + \eta Hi)^2/2] = -1/c^2 \cdot \partial^2 Wi/\partial\tau\partial t,$$

with $\partial Wi/\partial\tau = \varepsilon(Ei)^2$.

If we choose as the wave surfaces, the surfaces **si(x, y, z) + jT = Cte**, with **(grad si) ² = 1**, we may calculate:

$$\left|\begin{array}{l} \partial \boldsymbol{p}\mathbf{i}/\partial\tau = \varepsilon(Ei)^2.\ \text{grad si} = -\ \partial Ui/\partial si \cdot \text{grad si} \\ \varepsilon(Ei)^2/c = -\ \partial Ui/\partial si = 1/c \cdot \partial Wi/\partial\tau. \end{array}\right.$$

The $\varepsilon(Ei)^2$ depends only on the function ***Si*** and ***T***; supposing further the independency of wave surfaces, i.e. of the ones compared to the others, we obtain:

$$\overline{\underline{\partial \boldsymbol{p}\mathbf{i}/\partial\tau = -\ \text{grad Ui}.}}$$

By calling ***p*** density of diffuse electromagnetic energy in each point of the space which one will suppose homogeneous, and while posing successively:

$$\sum_{i=1}^{n} \partial^2 \boldsymbol{p1}/\partial\tau\partial t = \partial^2 \boldsymbol{p}/\partial\tau\partial t = \boldsymbol{p}/c^2 \cdot \partial v/\partial t = \boldsymbol{p}/c^2 \cdot \gamma,$$

and, $\sum_{i=1}^{n} \partial U\mathit{1}/\partial t = c^2/\boldsymbol{p} \cdot \partial U/\partial t = V,$

we obtain finally:

$$\boldsymbol{\gamma = -\,\mathrm{grad}\ V}$$
$$\boldsymbol{\mathrm{div}\ \gamma = 1/c^2 \cdot \partial^2 V/\partial t^2}$$

The vector $\boldsymbol{\gamma = \partial v/\partial t}$ is an acceleration which returns us to gravitation field created in space by the presence of the diffuse electromagnetic energy of density ***p***. The ***V*** represents the gravitation potential and the result obtained, by noticing that $\mathbf{div\ grad\ V = \Delta V}$, makes it possible to write that the Dalembertienne function of the potential ***V*** is null:

$$\Box V = \Delta V - 1/c^2 \cdot \partial^2 V/\partial t^2 = 0$$

This relation expresses that an unspecified gravity disturbance is propagated, in a diffuse energy medium with stationary inertia, at the same speed as the electromagnetic waves. This result can explain, without calling upon General Relativity, the advance of the perihelion of the Mercury planet. The corresponding calculation was made, some time ago, by M. Surdin [**16**].

The equations obtained show us that the forces of gravitation are due to differences in diffuse density energy which correspond to extremely high statistical frequencies, as we will see it further. If we admit, in addition - what seems probable - that density of energy $\boldsymbol{\partial W/\partial \tau}$ is equal to ***p***, we obtain for the gravity potential:

$$V = c^2/p \cdot \partial U/\partial t = c^2/p \cdot \partial W/\partial \tau = c^2 = 1/\varepsilon\eta$$

This relation confirms the value of the potential of gravitation which is not other than the square of the propagation velocity of the electromagnetic waves in a given medium of a stationary inertia that is empty of matter.

If the potential does not vary according to time, we find the traditional equations which the law of Newton confirms (see Annex 8, p. 135 and 136).

$\boldsymbol{\gamma = -\,\mathrm{grad}\ V}$, $\boldsymbol{\mathrm{div}\ \gamma = 0}$.

We can then write the general form of the equations which govern the fields of gravitation:

$$\boldsymbol{\gamma + \mathrm{grad}\, V = 0}$$
$$\boldsymbol{\mathrm{div}\, \gamma + 1/V(\partial^2 V/\partial t^2 + 4\pi k pm) = 0}$$

In these equations, **V = 1/εη, k = 6, 7 · 10(exp.-11), (M. K.S**.), the gravitation constant and ***pm*** is the density of energy-matter at the point considered.

It is important to note that these equations are only approximate and that they are justified only if the relative variation of the permittivity ***e*** of the matter vacuum remains weak.

According to the energy equivalence, $p = po - (\gamma)^2/8\pi k$, let us to suppose, that the fields of gravitation, just like the electric fields, have a limit. It is not impossible that this limit, appreciably equal to $yo = 2\sqrt{2\pi k po}$, is reached on the star surface formed by a fantastic energy-matter concentration. Along the star surface, the gravitational forces of attraction can tend to approach the limit ***yo***. Those then must be able to suddenly disappear and then to reappear, thus creating of, by relieving, the maintained oscillations. The gravity potential and, consequently, the propagation velocity, being almost null in their vicinity, on these stars must be obscure emitting no other electromagnetic signals, but of a very great wavelength that bring them back to the domain of a diffuse energy space [19].

It is important to note, in addition, that an electromagnetic wave can be regarded as the average statistical demonstration of the perturbing energy medium which it seems well to be its fundamental constituent. This disturbance is propagated by involving the medium partially, following the volume of integration **τm**, considered (***1***); that implies, consequently, the existence of a accompanied gravitation field. This field can be easily calculated if we know the total density of energy ***p*** in the reference frame related to the medium with stationary inertia of observation.

We obtain then, for an electromagnetic wave described by the Maxwell's equations, the expression of the associated gravity field:

$$\gamma = c^2/p \cdot \partial/\partial t \cdot \partial p/\partial \tau = c^2/p \cdot \partial/\partial t\, (\varepsilon E \wedge \eta H).$$

That is to say:

$$\gamma = 1/p \cdot \partial/\partial t\, (E \wedge H)$$

We see, as the gravity field created by an electromagnetic wave is getting high, that the electric field itself also raises so that its variation in time is faster and the energy density ***p*** is getting lower.

When the wavelengths are sufficiently large, the electromagnetic agitation which constitutes the diffuse medium is measurable using tuned circuits which we know to build. We note, however, that in the field of measurable wavelengths, the density of energy is too low to justify the importance of the forces of gravitation which appear in the vicinity of the material bodies. We are to note that for wavelengths of the same order of magnitude as dimensions of the atoms, we do not have any average physique of detection of diffuse electromagnetic energy, except the forces of gravitation themselves.

(***1***) Let us recall on this subject that the medium is defined in volume R by the average integral: $\iiint_{\tau} \mathbf{m}(\varepsilon \mathbf{E} \wedge \eta \mathbf{H}) \cdot d\tau = 0$.

The materialized energy of the photons can, on the other hand, be detected by photoelectric effect. *This fundamental difference makes it possible to explain the odd behavior of the hypothetical neutrinos which refuse, in general, to appear by photoelectric effect. Doesn't it act there, clearly and simply, in the case of dematerialization of 'material energy' which turns over to the diffuse medium? This satisfactory assumption is in the line of the theory suggested.*

Reciprocally, if diffuse energy, as it should it be admitted, is indeed very high in the cosmic space, the corresponding electric fields must sometimes there reach their disruptive limit ***Ed*** and give birth, according to the materialization law, to particles which, the put aside the frequencies, will have, in general, very high energies. Can't one see there, also, a satisfactory and simple explanation of the diffuse cosmic radiation?…

It is not surprising that this radiation occurs within interstellar space where we saw that the density of energy diffuses was maximal. The curve of distribution of cosmic energies is thus likely to provide us invaluable information on the average density ***po*** of diffuse energy in galactic space.
If we call ***c*** the mean velocity of electromagnetic wave propagation in this space of density ***po***, then the gravity potential ***V***, on the surface of a spherical star of radius ***R*** and mass ***M*** plunged in this space, is then given by the relation:

$$\mathbf{V = c^2 - k\, M/R = v^2}$$

where ***v*** represent the propagation velocity in the vacuum on the surface of the star and ***K*** the Newton's constant.

This relation enables us to calculate the speed ***v*** on the surface of any star, when we know its mass and dimensions.

We already saw that between sidereal space and the surface of the ground, the difference ***c - v***, was **0, 1 m/s.**

With regard to the surface of the sun, calculation shows that difference ***c-vs*** is approximately **300 m/s**. From there, relative difference is Δ**vs/c=10(exp.-6**).

The extreme smallness of these relative variations helps us with better understanding why the speed of light in the vacuum could give us, for so long, the illusion of a universal constant. This speed depends, actually, of the proximity of energy-matter, and the variation of the refraction index which results from this, with a more or less proximity involves the calculable deviations of the trajectory of the luminous radii and electromagnetic waves [17].

10

THE PRINCIPLE OF INERTIA, EFFECT MOSSBAUER AND THE BEAM DISPERSION PHENOMENON

The relation of equivalence between the mass and energy, such as is established by A. Einstein, ***W == mc2***, implicitly includes the potential energy of gravitation of the materialized body of mass ***m***.

We can thus write that the total energy of a solid body ***mo*** animated of a uniform movement speed ***v***, in a medium with stationary inertia corresponding to the gravity potential, $\mathbf{c^2 = V}$, is the sum of its kinetic energy, $\mathbf{moc^2 \cdot [1/(\sqrt{1-v^2/c^2}) - 1]}$, and of its potential energy, $\mathbf{moV=moc^2}$.

$$\mathbf{W = moc^2/(\sqrt{1-v^2/c^2}) = mc^2 = mV}$$

We note whereas total energy ***W*** of a material body in free fall remains constant and we deduce the equalities from there:

$$\mathbf{moc^2/(\sqrt{1-v^2/c^2}) = moco^2,}$$

$$\mathbf{- v \cdot dv = [1-3c(exp.4)/co(exp.4)] \cdot c \cdot dc}$$

Speed ***c*** is, in general, far from different from ***co*** and we can write:

$$\mathbf{v \cdot dv \approx - 2c \cdot dc.}$$

and from there:

$$\mathbf{v \cdot dv/dt \approx - 2c \cdot (\partial c/\partial x \cdot dx/dt + \partial c/\partial y \cdot dy/dt + \partial c/\partial z \cdot dz/dt).}$$

$$\mathbf{v \cdot \gamma \approx - v \cdot grad\ c^2.}$$

It, however, comes out from this approximation that the equality, ***Y* = - *grad V***, is valid only if the gravitation potentials remain sufficiently close in relative value. This observation confirms the imperfection of the physical laws which are always approximate. They are often asymptotic statistical laws, impossible to formulate in the absolute, but, however we can improve them in numerical precision, via terms or using complementary parameters which take account of the new results provided by finer experimental measurements. *Energy of mass, energies kinetic and potential are of the same nature. It is difficult to establish among them a clear distinction and that itself, without posing any principle, complies with the equivalence of the gravitational and inertial forces.*

With an observer placed in a medium with external stationary inertia in a mobile vehicle of total mass at rest ***mo***, which is moving uniformly at the speed ***v***, compared to this medium, it will appear that the mass of the vehicle increases $\Delta \mathbf{m} = \mathbf{mo} \cdot [1/(\sqrt{1-v^2/c^2}) - 1]$.

On the other hand, for the observer who is in the similar vehicle as previously described, but involved with the medium of interior stationary inertia, it is the square of the propagation velocity of the electromagnetic waves which will vary the quantity

$$\Delta c^2 = \Delta V = c^2 \cdot [1/(\sqrt{1-v^2/c^2}) - 1].$$

That returns us, in these two cases, to allot the same total energy ***Wt*** to the both vehicles in displacement:

$$W1=moc^2 + moc^2 \cdot[1/(\sqrt{1-v^2/c^2}) - 1] = (mo + \Delta m)c^2 = mo(c^2 + \Delta c^2).$$

For the external observer, Wt energy is equal to $\mathbf{mc^2}$**;** but for it that works inside the vehicle, this energy is equal to $\mathbf{moc1^2}$ with $\mathbf{c1=c^2 + \Delta c^2}$**.** There is well conservation of the energy and $\mathbf{mc^2}$ remains equal to $\mathbf{moc1^2 = moV1}$**.**

We thus discover a generalization of the principle of inertia where the free fall in a gravitation field can, in no way, be distinguished from the uniform movement.

In interior of a medium with stationary inertia limited to the non-deformable ***to*** *volume, the speed of the light* ***c*** *in exterior of the divergent zones remains constant and isotropic in any point of the given medium, within the limits of extremely reduced statistical discrepancies that are inaccessible to measurement.*

Any anisotropic speed ***c*** involves, in an energy medium, the appearance of accelerations, ***y = - grad c²***, that are responsible for the forces of gravitation ***my*** or inertias ***- my***. Within the medium which is not any more with stationary inertia, the inertias and forces of gravitation are equalized and nothing makes it possible to distinguish acceleration from the action of a gravitation field. We will decide, for this reason, to call the quantity ***V***, the ***synergy potential***, $\mathbf{V = 1/\varepsilon\eta=c^2}$**,** carrying out the speed of electromagnetic wave propagation in of the vacuum.

We showed that the coefficient of quantification, $\mathbf{h=8\pi ko\sqrt{\eta/\varepsilon} \cdot q^2}$ as well as the speed propagation **c,** $\mathbf{c = 1/\sqrt{\varepsilon\eta}}$, were not universal constants. It seems, on the other hand, that in the nonmaterial mediums it is possible to consider, with a good approximation, the permeability $\boldsymbol{\eta}$ like an invariant; what makes it possible to write: h/c = $\mathbf{8\pi ko\eta q^2 = 6,\ 625 \cdot 10(exp.-34)/3 \cdot 10(exp.8) = 2,\ 208 \cdot 10(exp.-42)Js^2/m}$**,**

$$\boxed{h/c = Cte}$$

P1. V --- THE ANIMATED DESIRE OF MANKIND TO KNOW, TO FORSEE AND TO CONTROL BETTER THE HUMAN DESTINY; A MAN, ENGAGED IN A DARING CONQUEST OF SPACE AS, ILLUSTRATED BY ASTRONAUT EDWARD WHITE IN FREE FALL IN THE VICINITY OF OUR PLANET.

The precise knowledge of the speed of light in the vacuum will allow us to comprehend, in every moment and at each point of space, the synergic potential c^2, as well as gravity and kinetic potentials**,** simply by comparing the surface of the earth to any other medium taken as reference.

Within the framework of the assumptions suggested, it appears that the frequency associated with a determined quantum phenomenon, brought back in its stationed medium of emission, remains practically independent of the energy concentration in this medium; that results from supposing that the appropriate frequencies associated with the stable elementary particles like are electrons, protons and cores stay independent of the physical characteristics of the medium. *Such an assumption suggests that the stability of these elementary particles could extremely well correspond to frequencies of resonance in the curve of diffuse energy distribution which would be thus similar to the curve of distribution of the energy of quantified matter.*

Let us consider a photon emitted at the frequency ***vo*** in a medium where the speed of light is equal to ***co*,** i.e. where the synergetic potential is **Vo =** co^2**.** This potential can be due to the gravity action, to the effect of inertia of a medium moving uniformly, or to that of a medium in free fall. The energy, **$W_t = h_o v_o$**, of the photon is preserved, in each case, and if this photon is received in a medium where the speed of the light is ***c*** and where, consequently, its synergetic potential is equal to **c_1^2,** this energy is equal to **$W_t = h_1 v_1$**, and further to: **$h_o v_o = h_1 v_1$.** We can write then, according to the wavelengths function, the equality:

$$h_o c_o / \lambda_o = h_1 c_1 / 1\lambda$$

The ratio between the coefficient of quantification ***h*** and the speed of propagation ***v*** remains constant, **$h_o/c_o = h_1/c_1$** , and finally we have:

$$\lambda_1/\lambda_o = c_1^2/c_o^2 = V_1/V_o$$

These relations quantitatively translate what we call "the Mossbauer effect" that we can also express in the differential form [18]:

$$\Delta\lambda/\lambda = \Delta c^2/c^2 = \Delta V/V$$

If medium, of synergic potential **$V_o = c_o^2$** at the uniform speed ***v*** moves within the medium of potential **V_1- c_1^2, ($V_1 < V_o$),** the ***v*** being weak in front of c1, the Δ**c^2** variation is also very weak and for the medium of observation, we may write:

$$c_o^2 \cdot \sqrt{1- v^2/c^2} = c_1^2$$

c can be regarded as an average value, **$c^2 = c_o c_1$**, for example, from where:

$$\lambda_o/\lambda_1 = 1/\sqrt{(1- v^2/c^2)}$$

This result does not take account of Doppler effect which also intervenes in measurements. The various cases are to be considered according to the medium in which the most of the photons propagate.

If the medium in displacement occupies a weak zone of space in the motionless medium of the observer and is approaching it while following an axis passing by the point of observation, the result of measurement provides the wavelength:

$$\lambda_2 = \lambda_1(1-v/c_1) = \lambda_o\sqrt{[(1-v/c_1)(1+v/c_1)]} \cdot (1- v^2/c^2).$$

If, on the other hand, the medium in displacement eloigns while following the same axis, the observer measures then the wavelength $\lambda 2$:

$\lambda 2 = \lambda 1(1+ v/c1) = \lambda o\sqrt{[(1+v/c1)(1 - v/c1)]} \cdot (1 - v^2/c^2)$.

We can also consider the case where the observer is in the medium in displacement and measure the wavelength of the photons emitted by a fixed source placed in the surrounding medium, **$V1=c1^2$** where the propagation is carried out. It finds then in this case:

--- if it approaches the source,

$\lambda 3 = \lambda o(1- v/c1) = \lambda 1\sqrt{[(1 - v/c1)(1 + v/c1)]}$

--- and if it moves away from there,

$\lambda 3' = \lambda 1\sqrt{[(1+v/c1)(1 - v/c1)]}$.

All these considerations enable us to discover a new phenomenon. Let us imagine, indeed, a compact beam of mono-energetic particles which move at the speed ***v*** in a medium of observation to stationary inertia. We admitted that this concentration of energy -- in uniform displacement and produced in the beam itself and its immediate vicinity --- entertains the medium. The speed of drive **Δv** can be calculated starting from the relation:

$$\Delta v = \frac{\iiint_{\Delta\tau o} \partial mv/\partial\tau \cdot d\tau}{\iiint_{\Delta\tau o} \partial W/\partial\tau \cdot d\tau} = \frac{\iiint_{\Delta\tau o} (\varepsilon E \wedge \eta H) \cdot d\tau}{\varepsilon o\eta o \iiint_{\Delta\tau o} [p + (\varepsilon E^2 + \eta H^2)/2] \cdot d\tau}$$

In this relation ***E*** and ***H*** represent the fields, electric and magnetic, associated to the particles in motion, 1/**εoηo**, carries the propagation velocity in the medium of observation of which the density of diffuse energy, on the level of the beam, is equal to ***p***. The composition of velocities must be done according to the laws of traditional kinematics which allows us to write that the speed of each particle, in the medium of observation, is equal to the speed ***v*** in the other medium involved, increasing its driving speed accordingly, **Δv**.

That is to say: **$vo= v + \Delta v$**.

If the energy of a material particle, in the beam, is equal to **$W = moc^2/\sqrt{1-v^2/c^2}$,** it must have, compared to the external observation medium, the energy appreciably equal to **$Wo = moc^2/\sqrt{[1-(v+\Delta v)/c^2]^2}$**.

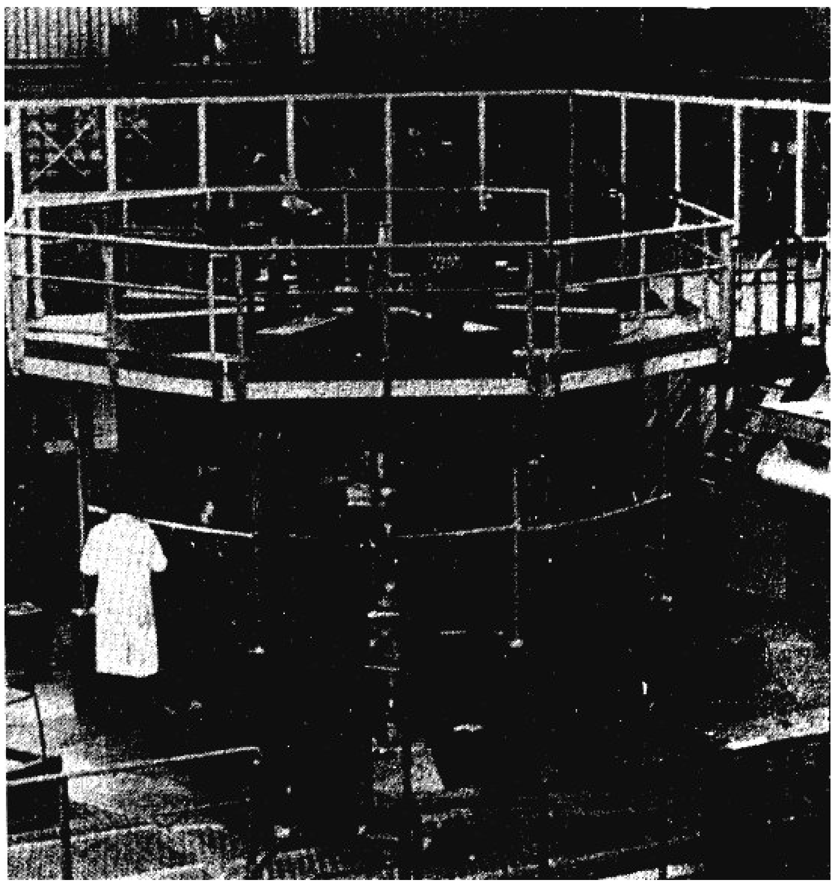
That is the difference

$\Delta W = Wo-W \approx mov/[(1-v^2/c^2)(exp.3/2)] \cdot \Delta v$.

The electromagnetic study of the quantum relations has shown to us that the coefficient of quantification **$ho = \eta q^2/2\acute{\alpha}o \cdot vo$ (§4, p. 31)** depend on the medium via the propagation velocity ***vo***. The relation ***W = hv*** thus provides us, by taking account of the Doppler effect, the information that specifies the energy of a particle compared to the energy of the surrounding medium. It follows that the brutal dispersion of the mono-energetic beam using a material target, for example, makes the speed of drive **Δv** to disappear. By noticing that the variation of ***c*** is in practice very weak, dispersion must allow the description of the frequency difference **Δv** such as:

$$h \cdot \Delta v = h \cdot (vo - v) = Wo - W \approx mov/[(1-v^2/c^2)(exp.3/2)] \cdot \Delta v.$$

When speed ***v*** is rather close to ***c***, the difference ***Wo - W*** can be very high and consequently measurable.



P1. VI --- This ring of the nuclear fusion controlled by magnetic containment of the plasma in “TOKAMAK” reactor type, designed by Soviet physicists, made it possible to prove that it was possible to collect the diffuse energy of gravitation per reconstitution, in plasma, radioactive “beta” isobars.

It can thus be interesting, even with a weak increase in the total power, to increase the energy concentration and the density of the beams in the large accelerators currently in service.

A particular experimental proof of this phenomenon can be easily given while concentrating, on a solid target, the infra-red beam of a powerful laser. *The noted effects are, without any doubt, the work of particles that are having, in the observational medium, the energies quite higher than that which an insulated infra-red photon would be able to provide.*

11

ELECTROGRAVITATION AND THE ELECTROMAGNETIC PROPULSION

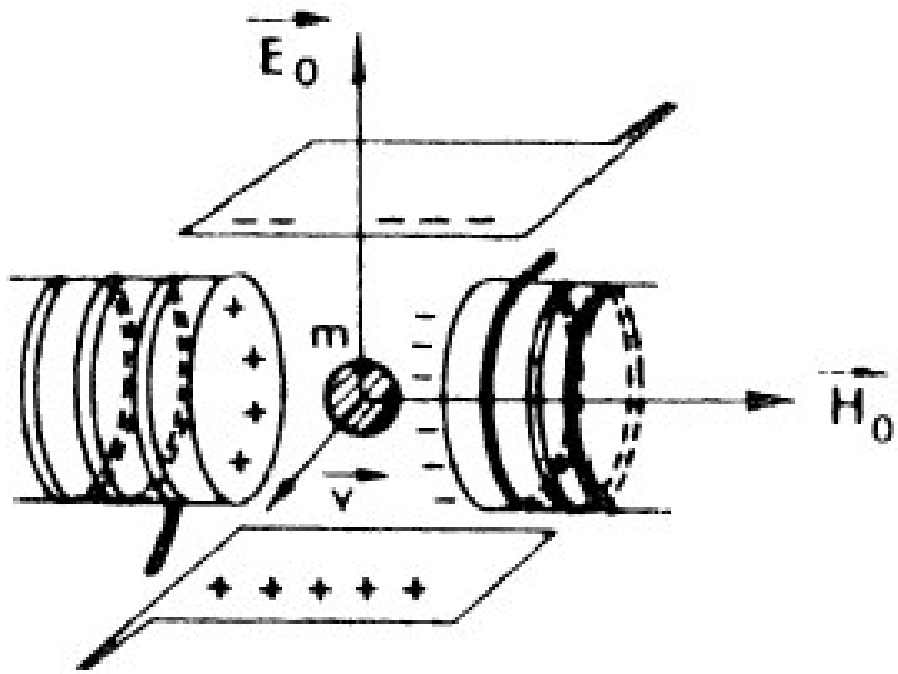
We saw that an electromagnetic wave was accompanied by a field of gravitation equal to $\gamma = 1/p \cdot \partial/\partial t$. Those fields must be, in general, extremely weak. Although we are unaware of the exact value of it, ***p*** undoubtedly represents a very high energy.

In order to be able to evaluate the possibilities which the artificial creation of fields of gravitation via the electromagnetic waves can offer, it is necessary to consider experiments likely to allow the determination of the value of this density of energy diffuses ***p***.

To this end, it appears convenient to study the combined action of an electric field ***E*** and of a magnetic field ***H***, that are of raised values, perpendicular to each other and variable in time; those should be tested on a mass of small dimensions that consists of a dielectric material which involves only very weak variations of electric field lines, as well as of magnetic, (**fig.15**). While making quickly pass the field of the initial value ***Eo*** at zero moment, with a zero value reached at moment **0**, we can write the equality:

$$\int_{o}^{o} (m+M)\gamma \cdot dt = \int_{o}^{o} m/p \cdot \partial/\partial t\,(E \wedge H) \cdot dt,$$

the equality in which ***M*** represents the mass of the reinforcement support to ***m***.



P1. VII. --- THIS IMPOSANT RADIO TELESCOPE, INSTALLED ON THE JODRELL BANK, HAS ONLY ONE NARROW CHANNEL OPEN AT THE RANGE OF DIFFUSE ELECTROMAGNETIC ENERGY SPECTRUM WHICH TRAVERSES THE VASTNESS OF UNIVERSE.

For wavelengths corresponding to fractions of angstrom, diffuse energy is not materialized and it seems possible to be detected only by its gravitational effects.

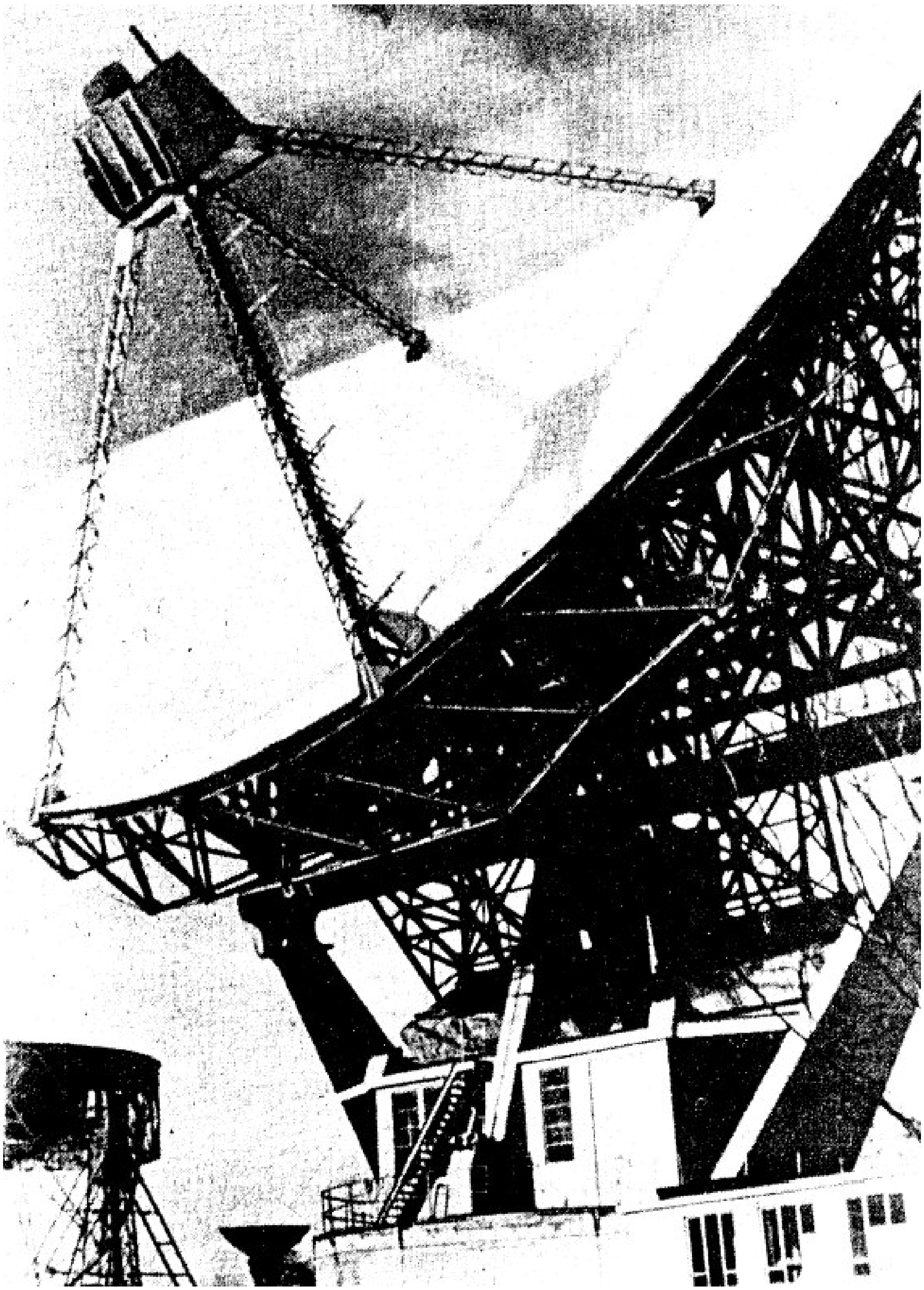


Fig.15. --- The polar parts of one electro-conductor and its reinforcements charged with a capacitor creating magnetic field ***Ho*** and the electric field ***Eo***. The discharge of the capacitor makes ***Eo*** field to disappear so transferring to the mass ***m,*** the momentum:

$$(m+M)v = m/p\ (Eo \wedge Ho).$$

By noticing that ***y*** is equal to ***dv/dt,*** we can proceed to integration of the two members of the preceding equality and to obtain between the momentums, the following relation:

(m+M)v = m/*p* (Eo ^ Ho).

Since ***Eo*** and ***Ho*** are perpendicular to each other, we can, knowing speed ***v***, the masses and the fields, to complete the search and to determine the density ***p***:

$$\boldsymbol{P = m/(m+M) \cdot |Eo| \cdot |Ho| / |v|}$$

The difficulty of such an experiment resides, not only at the measuring of low speeds, but also in the physical fact that it is difficult, in extreme cases, to distinguish a force of gravitation from an electromagnetic action, since it acts, actually, of the two aspects of the same phenomenon.

It is necessary to avoid, in particular, the resonances that come with the pseudo-periods of field variation, of the which it may result the calorific dissipation of the mass in consideration, so that, in principle, the expression, **γ = 1/p · ∂/∂t (Eo ^ Ho),** could not be any more valid and that holds for the transverse electromagnetic waves, especially.

It is not impossible that the use of magnetic ferrite bars more easily makes it possible to highlight the gravitational acceleration, having for expression: **γ = 1/p · ∂/∂t (E ^ H).**

We said, indeed, (§ 6, p. 62), that induction, **B = ηrηoH**, seems to correspond, actually, with a magnetic field which results from the superposition of the field of excitation ***H*** and the fields of two spins of the atoms oriented under the action of ***H***.

In a ferrite bar, the acceleration of gravitation must thus to be able to take the value, **γ = 1/*p* · ∂/∂t (E ^ B) = ηr/*p* · ∂/∂t (E ^ H).** , where **ηr** is the relative permeability of ferrite compared to the one of the vacuums. It can then be carried out an experiment using a crew suspended with a torsion wire, for example, (fig. 16) which horizontal arm supports, at its ends, two bars of ferrite polarized in opposite directions. These bars should be able, in their displacements, to pass between the reinforcements of two capacitors.

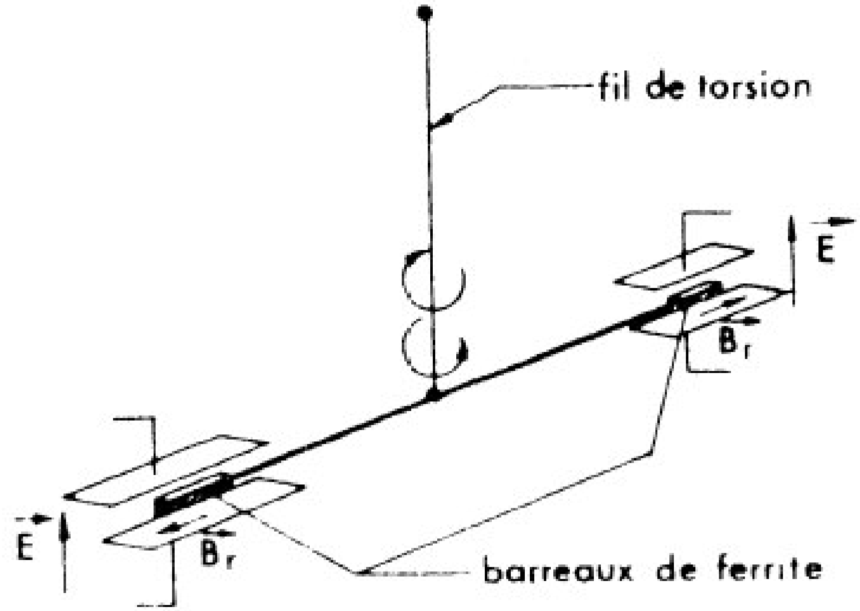


Fig.16. --- In each passage between the plates of the capacitors, the inversion of the electric field provides to the ferrite bars, **A** and **B**, the gravitational impulses which are produced by the oscillations of the torsion pendulum of which the suspended crew consist of.

By reversing the electric field for each passage of the ferrite bars between the reinforcements of the capacitors, it must be possible, via the impulses of gravitation which result from it, to communicate the oscillations that then maintain with the crew suspended by the torsion wire.

It is important to specify that the experiments which were quite summarily described do not have, for the moment, the practical application. It would be surprising, however, if the results of those will not positively fit.

If there were laboratories where such experiments would have been made and kept secret, let us say to their opposition that such simply objectified discoveries cannot be matter of secrecy and should be quickly announced and widely diffused. The knowledge must be available to the greatest number of people, and if it is not so, it does not have any value.

We saw that an electromagnetic wave transition is always accompanied by a gravitation field which effects are very weak and probably measurable with much difficulty. These effects are masked, on the one hand, by a density of diffuse energy ***p***, undoubtedly considerable, and by the dominating importance of the associated electromagnetic actions of the other fields. It is thus difficult to implement the electro-gravitational propulsion mode which would utilize the electromagnetic waves, because it would have to be made, with a poor output, against the prohibitory energies.

Calculation shows indeed, that in each case, the pushing energy obtained, $\mathbf{P = 1/c \cdot \partial W/\partial t}$, is being directly proportional to the energy ejected per unite of time and inversely proportional to the speed of ejection. The last is equal to the propagation velocity of the electromagnetic waves, while the push is reduced to its minimum for the same energy used.

In order to obtain a push of one kilo, for example, it would be necessary to eject, in the form of electromagnetic waves, an energy of 3000 Mega joules per second; that is to say a power of 3000 Mega watts.

The deduction of some that gives hope to implement the means of economical propulsion, using the Gravitation, presupposes the discovery of the possibility of direct action on the diffuse energy density distribution, ***p***, without the emission of electromagnetic waves.

The discovery of such a possibility cannot happen, to our opinion, without a more thorough knowledge of the matter properties and without taking into account the new elements which one developed theory inevitably reveals, the theory that is based on the existence of diffuse energetic mediums.

THE PROSPECTS FOR QUANTUM AND GRAVITATIONAL ENERGY THEORY

It could not act, in this work, to study in details all the phenomena which are explained by the existence of the energy mediums and the law of materialization.

The fact of finding, on the basis of the laws of traditional Electromagnetism, the equations of Relativity, those of the Wave mechanics and the Gravitation, are the elements which we considered to be sufficient to affirm all the experimental checks relating to each one of these theories that could, overall, be carried in the active of a general theory which confirms them.

There exists, however, of the particular and new results to retain, which are, in short, the following:

--- The Planck's constant, and the speed of light which is equal to the square root of the gravity potential, are not universal constants since that the permeability ηo of the vacuum can be regarded as such,

$$\mathbf{h = 8\pi k o \eta o \boldsymbol{q}^2 c} \qquad \textbf{and} \qquad \mathbf{c = \sqrt{Vg} = 1/\sqrt{\varepsilon \cdot \eta o}}$$

--- Energy equivalent to the mass, ***W = mc2***, whose expression was established by Einstein, and was shown as the general information (§ 2, p. 15) without calling upon the principle of Relativity, that conforms energy potential of Gravitation of the mass ***m***, W in only one and even expression,

$$\mathbf{mVg = mc^2 = m/\varepsilon \cdot \eta o}$$

--- Any transverse electromagnetic wave is accompanied by a field of gravitation which has as an expression,

$$\boldsymbol{\gamma} \mathbf{= 1/p \cdot \partial/\partial t\ (E \wedge H)}$$

--- For weak variations, the potential of gravitation, ***Vg*** , obeys the equation of propagation:

$$\Delta Vg = - 1/Vg\ (\partial^2 Vg/\partial t^2 + 4\pi k\rho m) = 0$$

Let us note that the vector-summation of fields of gravitation, or that of electric or magnetic fields, is not possible, at first approximation, that in the case of weak variations of the permittivity **ε**, because these fields take part in the existence even of the energy medium of propagation.

The most important discovery is certainly that of mediums made up of diffuse electromagnetic energy with the high concentration that is responsible for the inertias and gravitational accelerations; that discovery is the one which opens the way to a new research.

The existence of these diffuse mediums is confirmed by the electromagnetic fields and the fields of gravitation which are its measurable elements and which translate, with certainty, the existent and usable energy.

The water masses which descend through the channel of pressure pipes towards the hydroelectric factory use the diffuse energy of gravitation to actuate the turbines. This diffuse energy then is converted, channeled and then transported, at very low frequency, around the "high voltage" conductors which use the property of the charged particles to be able to condense or to convey this energy with weak losses. It is known, indeed, that the electric power transported by a conductor is, in major part, located, in diffuse form, in the space external to the conductor and that the usage of high electric fields, corresponding to high voltages, makes it possible to increase the proportion of this external energy with, for consequence, a reduction in the thermal losses in the conductor (Joule effect).

The existence of this not-materialized energy, which is not thermodynamic, is also confirmed by the dematerialization of the neutrinos and by the diffuse cosmic radiation which occurs within deep spaces where, as we saw, the density of diffuse energy is the highest.

Let us try to imagine how can be born a cosmic particle.

When the electric field tends, in a point of space and randomly of its fluctuations, to exceed the value limits ***Ed,*** the true "energy implosion" it must occur. The disruptive zones which appear must cause an increase in the permittivity **ε** and, consequently, those will also cause the deformation of the tension lines of the electric field. The concentration which results from it involves a depression of diffuse energy in the vicinity of the thus created cosmic photon, which is then projected at the speed, $\mathbf{1/\sqrt{\varepsilon\eta o}}$, in the diffuse wave direction, while taking from the surrounding diffuse chaos the energy proportional to its average frequency, $\boldsymbol{W = h\nu m}$. The cosmic materialization would thus be presented in the form of a true phenomenon of "negentropy".

If the distribution of diffuse energy is random, it must correspond to it a curve of distribution which, by recording in the experiments, would make it possible to know the most probable energy density in each field of the frequency $\boldsymbol{v}$*,* $\boldsymbol{v + dv}$. This curve of distribution constitutes, perhaps, the key of the mystery of the stability of the elementary particles of matter, explaining the natural Radioactivity as much as artificial.

Why stable particles, electrons, protons atomic nuclei, and their antiparticles, wouldn't correspond to energy peaks of this particular curve? (Fig.17).

Stability is perhaps, only the translation of a phenomenon of resonance which results from the ‘particle - diffuse medium’ interaction at the frequency corresponding to the one of the peaks of the distribution curve.

And why the peaks wouldn't be distributed according to the repartition of a decomposition in Fourier’s series?… with two average fundamental frequencies modulating one the other: that of the proton $\boldsymbol{vp}$ and that of the neutron $\boldsymbol{vn}$. The general term of this inter-modulation would have very roughly as an expression:

$$Ako \cos (ko\,vp\,t - \varphi o) \cdot Ak1 \cos (k1\,v\,nt - \varphi 1)$$

that is to say:

$$\mathbf{1/2ko \cdot Ak1\ [[\ \cos [(kov\boldsymbol{p} + k1vn)t - (\varphi o + \varphi 1)] +}$$
$$\mathbf{+ \cos [(ko\boldsymbol{vp} - k1\boldsymbol{v}n)t - (\varphi o - \varphi 1)\ ]].}$$

If product $\boldsymbol{Ako \cdot Akl}$ is maximal for $\boldsymbol{ko = k1}$ that can explain the stability of the cores in which the number of nucleons is equally distributed between neutrons and protons. Half-value layer could also explain the existence and the stability of the electrons and the deuterons, corresponding to $\boldsymbol{ko = kl = 1}$.

The shifts of peaks due to the superposition could also explain the existence binding energies. The probability of disintegration of a particle of energy, $\boldsymbol{E = hv}$, would be then lower as the corresponding derivative $\boldsymbol{dE/dv}$, of the diffuse energy distribution, would be weaker.

That should involve the existence, between the peaks, of particles meta-stable of which the lifespan could show rather great variations according to the fluctuations of the medium. Wouldn't these particles deserve then to be called “strange particles“?… Why wouldn't they correspond to “mesons” in the portion of curve located between the peak of the electron and that of the proton, and also correspond with “baryons” between the peak of the proton and that of the deuteron?

If that were so, the nuclear physicists should discover - using the accelerators of very high energy that are currently under construction - *the new meta-stable particles, the kinds of “hyper baryons“* that are located between the peak of the deuteron and that of the particle **ά**, and even beyond. The "triton" is, among these particles, that one which has, probably, the greatest lifespan.

It is not impossible that the natural radioactivity is, finally, the consequence of instability due to the low amplitude relating to the energy peak which corresponds to a radioactive core, compared to that of the statistical fluctuations of the ambient conditions.

The assumptions which have been just made are only susceptible suggestions to direct research towards a satisfactory interpretation of the nuclear phenomena. We think, however, that the studying of these phenomena in connection with the intimate matter structure and the physics in general, as with Astronomy and Cosmology, cannot any more neglect the existence of the diffuse electromagnetic mediums which seem to constitute the screen of our Universe; that is obliging us, in certain fields, to a substantial revision of our scientific designs.

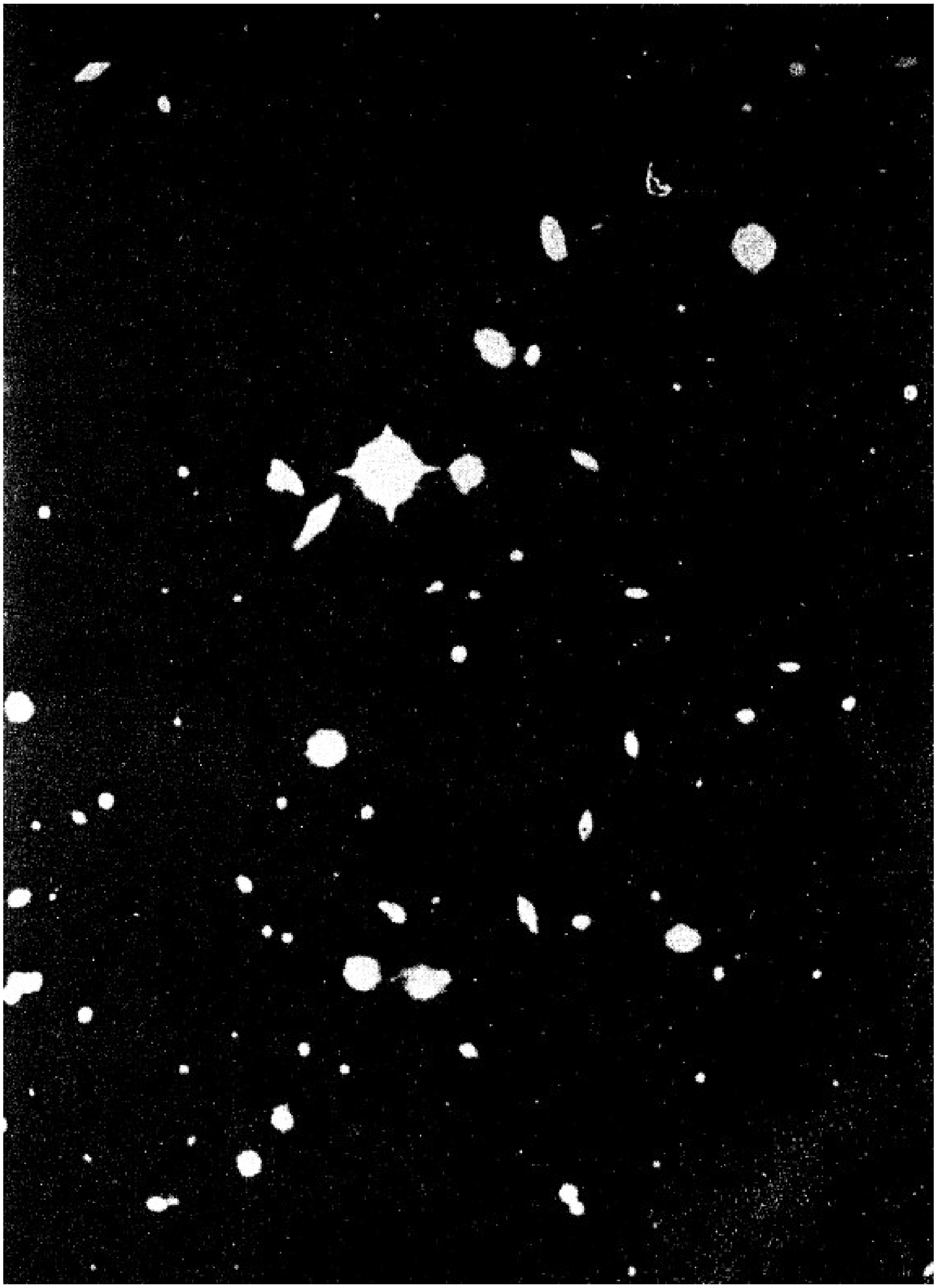
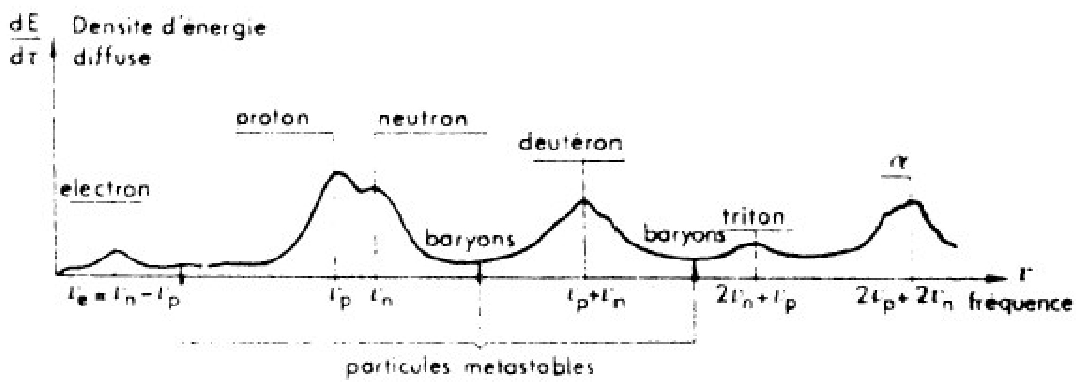


Fig. 17. --- We can imagine a curve of distribution giving the most probable density of diffuse electromagnetic energy according to the frequency function, which the peaks would correspond to the particles and to the most stable atomic layers. In this curve the peak of the electron would have for the abscissa coordinate ***ve = vn - vp + dvo.*** The difference ***hdvo*** corresponds to energy that is associated with neutrino and which simply represents its energy exchange with the diffuse medium.

We live certainly in a world in precarious balance of which we need, step by step, to discover all the secret links which constitute its causal reality, in order to be likely to ensure the future and the perennial existence of our specie threatened by currently close limits, which are position us, without any doubt, below the natural conditions of survival.

If, for example, the function of distribution of diffuse energy is, as it seems, responsible for the stability of the matter, one can be sure that the least shift of frequency relative to the peaks of this function, can involve an appalling cataclysm which would transform, almost instantaneously, our solar system in gigantic a nova, or even a supernova, where more then million years of human adventure would come to be destroyed, without no trace remaining about it, in a fantastic flashover. That occurred already and still occurs in all the galaxies, although the probability of such an upheaval is very weak.



P1. VIII. --- GALAXY CLUSTERS SEEN WITH THE LARGE TELESCOPE OF MOUNT PALOMAR IN A NEGLIGIBLE PART OF THE BOREAL HEMISPHERE.

These multitudes of Universe-Islands., which seems to populate the vastness of Cosmos, correspond to fantastic local condensations of materialized energies, although the density of diffuse energy is still very high there in the interstellar areas.

To avoid being the ignorant victims of a blind fate and relentlessness, to be likely some to act on our destiny, we must envisage - and to envisage, it is initially to know. And that requires a whole of knowledge at the base, pragmatic, simple and coherent.

Let us recall that the theory of quantum and gravitational energetic rest, primarily, *on the possibility of an electromagnetic representation of any density of momentum,* $\partial \mathbf{mv}/\partial \tau = \mathbf{D} \wedge \mathbf{B}$; the representation is suggested, at the origin, by existence of the Poynting's vector. This link, between traditional mechanics and the electromagnetism, makes us discover whereas the whole of the concepts of mechanics, of optics and physics in general, of matter, of energy and its potentials, or photons or particles, can be expressed by established electromagnetic terms starting from the fundamental equations of Maxwell-Ampere and Maxwell-Faraday.

Doesn't it act, in fact, as the true united theory?... which places *electromagnetism and electronics* at the base of the existence of matter and our entire sensible and observable universe.

It would be, however, not very reasonable to say that this Universe is gifted only of electromagnetic properties, because in that way it will not be possible for us to express scientifically the nature of things. But, let us affirm that on the other hand, because of the reports, all the currently known physical laws must be able to be expressed in terms which concern traditional electromagnetism.

Let us note that it does not exist, as for the experimental results, any conflict between the theory suggested and traditional Mechanics, or thermodynamics, or the quantum theory, or the Wave mechanics, or the restricted or generalized Relativity; those we may, at any moment, to call upon as evidences of the assumptions which were advanced. We must, however, reject any principal judgment a priori as that we thought of the subject false or debatable, since such approach is simply useless and sometimes is the obstacle to comprehension.

We showed, using the Maxwell's equations and the Lorentz's transformations of which those result, without calling upon the relativistic principles, that the mass with inertia could be generally associated with an energy medium, as we also calculated **(§ 2, p. 15**). We showed, by using the law of materialization, the fundamental equation of quantum Mechanics **(§ 4, p. 29**) and that of the Wave mechanics **(§ 5, p. 46**) which legitimate the equation of Schrödinger with a specified validity limits. We established, finally, the equations of the gravitation fields, *without calling upon General Relativity and by rejecting even the principle according to which the speed of the light is "the universal constant".*

We have no doubts in what we said, not for a single one moment, because it is an undeniable reality to which Relativity could arrive with a same results, by the condition, however, to introduce there the laws of the electromagnetism which were not possible to regard as a pure ‘geometrization’ of space. We see no other interest in this than there would be to maintain principles of a more justified utility, the principles better than those which involve only complications, unfamiliar results, designs and risks of errors generated by the mixing of unusual ideas, that are abstract and sometimes diverting and where our logic ends up being lost in the mazes of uncertainty and the paradoxes.

CONCLUSION

A conclusion is not an end.

It marks the term of a stage and, in this case, is to specify the ways open to the investigation and new research.

In spite of the imperfections, the traversed way is irreversible and the new data from now remain on sure.

Thanks to an objective comprehension and to the concrete representation of the phenomena, it appears now, in a clear way that energy can take on two different aspects, continuous and discontinuous. These two aspects are differentiated and separated by zones which imply the existence of a precise higher limit of the electric field related to the medium and function of the elementary charge of the electron.

The Gravitation ceases being an unprecedented mystery. The enigma ***W = mc2*** which intrigued L. Brillouin [21] finds cleared up in perfect harmony with the electromagnetic phenomena and the law of the gravitation.

The important fact that it is especially necessary to retain: it is that the unification of physics seems to be able and to want to be done around electromagnetism. That includes, as it is noted, that energies, the masses, the momentum, the forces of any nature must be able to be expressed in electromagnetic terms.

Compared with those of other disciplines of physics, laws of electromagnetism have priceless advantage to basically cover the vector physical aspect, and consequently, the multidimensionality which confers to them broader possibilities of expression using a symbolism which remains, in addition, simple and comprehensible. What is essential, finally, it is not to affirm that an energy is always, in its essence, of electromagnetic nature - that would not have in fact any significance - but, on the contrary, to be assured that the energy can symbolically be translated in an electromagnetic form which, quantitatively, makes it possible to explain its behavior in concord with the experiments.

Admittedly, it remains still much to make. And when a new stage has been just crossed, it is rare that the new raised problems do not arise in greater number than those which were solved. Many, indeed, are the questions which remain outstanding.

Which can be the value of the average density of diffuse energy in deep space? … is the same one in intergalactic spaces? Which are, according to the density of energy, the variations of the electric permittivity? …and for a diffuse medium? …and for a material medium? ...and within the divergent zones?

Is it possible, like in the case of the photon and of the electron, and according to the law of materialization, to build a concrete model for each of many currently known elementary particles? How exactly presents itself the diffuse energy distribution curve?

The list of the questions can extend thus without limits, recalling us, if it were necessary, of poverty and the exiguity of the field of Knowledge in regard to the vastness of that of our ignorance which have as an eternal object - the reality, the universe, the existence, but, also, the magnitude, the sense and the possible reason of being and of the human one.

A P P E N D I X

THE RECALL OF THE PRINCIPAL BASIC CONCEPTS USED IN THE TEXT

1• ***The intrinsic definition of a potential gradient.*** ---
When a function "potential ***U***", definite and continuous, is an expressed using function, ***Si (x, y, z), i = 1, 2,…n,*** also definite and continuous, which depend on variables ***x, y***, and ***z,*** the gradient of this function ***U*** (***s1, s2…sn)*** has as a general expression:

$$\mathbf{grad\ U} = \sum_{i=1}^{n} \partial U/\partial s\mathit{l} \cdot \mathbf{grad\ st}$$

In the particular case where ***S1=x, S2=y, S3=z*** and ***Si=0***, for 4, and by posing ***grad x = i, grad y = j, grad z = k,*** we obtain the traditional expression of the gradient of the function ***U*** brought back to three axes of Cartesian coordinates ***Ox, Oy, Oz***:

$$\mathbf{grad\ U} = \boldsymbol{i} \cdot \partial U/\partial x + \mathbf{j} \cdot \partial U/\partial y + \mathbf{k} \cdot \partial U/\partial z.$$

2• ***The intrinsic definition of the divergence***. --- If **V** ***(S1, S2…Sn)*** is a vector which depends on ***Si (x, y, z), i = 1, 2,…n***, functions of variables ***x, y,*** and ***z,*** one calls, by definition, divergence of this vector; the scalar expression:

$$\mathbf{div\ V} = \sum_{i=1}^{n} \mathbf{grad\ si} \cdot \partial V/\partial si$$

By posing, like previously, ***S1=x, S2=y, S3=z*** and ***Si=0***, for **i ≥ 4**, and ***grad x = i, grad y = j, grad z = k,***, we obtain the expression of the divergence brought back to the three rectangular axes ***Ox, Oy, Oz***:

$$\mathbf{div\ V} = \partial Vx/\partial x + \partial Vy/\partial y + \partial Vz/\partial z\ .$$

3• *The intrinsic definition of the rotational one.* --- One calls rotational vector ***V (s1, s2…sn)*** and writes, ***rot V***, the vector obtained by carrying out the sum of the vector products, gra**d si ^ ∂V/∂si:**

$$\mathbf{rot\ V} = \sum_{i=1}^{n} \mathbf{grad\ si} \wedge \partial \mathbf{V}/\partial \mathbf{si}$$

By posing ***S1=x, S2=y, S3=z*** and ***Si=0,*** for **i ≥ 4**, we find the known expression:

$$\mathbf{rot\ V} = \boldsymbol{i} \wedge \partial \mathbf{V}/\partial x + \mathbf{j} \wedge \partial \mathbf{V}/\partial y + \mathbf{k} \wedge \partial \mathbf{V}/\partial z.$$

and that is to say:

$$\mathbf{rot\ V} = \boldsymbol{i} \cdot (\partial Vz/\partial y - \partial Vy/\partial z) + \mathbf{j} \cdot (\partial Vx/\partial z - \partial Vz/\partial x) + \mathbf{k} \cdot (\partial Vy/\partial x - \partial Vx/\partial y).$$

4• *The symmetrization of Dalernbertien*. --- The Dalembertien vector is usually written:

$$\square V = \partial^2 V/\partial x^2 + \partial^2 V/\partial y^2 + \partial^2 V/\partial z^2 - 1/c^2 \cdot \partial^2 V/\partial t^2$$

By posing $\mathbf{T = j \cdot t/\sqrt{\varepsilon\eta}, j = \sqrt{-1}}$ we can obtain, for this vector, a symmetrical expression in ***x, y, z*** and ***T***:

$$\square V = \partial^2 V/\partial x^2 + \partial^2 V/\partial y^2 + \partial^2 V/\partial z^2 + \partial^2 V/\partial T^2$$

5• *The general expression of the Maxwell's in the Heaviside's form*. --- In homogeneous medium with stationary inertia, we write the Maxwell's equations as:

$$\left| \begin{array}{ll} \mathbf{rot\ E} = -\eta\ \partial \mathbf{H}/\partial t, & \mathbf{div\ E} = 0 \\ \mathbf{rot\ H} = \varepsilon \cdot \partial \mathbf{E}/\partial t, & \mathbf{div\ H} = 0 \end{array} \right.$$

We can multiply the first line by $\sqrt{\varepsilon}$, and the second by $\mathbf{j} \cdot \sqrt{\eta}$ to add member to member. We thus obtain:

$$\mathbf{rot}\ (\sqrt{\varepsilon}\mathbf{E} + \sqrt{\eta}\mathbf{H}) = \mathbf{j}\ \sqrt{\varepsilon\eta}\ (\sqrt{\varepsilon} \cdot \partial\mathbf{E}/\partial\mathbf{t} + \mathbf{j}\ \sqrt{\eta} \cdot \partial\mathbf{H}/\partial\mathbf{t}),$$

and,

$$\mathbf{div}\ (\sqrt{\varepsilon}\mathbf{E} + \mathbf{j}\sqrt{\eta}\mathbf{H}) = 0.$$

It is then enough to pose: $\sqrt{\varepsilon}\mathbf{E} + \mathbf{j}\sqrt{\eta}\mathbf{H} = \mathbf{Q}$ and $\mathbf{T} = \mathbf{j} \cdot \mathbf{t}/\sqrt{\varepsilon\eta}$ that is to say, $d\mathbf{t} = -\ \mathbf{j} \cdot \sqrt{\varepsilon\eta}\, d\mathbf{T}$, to establish the equations of Maxwell-Heaviside:

$$\boxed{\begin{array}{l}\mathbf{rot\ Q} + \partial\mathbf{Q}/\partial\mathbf{T} = 0\\ \mathbf{div\ Q} = 0\end{array}}$$

Q represents an electromagnetic field complex in which it is enough to separate the real part and the imaginary part to obtain the electric field and the magnetic field associated.

6• *The general study of the electromagnetic waves propagation in a medium with stationary inertia.* --- II is always possible to choose arbitrarily ***n*** functions ***Si (x,y,z, T), i = 1,2,…n***, with **n ≥3**, such as the electromagnetic field complex ***Q*** can be expressed in function of ***s1, s2,…sn, Q (s1,s2,…sn).***

The intrinsic expressions of the divergence (**2**) and of the rotational **(3)** make it possible to write, in another form, the general equations of Maxwell-Heaviside:

$$\left|\begin{array}{l}\sum_{i=1}^{n} (\mathbf{grad\ si} \wedge \partial\mathbf{Q}/\partial\mathbf{si} + \partial\mathbf{Q}/\partial\mathbf{si} \cdot \partial\mathbf{si}/\partial\mathbf{T}) = 0\\ \sum_{i=1}^{n} \mathbf{grad\ si} \cdot \partial\mathbf{Q}/\partial\mathbf{si}\end{array}\right.$$

It is interesting to seek the properties of the functions ***Si (x, y, z, T)*** their number which can be unspecified, so that each one of them taken separately satisfies the equalities:

$$\mathbf{grad\ si} \wedge \partial\mathbf{Q}/\partial\mathbf{si} + \partial\mathbf{Q}/\partial\mathbf{si} \cdot \partial\mathbf{si}/\partial\mathbf{T}) = 0$$
$$\mathbf{grad\ si} \cdot \partial\mathbf{Q}/\partial\mathbf{si} = 0.$$

.

Scalar multiplication of the first of these equalities by the derived vector $\partial\mathbf{Q}/\partial\mathbf{si}$ provides the relation:

$$/1/ \qquad \boxed{(\partial\mathbf{Q}/\partial\mathbf{si})^2 \cdot \partial\mathbf{si}/\partial\mathbf{T} = 0}$$

By multiplying this same equality of vectors by the gradient of function ***si, grad si***, and by taking account of the fact that
grad si $\cdot$ **$\partial Q/\partial si = 0$**, we obtain the second relation:

$$/2/ \qquad [(\text{grad } si)^2 + (\partial si/\partial T)^2] \cdot \partial Q/\partial si = 0$$

If we impose, by assumption, that the derivation $\partial si/\partial T$ and the vectors $\partial Q/\partial si$ are different from zero, the relation **/1/** means that that vectors $\sqrt{\varepsilon} \cdot \partial E/\partial si$ and $\sqrt{\eta} \cdot \partial H/\partial si$ are equal in module and perpendicular between them.

It is enough, indeed, to replace the vector ***Q*** by its expression complexes, to obtain:

$$(\partial Q/\partial si)^2 = (\sqrt{\varepsilon} \cdot \partial E/\partial si + j \cdot \sqrt{\eta} \cdot \partial H/\partial si)^2 = 0.$$

and that is to say:

$$\varepsilon\, (\partial E/\partial si)^2 - \eta\, (\partial H/\partial si)^2 + 2j \cdot \sqrt{\varepsilon\eta} \cdot \partial E/\partial si \cdot \partial H/\partial si = 0.$$

As this last expression is null, it is necessary to discern the real part from the imaginary part that are equalized; from where:

$$\left| \sqrt{\varepsilon} \cdot \partial E/\partial si \right| = \left| \sqrt{\eta} \cdot \partial H/\partial si \right|, \text{ and, } \partial E/\partial si \cdot \partial H/\partial si = .0$$

As for the relation **/2/** we write:

$$(\text{grad } si)^2 + (\partial si/\partial T)^2 + 0.$$

it means, as we will show it, that surfaces ***Si (x,y,z, T) = Cte*** are parallel surfaces of which each point moves, according to a common normal, at the speed $c = 1/\sqrt{\varepsilon\eta}$. Let us suppose that the medium with stationary inertia is brought back to three axes of Cartesian coordinates ***Ox, Oy, Oz*** and consider ed family of surfaces ***S*** represented by the function ***Si (x,y,z, T) = Cte*** .Each surface becomes deformed according to the time parameter, $t = - j \sqrt{\varepsilon\eta}$, on which it depends… Let us take two neighborly points, one ***Mo (x, y, z, t)*** and the other ***M1 (x+dx, y+dy, z+dz, t+dt),*** located on the surface ***St***, at the instant ***t*** and the other on the surface ***St-dt,*** modified in function of time. These two surfaces belong to the family ***Si (x, y, z, T) = Cte***. We can thus write the differential relation:

$$\partial si/\partial x \cdot dx + \partial si/\partial y \cdot dy + \partial si/\partial z \cdot dz + \partial si/\partial \,|\, t \cdot dt = 0,$$

this can express itself in the form of the scalar product:

$$\text{grad } si \cdot MoM1 = - \partial si/\partial t \cdot dt,$$

since the vector ***MoM1*** admits respectively for components ***dx, dy*** and ***dz***. While choosing, ***MoM1 = dOM***, directed according to the normal on the surface ***s***, the **grad *si*** and the ***dOM*** become collinear and we obtain the equality:

$$|\mathbf{grad\ si}| \cdot |d\mathbf{OM}| = |\partial \mathbf{si}/\partial \mathbf{t} \cdot d\mathbf{t}|,$$

and that is to say:

$$|d\mathbf{OM}/d\mathbf{t}|^2 = (\partial \mathbf{si}/\mathbf{dt})^2/(\mathbf{grad\ si})^2,$$

and we deduce:

$$\boxed{|d\mathbf{OM}/d\mathbf{t}| = 1/\sqrt{\varepsilon\eta}}$$

dOM/dt represents the rate of motion of an unspecified point ***M*** of a surface ***S***, corresponding to ***Si (x,y,z, T)*** = ***Cte*** following the normal to this surface, when the latter becomes deformed according to time.

The vector, $\mathbf{u1} = 1/\sqrt{\varepsilon\eta} \cdot \mathbf{grad\ si}/(\partial \mathbf{si}/\partial \mathbf{t})$, is a united vector which, by the equality ratio, allows us to write the starting equations:

$$\left| \begin{array}{l} \mathbf{u1} \wedge \sqrt{\eta} \cdot \partial \mathbf{H}/\partial \mathbf{si} = - \sqrt{\varepsilon} \cdot \partial \mathbf{E}/\partial \mathbf{si} \\ \mathbf{u1} \wedge \sqrt{\varepsilon} \cdot \partial \mathbf{E}/\partial \mathbf{si} = \sqrt{\eta} \cdot \partial \mathbf{H}/\partial \mathbf{si} \end{array} \right.$$

Let us note that these particular properties always make it possible to express the functions ***Si*** in an explicit form, ***Si (x, y, z) ± jT***, showing clearly that ***T*** plays a part different from that played by the space variables ***x, y*** and ***z.***

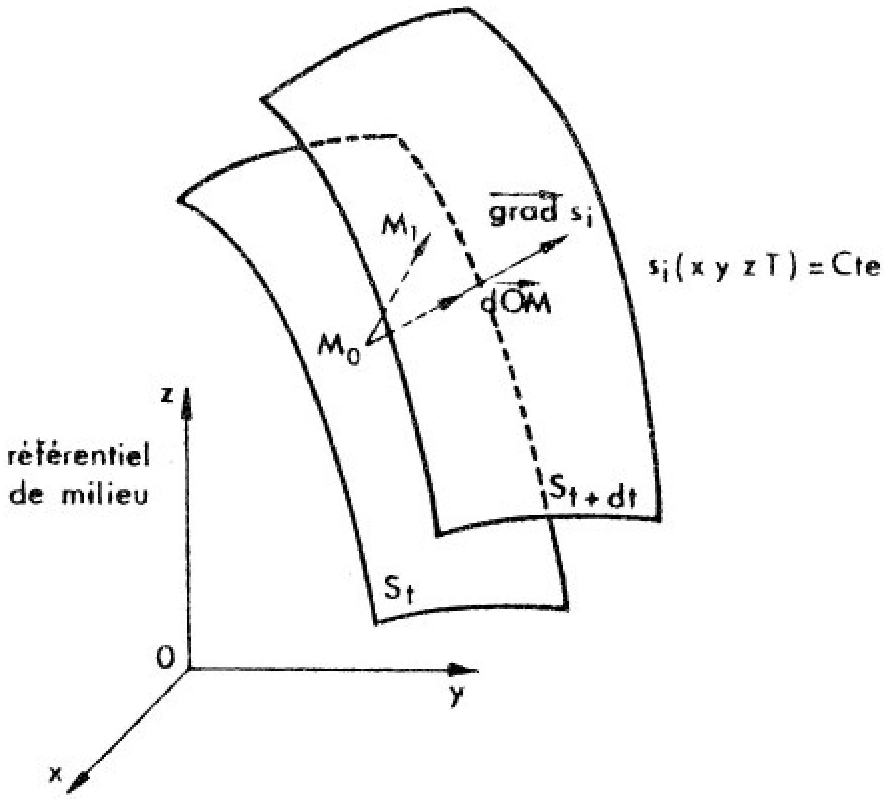


Fig.18. --- Every point of the surface ***S,*** which admits for equation ***Si (x, y, z, T) = Cte***, moves, due to the time function, along the same length ***dOM*** according to the normal defined by ***grad Si***.

By definition, we will say that a family of surfaces corresponding to the functions ***Si (x, y, z, T) = Cte***, is a family of surfaces of waves. Those are parallel surfaces which move according to their perpendiculars at the speed **c = 1/√εη.**

The Maxwell's equations thus imply well that the electromagnetic disturbances are propagated, in a medium with homogeneous stationary inertia, at an isotropic speed **c = 1/√εη** and that these disturbances always result from the linear superposition of independent waves surfaces, in an unspecified number, with the direction which has just been defined, and whose perpendiculars are conservative trajectories of propagation in the homogeneous medium considered.

The independence of surfaces of waves and their separation allow us, after integration, to extend the properties which were shown, to the electric and magnetic fields, ***Ei and Hi.***. Each one of these fields depends on the only one function ***Si (x, y, and z) ±jT.***

7• *The spherical waves and the generalization of the second law of Laplace*. --- A general solution of the equations of Maxwell-Heaviside, in homogeneous medium, is given by any vector of propagation, ***A (x, y, z, T),*** such as $\square A = 0$. We will show, under these conditions, that the complex electromagnetic vector,

$$\mathbf{Q = rot\ (rot\ A - \partial A/\partial T)}$$

is the solution of the Maxwell's equations.
We can, indeed, develop this expression and write:

$$\mathbf{Q = grad\ div\ A - \Delta A - rot\ \partial A/\partial T.}$$

By taking account of $\mathbf{\Delta A = - \partial^2 A/\partial T^2}$, $(\square \mathbf{A = 0})$, we draw some:

$$\mathbf{Q = grad\ div\ A - \partial/\partial T\ (rot\ A - \partial A/\partial T).}$$

and that is to say:

$$\text{rot } Q = - \mathbf{\partial/\partial T\ rot\ (rot\ A - \partial A/\partial T) = - \partial Q/\partial T.}$$

Q is being rotational, its divergence is null and we can write consequently.

$$\mathbf{rot\ Q + \partial Q/\partial T = 0}$$
$$\mathbf{div\ Q = 0}$$

In order to study spherical waves, let us seek a vector, ***A (r, T)*** that is independent of **radius** $\mathbf{r = \sqrt{(x^2+y^2+z^2)}}$ and time $\mathbf{t = - j\sqrt{\varepsilon\eta} \cdot T}$. Calculation shows that vector A takes the general form:

$$\mathbf{A(r, T) = 1/r\ [V(r + jT) + V'\ (r - jT) + grad\ U(r)}$$

where ***U (r)*** is a harmonic function $(\mathbf{\Delta U = 0})$ independent of times.

In what follows, we will eliminate the fields independent of times, which are perfectly known, and we will preserve only the wave emitted by the disturbance which occurs in the center of concentric spheres. It remains then, $\mathbf{A = 1/r\ V\ (r + jT),}$ and consequently:

$$\mathbf{Q = rot\ [rot\ V(r + jT)/r - j \cdot 1/r \cdot \partial V(r + jT)/\partial r]}$$

If the vector ***V (r+jT)*** is a real vector, the imaginary part:

$$\mathbf{rot\ [1/r \cdot \partial V(r + jT)/\partial r].}$$

represents a magnetic field that, by analogy with the second law of Laplace and by using suitable coefficients, we can write finally:

$$d\mathbf{H = 1/4\pi\ rot\ \mathit{i} \cdot (t - r/c)/r \cdot \mathit{dl}\ (M.\ K.\ S.\ A.)}$$

That is still to say:

$$d\mathbf{H} = 1/4\pi \cdot [i \cdot dl \wedge \text{grad } r/r^2 + i' t/c \cdot dl \wedge \text{grad } r/r] \text{ (M. K.S.A.)}$$

8. *Gravitation fields in spherical distribution*.

The Maxwell's equations make it possible to calculate the relations between the fields and the potentials of gravitation brought back to a quasi-stationary medium, empty of matter, where density of diffuse energy is supposed to undergo only very weak variations. These relations are written:

$$\left| \begin{array}{l} \gamma + \text{grad } V = 0 \\ \text{div } \gamma + 1/V \cdot \partial^2 V/\partial t^2 = 0. \end{array} \right.$$

When the fields and the potentials are static ($\partial^2 V/\partial t^2 = 0$), we obtain:

$$\left| \begin{array}{l} \gamma = - \text{grad } V \\ \text{div } \gamma = 0. \end{array} \right.$$

We can easily solve this system of equations in the case of a spherical distribution $V(r)$ of the gravitation potential, with $r = \sqrt{(x^2+y^2+z^2)}$. $V(r)$ is a harmonic function which leads to a null expression of the Laplacienne function:

$$\Delta V = \partial^2 V/\partial x^2 + \partial^2 V/\partial y^2 + \partial^2 V/\partial z^2 = 0$$

And that is to say:

$$r^2 \Delta V(r) = r^2 \cdot \partial^2 V/\partial r^2 + 2r \cdot \partial V/\partial r = 0.$$

By integration we obtain:

$$V(r) = - ko/r + Co \text{ and } \gamma = - \text{grad } V(r) = - ko/r^2 \cdot \text{grad } r.$$

This proves that in the case of a spherical distribution, the accelerations vary in proportion to the inversed squares of distances.

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