

An Alternative to the Standard Model

Spin and magnetic moment

By

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This work is a continuation of another recently published by The General Science Journal entitled "The Standard Model is wrong" where the reader was invited to verify a number of relatively simple mathematical proofs in relation to a physical Theory on the mass and its origin as an Alternative to the Standard Model.

This new article will focus on the concepts of spin and magnetic moment, so differently considered by the two options of the Alternative. The Standard Model inevitably hides in the virtual and claims that they have virtual features with no physical meaning. By contrast, the Alternative Theory must face the irremediable fact that these two concepts are the product of a rotation with the corresponding consequences: there is something rotating in material particles.

The fact that the spin of all simple material particles, such as proton, neutron, electron, neutrino and its antiparticles, is $h/4\pi$ is one of the great mysteries of our Universe. As I say, there are two ways of facing the mystery. One, followed by the creators of Quantum Mechanics and Standard Model, who flees in retreat claiming that particles are not defined objects but virtual entities with virtual and even absurd properties, admitting the double behavior as particle and wave and the other way of facing the problem is to define the particles as real objects composed of "something" that can rotate and move. This second assumption involves a spin, and this in turn implies a mechanical moment (spin) and a magnetic moment.

Once these facts are established, I dare to listen to anyone who comes with a proposal of particles composed of "something that rotates", that is able to demonstrate that that rotation causes in "all" the simple material particles a mechanical moment or spin equal to $h/4\pi$ and magnetic moments according to the experimental reality. I dare say it is impossible unless it is based on the Principles of this Theory.

Simply by admitting these Principles: $E 2\pi R = hc$; $E = mc^2 = h\nu$; $2\pi R v = c$ (at rest) and executing a series of operations involving the use of differential and integral calculus, we arrive at the strange conclusion that the spin of all simple material particles is equal to $h/4\pi$ and all magnetic moments are coincident with the experimental results.

This is a new mystery that Modern Physics must face and explain how this can happen without accepting that the Theory in question is correct.

So, the Alternative Theory says that the spin implies "some kind of intrinsic rotation". It is nothing but an angular momentum or mechanical moment and its value is $m r v$, where m is a mass, r is a turning radius and v is a linear speed. The magnetic moment is the surface covered by an electric charge when turning around a central point multiplied by the current intensity originated by that charge. The first idea when considering the spin and the magnetic moment is that they are caused by a rotation, that there is something turning. The word rotation is implicit in the definition of both concepts. And, of course, the number π , which is always related to a rotation, forms part of the expressions of the spin and the magnetic moment.

Let us remember that "Nature is always economical in stating rules and at the same time infinitely clever and its rules are simple". Why should "Nature" include number π in the value of spin and magnetic moment if they were not related to some kind of rotation? Especially if we can think of a more logical explanation: that modern physicists do not exactly know what elementary particles are and besides they loathe the idea of rotation because it is outside the virtual world.

The real situation today is that modern physicists have no choice but to avoid the concept of "well-defined objects" when referring to material particles. And the reason is that when they have tried to give a definition, that definition does not hold water everywhere. They have not found the correct definition and the reaction to this has been to take a headlong rush hiding themselves in the virtual and the absurd.

According to Einstein "Quantum Mechanics does not furnish a complete description of the physical reality of individual systems but merely describes the statistical properties of ensembles of systems". Einstein took the position that "Physics is concerned with the description of physical reality". He affirmed that "an objective reality exists which does not depend on our observation. A priori, we do not know what it is, but this precisely is the task of Physics: to establish the properties of the existing physical reality". Einstein was aware that this position required a "meaningful definition of physical reality", and that this was not easy. It was considered by some as impossible "in physical terms alone".

There is a limit beyond which we can not observe directly the subatomic world. It seems natural that, beyond that limit, the empirical method, which relies on observation and experiment is no longer valid. Beyond that limit, direct observation and experiment must be forgotten. What is the sense of imagining an observer and an observed system when the observed system can never be directly observed? And if the observer tries to observe the observed system it is modified so that the observation is not reliable. The only way of acquiring knowledge beyond that limit is theory.

But this theory should be complete, consistent, simple and logical. It is a general rule that the significance of a theory depends on the economy of its concepts and the generality of its conclusions. In words of James Clerk Maxwell: "The first process in the effectual study of the sciences must be one of simplification and reduction of the results of previous investigations to a form in which the mind can grasp them". And besides that, the theory must be able to establish the properties of the existing physical reality, that meaningful definition of physical reality, required by Einstein, and considered by some as impossible "in physical terms alone". This physical reality should be defined through very few and simple laws. This theory must be in agreement with all existing knowledge and must be able "to observe the unobservable" by giving explanation of phenomena which form part of the physical reality but can not be observed. In the case of elementary particles, the theory should be able to define what they are, where they are, what they are doing. In a word, the theory must be able to explain in detail what is happening at the subatomic level, although experimenters will never be able to go on with their empirical method based on observation and experiment.

Experimenters will never be able to observe directly an electron orbiting around the nucleus. But, if we know the laws of electric attraction and the laws of elementary particles proposed by this Theory, we shall be able to deduce what the electron is doing all the time. Experimenters will never be able to check the fact that the turning axis of the electron is adjusting its position whenever the speed of the electron changes along the orbit (this is shown in the book "A New Physics for a New Millennium", Chapter 10: "Orbital electrons do not emit energy"). But this adjustment can be deduced by reasoning when we know that there is a law stating that every differential element of the electron's equator must necessarily travel at the speed of light. This phenomenon is out of all observation and consequently can not be subjected to any empirical method. The empirical method, which requires an observer who sees and feels the phenomenon, must be substituted, beyond certain limit, for the deductive method.

According to Quantum Mechanics "it does not make sense to ask what the real electron is doing during the intervals between the observations on which the state function is based. At this question the physicist can only reply: "I do not know. If you want an answer to that you must ask a philosopher. He won't know either, but he will probably tell you" ". The answer to this question, concerning orbital electrons, is that the electron actually follows a classical orbit with definite positions and momenta which, owing to our clumsiness and the limitations imposed by our probes, we are unable to observe.

So, concerning the atom we are not allowed since 1913 to imagine that orbiting electrons carrying their negative electric charge are circling around an atomic nucleus also made up of well-defined objects with a positive electric charge, as in the case of the planetary motion in the macrocosm. In this case the atom would collapse and we know that atoms are stable. Nor are we allowed to view the material particles and their features, including the spin and magnetic moment, as conceived by classical physics,

but as virtual facts.

Nevertheless, some physicists have rebelled against that impotence that has been preventing them from following the logical path of considering material particles "well-defined objects". I shall cite a paragraph from Alan D. Krisch, Professor of Physics at the University of Michigan: "The clever and catchy QCD (Quantum Chromo-dynamics) ideas that have been proposed to explain the apparent confinement of quarks may turn out to be correct, and perhaps I shall eventually change my old-fashioned view that particles must be well-defined objects. I believe, however, that a simple concept should not be abandoned in favour of a more complex one until the hard experimental evidence is overwhelming."

On the other hand this situation helped physics to give an explanation of some phenomena by admitting that the nature of physics was such that mankind was unable to comprehend. Paradoxes were accepted by some as normal events, without even considering that the cause of the paradox could be an inconsistent theory. There was an immense sack which accepted all that was difficult or impossible to understand. The behaviour of orbital electrons could not be explained. The main protagonist of this drama, the electron, which made physics turn 180° on its path, was completely unknown. Nobody had defined what the electron could be. A charge point with a certain mass, a certain spin and a certain magnetic moment, impossible to observe as they are virtual. Even its size was completely unknown. Nobody could say anything about what the real cause of its mass, its spin and its magnetic moment was. But nobody thought of the possibility of looking for the right definition of the electron which could help physics to solve the problem of orbiting electrons. The electron, something which has not yet been defined, has marked the path of physics since the beginning of the twentieth century.

Quantum Mechanics has to resort to "abstract entities which have a dual aspect", impossible to define. As a matter of fact Quantum Mechanics has not even tried to define what particles are, unless one can consider this a definition: "Particles are probability waves, abstract mathematical quantities with all the characteristic properties of waves which are related to the probabilities of finding the particles at particular points in space and at particular times. Matter does not exist with certainty at definite places, but rather shows tendencies to exist. A particle is a localizable system for which the position observables constitute a complete system of compatible observables". For Quantum Mechanics the only cause of concern is "where" and "when". "The concept of a distinct physical entity, like a particle, is an idealization which has no fundamental significance". There is no possibility of knowing what particles really are. Which is more important: to know what they are or where they are? Robert Oppenheimer said this: "If we ask, for instance, whether the position of an electron remains the same, we must say 'no'; if we ask whether the electron's position changes with time, we must say 'no'; if we ask whether the electron is at rest, we must say 'no'; if we ask whether it is in

motion, we must say 'no' ".

In some cases, there seem to appear paradoxes. But "there is nothing paradoxical about the physical world. Thus if paradoxes seem to appear, they must originate either from an inconsistent physical theory, or they must indicate the limitation of concepts in physics which have acquired their meaning outside the domain of physics". This sentence is not mine, it belongs to Professor Josef M. Jauch, Director of the Institute of Theoretical Physics at the University of Geneva, Switzerland. He has been a visiting scientist at CERN and has taught at Princeton University. He is the author of a book entitled "Foundations of Quantum Mechanics".

We must compare Professor Jauch's way of dealing with paradoxes with that defended by those (a great part of contemporary physicists) who are willing to blindly accept new ideas, impossible to understand, but that have been supported by cleverer people: This is from one of those modern physicists: "Every time the physicists asked nature a question in an atomic experiment, nature answered with a paradox, and the more they tried to clarify the situation, the sharper the paradox became. It took then a long time to accept the fact that these paradoxes belong to the intrinsic structure of atomic physics and to realize that they arise whenever one attempts to describe atomic events in the traditional terms of physics".

Has the author of the above sentence ever thought that he has been working with an inconsistent physical theory and that this is precisely the cause of the paradox? Can we accept, when a physical phenomenon seems to be paradoxical, that such a phenomenon may be considered as one more of the great number of "quantum paradoxes", which can not be explained simply because Quantum Reality has nothing to do with Physical Reality? This is completely unacceptable.

Here are some arguments presented by eminent physicists against classical ideas of spin and magnetic moment:

- Morton Travel, professor of Physics at Vassar College: "When certain elementary particles move through a magnetic field, they are deflected in a manner that suggests they have the properties of little magnets. In the classical world, a charged spinning object has magnetic properties that are very much like those exhibited by these elementary particles. Physicists love analogies, so they described the elementary particles too in terms of their spin. Unfortunately, the analogy breaks down, and we have come to realize that it is misleading to conjure up an image of the electron as a small spinning object. Instead we have learned simply to accept the observed fact that the electron is deflected by magnetic fields. If one insists on the image of a spinning object, then real paradoxes arise; unlike a tossed softball, for instance, the spin of an electron never changes, and it has only two possible orientations. In addition, the very notion that electrons and protons are solid 'objects' that can 'rotate' in space is itself

difficult to sustain. The term 'spin,' however, still remains."

- Kurt T. Bachmann of Birmingham-Southern College: "Starting in the 1920s, Otto Stern and Walther Gerlach of the University of Hamburg in Germany conducted a series of important atomic beam experiments. Knowing that all moving charges produce magnetic fields, they proposed to measure the magnetic fields produced by the electrons orbiting nuclei in atoms. Much to their surprise, however, the two physicists found that electrons themselves act as if they are spinning very rapidly, producing tiny magnetic fields independent of those from their orbital motions. Soon the terminology 'spin' was used to describe this apparent rotation of subatomic particles. Spin is a bizarre physical quantity. It is analogous to the spin of a planet in that it gives a particle angular momentum and a tiny magnetic field called a magnetic moment. Based on the known sizes of subatomic particles, however, the surfaces of charged particles would have to be moving faster than the speed of light in order to produce the measured magnetic moments. Furthermore, spin is quantized, meaning that only certain discrete spins are allowed. This situation creates all sorts of complications that make spin one of the more challenging aspects of quantum mechanics."

- Victor J. Stenger, professor of physics at the University of Hawaii at Manoa: "Spin is the total angular momentum, or intrinsic angular momentum, of a body. The spins of elementary particles are analogous to the spins of macroscopic bodies. In fact, the spin of a planet is the sum of the spins and the orbital angular momenta of all its elementary particles. So are the spins of other composite objects such as atoms, atomic nuclei and protons (which are made of quarks). In classical physics, angular momentum is a continuous variable. In quantum mechanics, angular momenta are discrete, quantized in units of Planck's constant divided by 4π . Niels Bohr proposed that angular momentum is quantized in 1913 and used this to explain the line spectrum of hydrogen: At our current level of understanding, the elementary particles are quarks, leptons (such as the electron) and bosons (such as the photon). These particles are all imagined as point like, so you might wonder how they can have spins. A simple answer might be, perhaps they are composite, too. But deep theoretical reasons having to do with the rotational symmetry of nature lead to the existence of spins for elementary objects and to their quantization. Of particular significance is the difference between fermions, particles that, like the electron, have half-integer spins (half-integer multiples of Planck's constant divided by 2π), and bosons, particles that have integer spins."

It is clear that orthodox physicists have abandoned the idea of particles as small spinning objects. These are their opinions, which lead to the idea that rotation is not accepted and has been condemned, although rotation is the idea that presents more logic at first sight.

- Spin is quantized in units of Planck's constant divided by 4π .
- The spin takes only two possible orientations.
- Based on the known sizes of subatomic particles, the surfaces of charged particles

would have to be moving faster than the speed of light in order to produce the measured magnetic moments.

- Electrons are imagined as point like, so you might wonder how they can have spin.
- The conclusion is that particles have spin that gives them angular momentum and a tiny magnetic field. But this spin has nothing to do with small spinning objects. Spin has become one of the more challenging aspects of Quantum Mechanics.

And here is the answer:

It is incredible, but the fact is that Nature has conceived material elementary particles as small spinning "dynamic" objects with a very strange feature: their angular momentum is always $h/4\pi$ (you can see the demonstration of this subject in previous article "The Standard Model is wrong"). The real miracle of Nature is that all elementary particles are the same thing in different states of movement and their spins are not quantized, they are simply fixed, equal to $h/4\pi$. This extraordinary fact has nothing to do with Quantum Mechanics and is valid for electrons, protons, neutrons, neutrinos and particles forming what is called dark matter and even the initial particle that stored the whole energy of the Universe at the very beginning.

Speaking of dark matter I will mention two comments on the subject that I consider very eloquent:

'No one knows what dark matter is, but they know what it is not. It's not part of the 'Standard Model' of Physics that weaves together everything that is known about ordinary matter and its interactions' Jenny Hogan, 'Welcome to the Dark Side,' Nature, Vol. 448, 19 July 2007, p. 241.

'We know little about that sea. The terms we use to describe its components, 'dark matter' and 'dark energy', serve mainly as expressions of our ignorance.' David B. Cline, "The Search for Dark Matter," Scientific American, Vol. 288, March 2003, p. 52.

And it is precisely the electric rings, which constitute small dipoles, what brings an irresistible orientation in space beyond quantum mechanics. To say that the material particles, both in the free state or as orbital electrons are quantized, is a mistake that will hinder our understanding of the Universe until that misconception is banished from physics.

There is good evidence that the spin of the orbital electrons is not virtual, but rather a spin in accordance with the concepts of classical physics. The previous article of "The General Science Journal" entitled "The Standard Model is wrong" shows demonstration that the Bohr Theory of the atom is correct. In other words, that the atom works as a planetary system since the emissions of the hydrogen atom obtained experimentally coincide with the emissions which result from a situation in which the atom consist in a planetary system. That admitted, the orbital electrons have a spin as a result of their

orbital rotation and this spin is added to the internal spin of orbital electrons and nucleons to determine the total spin of the atom. It would be painful to believe that we are adding inside the atom real spins from the orbital electrons and internal virtual spins from electrons and nucleons.

It is difficult to imagine the enormous complexity and the great amount of restrictions orbital electrons must be subject to. They must follow the electromagnetic laws. It may be noted here, on the one hand, that relative distances are much shorter in the case of the atom than in the case of the motion of planets around the sun and, on the other hand, that the forces acting on the atom are much stronger than the force of gravitation. Another fact adding complexity to the atom is the enormous number of electrons which may be orbiting the nucleus. Orbital electrons must also obey the strict energy and spin invariability laws. All these laws together with the proven fact that the emission or absorption of a photon creates an alteration in the angular momentum of the system equal to the spin unit $h/2\pi$, originate a situation so complex that it is impossible for the human mind to try to deduce some reasonable rules. Paradoxically one of the very few rules we can establish is that electronic jumps must always take place between orbits so that the change in angular momentum should be $\pm h/2\pi$ (positive for absorption and negative for emission), which means abandoning the idea that electrons can follow infinite orbits. The spin or angular momentum of the whole atom must remain constant and, when this spin is modified by the emission of a photon, the atom must necessarily in some way offset that alteration and this can only be done by changing the electron's orbit path, so that the electron's angular momentum should change in the same amount.

This is an experimental fact that cannot be discussed. It is "the main observable fact incorporated to Quantum Mechanics". I don't care whether the photon has a spin equal to $h/2\pi$ or whether the emission of the photon changes the whole spin of the atom in an amount equal to the spin unit. This is a fact and it is neither patrimony of Quantum Mechanics nor the result of any prediction. I shall mention this paragraph from Heckman and Starring: "Historically, the four quantum numbers n , l , m and s were incorporated in the Theory of atomic spectra simply to account for experimental observations."

The pillars of Quantum Mechanics lie in quantization. But there is no place for quantization: We have already shown that all elementary particles have a simple spin equal to $h/4\pi$ (one of the great achievements of this Theory), that orbital jumps of electrons are subject to the law of conservation of spin (when a photon is absorbed or emitted by the atom a fact that has been experimentally observed to satiety occurs: the spin of the whole atom is altered in an amount equal to $\pm h/2\pi$) and that elementary particles, being real magnetic dipoles, have only two possible positions: up and down. Now it is evident that $h/4\pi$ is not a quantum number, that atomic orbits are not infinite and they are not quantized, they are well regulated by simple rules, and the particles are subject to an orientation similar to that of magnetic dipoles and besides the atom works

as a planetary system. These facts are clearly faced with the postulates of Quantum Mechanics and their accuracy is proved. What makes us think that perhaps Quantum Mechanics should undergo a severe overhaul. It is not enough reasoning that the Theory has achieved notable successes when trying to explain the inexplicable and its paradoxes. Can't we think that the cause of the paradoxes could be again an inconsistent theory? And Quantum Mechanics is precisely the Theory that has led Modern Physicists to the freedom to accept the virtual world in physics. Nature does not accept quantum whims. Accepts only simple laws and rules and makes it easy to understand what is complicated.

I shall mention here an English Professor named Brian Cox who runs a science program on the BBC entitled "A Night with the Stars". Mr. Cox goes on to say: "We teach kids that atoms are like little solar systems, but that model is really bad! In principle, planets can orbit the Sun at any distance; give a planet more orbital energy and it'll move away from the Sun and continue orbiting, happy as you please. But electrons can't do that. They can only be at energy levels where they don't interfere with themselves (and each other). It's more like a staircase; they can only move up or down by discrete amounts. Once you figure this out, a ton of stuff becomes possible: lasers, semiconductors, fluorescent bulbs, atomic bombs... it's quantum mechanics, and it's a huge, huge field of science".

This shows very well the position of modern physics: "All new advances in physics are due to the great freedom of thought which confers believing that the atomic and subatomic worlds are beyond all human understanding." The fact that Mr. Cox is unable to rationally explain how the atom works, due to the only and simple reason that his theory is inconsistent, leads him to accept whatever comes, opening doors to the irrational in the name of the theory that has previously been used successfully: Quantum Mechanics. Mr. Cox's enthusiasm increases prodigiously when he sees the results Quantum Mechanics has achieved: "Once you figure this out, a ton of stuff becomes possible: lasers, semiconductors, fluorescent bulbs, atomic bombs... it's quantum mechanics, and it's a huge, huge field of science".

What will he think when he finds out that it has been demonstrated that the atom works similar to a planetary system and that all simple material particles have a spin equal to $\hbar/4\pi$, which is not at all a quantum number, and orbital jumps that cause the light is produced as an offset to the modification of the spin or mechanical moment of the whole atom, which is what happens when there is an emission or absorption of a photon, a phenomenon known experimentally that has nothing to do with Quantum Mechanics?

Concerning the objection "Based on the known sizes of subatomic particles, the surfaces of charged particles would have to be moving faster than the speed of light in order to produce the measured magnetic moments", this is the answer: The origin of the nuclear

forces are both electric and magnetic but when the electric charges are moving above the speed of light, the magnetic effect is higher than electric. This is what allows that the nuclear magnetic forces can be strong enough to overcome by far the repulsive electric forces between protons at short distances and they disappear at the distance of a fermi (length unit in the nucleus, 10^{-13} cm.). Moreover all these electric and magnetic forces have been measured with the result that the binding energy of proton and neutron coincides with the experimental value of 2.21 MeV. From this, the reader may not have the slightest doubt. The fact is more than proven. In this situation, if someone tries to find another solution to the big question of the nuclear forces is doomed. Especially if the solution is to involve virtual particles as intermediaries.

Let's now go on to some of the details concerning the numbers accompanying the spin and magnetic moment. I remember that the spin of the particles is due to the rotation of what I have called "goo" which is the only component of the mass. Moreover, the magnetic moment arises as a result of electrical rings external to the particle and which rotate with the same frequency.

Later on I will show that the value of magnetic moments of simple elementary particles fit in with those of angular momenta in a really amazing way. So amazing that nuclear forces can be defined and measured, getting results such as the binding energy of deuteron equal to 2,21 MeV.

Let me focus on the demonstration of the value of the spin of all simple material particles equal to $h/4\pi$.

I must remember that in Chapter "Starting Point of the Theory", based on experimental facts, such as the gyro-magnetic ratio of the electron and $h/4\pi$ as the value of all simple elementary particles, certain conclusions have been reached: the energy of the particles is equal to $h\nu$, similar to that corresponding to the electromagnetic radiation, and every differential element of the equator of the particle always moves at the speed of light. From these conclusions the fundamental formula of the Theory has been established: $2\pi R E = hc$.

Now let's do the calculations in reverse. Given the fundamental formula $2\pi R E = hc$, we will proceed to show that the spin of all the simple material particles is $h/4\pi$, which will come to certify the validity of the Theory in a definitive way.

In the mentioned Chapter "Starting Point of the Theory" we had arrived at this formula for the spin q :

$$q = \int r v \, dm = 2 \pi v \int r^2 \, dm = 8 \pi^2 \delta v c \int_0^R \frac{r^3 \sqrt{R^2 - r^2} \, dr}{\sqrt{c^2 - 4 \pi^2 r^2 v^2}} .$$

Let us make a variable change, so that $x^2 = c^2 - 4 \pi^2 r^2 v^2$; and let us remember that

$2\pi R v = c$. We are going to get a first equation referred to the spin q :

$$r dr = \frac{-x dx}{4 \pi^2 v^2} \quad ; \quad q = \frac{\delta c}{4 \pi^3 v^4} \int_0^c x (c^2 - x^2) dx$$

$$\textbf{First equation: } q = \frac{\delta c^5}{16 \pi^3 v^4}$$

It is clear on the other hand that, m being the mass of the particle, the sum of all differential elements of mass which form the whirl should be equal to m . As we have seen before

$$dm = \frac{4 \pi \delta c r \sqrt{R^2 - r^2} dr}{\sqrt{c^2 - 4 \pi^2 r^2 v^2}} \quad ; \quad m = 4 \pi \delta c \int_0^R \frac{r \sqrt{R^2 - r^2} dr}{\sqrt{c^2 - 4 \pi^2 r^2 v^2}}$$

Using the same variable change as before we have:

$$m = \frac{\delta c}{2 \pi^2 v^3} \int_0^c x dx$$

And then we have a second equation referred to the mass of the particle:

$$\textbf{Second equation: } m = \frac{\delta c^3}{4 \pi^2 v^3}$$

From the two expressions we have obtained, one for q and the other for m , we have by eliminating δ that $4 \pi q v = m c^2$. But one of the fundamental Principles of this Theory is $E = m c^2 = h v$

$$\textbf{Third equation: } m c^2 = h v$$

And introducing this expression, we finally have:

$$q = \frac{h}{4 \pi}$$

No doubt the calculation has been a little bit complicated. High powers of c , π and v have intervened, but in the end there is an incredible simplification. The reasoning leads to two rather complex equations. These two equations and one of the Principles of this Theory form a system of three equations with four variables: m , q , v and δ . The extraordinary thing is that one of the variables, precisely q , is constant, and its value is precisely $h/4\pi$.

It must be noted that the calculated value of the spin $h/4\pi$ is valid for any whirl which responds to the two Principles of this Theory:

$$E = m c^2$$

$$E = h \nu \text{ (at rest)}$$

$2 \pi R \nu = c$ (at rest); This means that all differential elements of the equator ring move at the speed of light. This circumstance is maintained regardless of the motion of the particle, but in this case the formula $E = h \nu$ ceases to be valid. In other words, all points of the equator ring **always** move at the speed of light.

We have seen how any spherical whirl subject to the two simple Principles proposed by this Theory has, surprisingly, a spin permanently equal to $h/4\pi$, whatever its energy may be.

Note the value of δ , density (mass per unit volume) at rest, that is, on the rotational axis of the particle

$$\delta = \frac{4 \pi^2 h \nu^4}{c^5}$$

Not a result easy to remember.

Before this result only two positions fit: to say that the calculations are erroneous or to accept that the Theory is correct, with many more tests in its favor that will never have The Standard Model. I would like to know the position of the great Physicists. If it is the first option they should show where the error is and if it is the second one they should abandon definitively the absurd well where Physics is today.

Another point to consider is the coherency between the results obtained by applying the known values of the magnetic moments of the different particles. This is a key point that could destroy the Theory without remission. The value of the magnetic moment allows us to know the dimensions of the corresponding electric rings. These dimensions must be consistent with the dimensions of the particle. The size of a particle is related to its mass, its frequency, its energy. By contrast the size of the electric ring only depends on its magnetic moment, which is a purely experimental data. Clearly the size of the particle and the size of its electrical ring are quite independent of each other. In principle, it is not easy to predict that they will be consistent. We are always playing with very different figures and very high powers of 10. But the fact is that they are so consistent that, in the case of the electron, there is total coincidence as the sizes are equal and in the case of proton and neutron consistency is such that it allows the definition of nuclear forces and measurement of the binding energy of deuteron with total accuracy. This is no doubt an irrefutable proof that this Theory is on the right path. The radius of particles is called R with a sub index coinciding with the initial of each particle. The radius of the charge-rings is named R with two sub indices, the first one indicates the sign of the electric charge and the second one the initial of the particle. The speeds of charge-rings are called V and sub indices with the same meaning as before.

The figures come from the Principles of this Theory: $m c^2 = h \nu$; $2 \pi R \nu = c$

Then $R = \frac{h}{2 \pi m c}$; thus we get the radii of the different particles.

	Particle radius in fermi	Charge-rings radius in fermi	Charge-rings speed
Proton	$R_p = 0,2103$	$R_{+p} = 0,3514$	$V_{+p} = 1,6709 c$
Neutron	$R_n = 0,2100$	$R_{-n} = 0,3586$ $R_{+n} = 0,2100$	$V_{-n} = 1,7073 c$ $V_{+n} = c$
Electron	$R_e = 386,23$	$R_{-e} = 386,23$	$V_{-e} = c$

Please note the small detail concerning the size of proton and neutron, next to a fermi. Otherwise this Theory would be immediately discarded.

As far as the charge-rings are concerned, the values are obtained from the corresponding magnetic moment, which is an experimental datum. These are the experimental data, calling M_{mp} , M_{mn} and M_{me} the magnetic moments of proton, neutron and electron respectively:

$$M_{mp} = \frac{2,792 e h}{4 \pi m_p} \quad ; \quad M_{mn} = \frac{-1,913 e h}{4 \pi m_n} \quad ; \quad M_{me} = \frac{-e h}{4 \pi m_e}$$

Where e is the fundamental electric charge and m_p , m_n and m_e are the masses of the three particles at rest.

We know that the magnetic moment of a charge which turns around an axis is the area swept by the charge multiplied by the current intensity. Thus the magnetic moment is in general for any charge-ring with radius R_{cr} : $M = \pi R_{cr}^2 \nu e$.

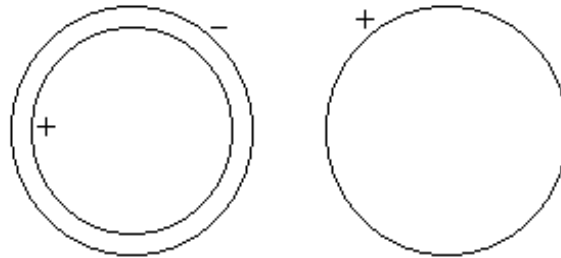
If we make this expression equal to the above values, calling K the constants 2,792 for the proton, -1,913 for the neutron and -1 for the electron, we have

$$R_{cr} = \sqrt{K} \frac{h}{2 \pi m c}$$

If we put the corresponding absolute values of K and the masses, we reach the mentioned results.

But first I want to point out that the neutron has two concentric electric rings, the outer one with negative charge and the inner one with positive charge, its magnetic moment being negative and its electric charge being zero. As I have said, in order that the Theory may go ahead it is necessary, on the one hand, that the dimensions of the

circular electric currents and those of the corresponding particles be coherent, and on the other hand, that the positive electric ring of the proton does not differ much from the outer negative ring of the neutron.



Otherwise great problems would arise when dealing with the nuclear framework. There is complete coincidence between the two radii for the electron. This leads us to believe that there exists a certain tendency in Nature to make the equator of the whirl, which always travels at the speed of light, and the electric ring to coincide.

There is coherence, on the one hand, between the dimensions of each particle and those of its corresponding charge-rings and, on the other hand, between the charge-ring of the proton and the outer negative ring of the neutron, which are practically equal in size. These coincidences are completely necessary. Without them the Theory could not explain the nuclear framework and the nuclear forces. As a matter of fact I must say that, if the experimental values of the three fundamental particles' magnetic moments were not precisely what they are, this Theory could never have been worked out. And, if it had been worked out, it would have incurred great blunders and, of course, the summit of the Theory's checking, which is the measurement of nuclear forces according to experiment, would not have been carried out.

If one analyses this subject rigorously one will reach the conclusion that the experimental values of nucleons' magnetic moments determine certain circular electric currents created by turning charge-rings, which allow us to understand nuclear forces. If the values of the nucleons' magnetic moments were different, there would be no explanation for these forces. In other words this Theory would not exist and the nature of nuclear forces would remain an enigma. And we are going to discuss now those facts, deduced from the above data, which may lead to "strangeness" in the conventional way of understanding the physical world at nuclear levels. The first one is the existence of charge-rings which travel at speeds higher than that of light. It may seem strange, but there is no real reason to prevent that circumstance. We have seen before how this Theory reaches the conclusion that matter never travels faster than light. But nothing is against other components of the Universe being able to do it.

We have already seen that precisely the above circumstance is the cause of nuclear forces and nuclear cohesion, in a way which is completely in agreement with the experimental knowledge of today. It has already been mentioned that the circular electric currents created by the turning charge-rings are, according to this Theory, the origin and cause of all electromagnetic manifestation in the Universe and these currents, the existence of which is necessarily related to the material whirls, represent a double role in the "game" of the Universe: on the one hand, as the transformer of the two sole existing kinds of energy, transforming one of them into the other, and on the other hand, as the linking element between material particles, notwithstanding their electric charges. They are both very complex missions that could not be performed by what I have called "the electric element" if its entity were so simple as to be uniformly distributed in the mass. Not only the entity of the electric charge accompanying matter must necessarily be more complex, but it seems natural that it must present some characteristic which may be beyond the assumptions and concepts admitted today by Science. The fact is that the existence of these charge-rings can explain many phenomena inexplicable until now.

An argument against it may arise: "Nothing can travel faster than light." This argument seems to have a relativistic basis, but it has a fundamental flaw. Einstein's Theory of Relativity proposes that no energy transmission can travel faster than light. This proposal is today accepted. But, in this case, the fact of admitting that the differential elements of charge reach speeds higher than the speed of light, when they turn around their corresponding material particle, does not imply any energy transmission. I must recognize that the idea that "something" can travel faster than light may be difficult to accept if it is analysed in a simple way.

Another point which could cause strangeness is the coexistence of two circular concentric electric rings of opposite signs for the neutron. One could ask: how is the coexistence of two electric rings of opposite signs in the neutron possible? We can now outline the following considerations: the two rings forming the circular currents of the neutron being concentric and located on the same plane, all the electromagnetic forces acting between them are cancelled. The only conditions for that are, on the one hand, that the rings are in deformable, that their size is determined and not subject to deformation, and on the other hand, that the rings are perfectly located on the equatorial plane of the neutron.

As far as the first point is concerned, referring to the size of the rings, this Theory proposes that the turning charge-rings are the intermediate step between mass energy $E = m c^2$ and electromagnetic radiation. Any change from one kind of energy into the other implies a modification of the frequency and the radius of the particle as well as the size of the charge-rings. We must therefore think that, if there is neither absorption nor emission of energy nor energy transformation, the charge-rings are not modified; we can consider them as rigid. We could explain in this way the fact that the two charge-

rings of the neutron can coexist. If they are in deformable and the forces acting between them are symmetrical, those forces cancel out. The condition for that is that the charge-rings are located on the equatorial plane. On analysing this point, one should consider that Nature designed and worked out the neutron with such precision that the charge-rings were exactly located on the equatorial plane of the particle. Let us consider that the neutron is a key piece in the constitution of the Universe. I have already said that the neutron may be considered as the cement which allows cohesion of atomic nuclei. It is an evident fact that the formation of atomic nuclei has been designed following the idea of accumulating positive charges in the nucleus, that is to say, protons. But it is also an evident fact that this union of protons requires, for one reason or another, the presence of neutrons. In other words, neutrons are the joining cement of protons. And it is also a well known fact that, in general, the greater the number of protons, the more cement is needed, that is to say, more neutrons.

We can therefore assume that such a fundamental piece for the existence of the Universe will have been made with sufficient precision. The charge-rings of the neutron are the key to the whole nuclear framework and the nuclear forces and this Theory reaches the conclusion that neutrons are needed as "nuclear cement". The circular electric currents created by the charge-rings are the cause which allows the nuclei to join together. Otherwise hydrogen would be the only chemical component of the Universe.

I would like to point out something here. The mean life of an isolated neutron is about 16 minutes. Nature has allowed for some reason that the precision in designing the neutron has a flaw. We could suppose that this flaw consists in a maladjustment of the charge-rings of the neutron on its equatorial plane, so that one of them does not coincide exactly with said plane. In this case, the two charge-rings are not on the same plane and the electromagnetic forces acting between them do not cancel out, they have a resultant. That is to say, when a minimum lack of equilibrium occurs, some forces between the rings appear. When dealing with β emission this point will be discussed in detail. What I want to point out here is that some forces between the two rings appear when a lack of equilibrium occurs, which make the particle unstable. Both rings separate, taking each of them part of the "goo". This lack of equilibrium occurs for the neutron, when isolated, after 16 minutes as mean time.

The coexistence of electrical charges of opposite signs in the neutron is not a new idea. Let us quote P.T. Matthews, from the University of London, in his book "The Nuclear Apple": "The Yukawa model also implies that the electron charge of the proton, which is carried by the "goo", will not be concentrated at a point but spread over a region of dimensions given by the nucleon radius. Since the proton is spinning, this charge will form small current loops which give it magnetic properties, although its total electric charge is zero. These predictions have been dramatically confirmed during the last ten years in a study of deflections produced in a beam of very high energy electrons by

target protons."

So Yukawa's idea is that the "goo" turns and, the electric charge being distributed in some way, not at a single point, magnetic effects take place. Referring to the neutron, he makes the same point, but assigning a mixture of identical positive and negative charges to it. This Theory is similar in a certain way to that of Yukawa, but it defines how electric charge is distributed in the particle, introducing the new concept, that I consider fundamental, that electric charge always adopts the form of charge-rings, which turn with the corresponding frequency of the particle.

And now referring to the size of the electron, I shall again quote Herry H. Heckman and Paul W. Starring in their above mentioned book "Nuclear Physics and the Fundamental Particles": "Size of the electron.- Up to this point, the properties of the electron have been deduced from experiments. First, the value of e/m was measured by J.J. Thomson. After the absolute charge "e" of the electron had been determined by Robert Millikan, the mass could be calculated as $9,1 \times 10^{-28}$ gram. Unfortunately, the nature of the electron is such that to perform an experiment to determine its size and structure has not been possible up to the present time. Therefore, it is necessary to rely on theoretical considerations to evaluate the radius of the electron."

And after that they say: "In some instances, the electron, which has a radius (theoretical) of 2,82 fermi, is larger in size than the nucleus. This makes it highly improbable that an electron could actually reside in a nucleus smaller than itself."

We are faced with something difficult to define: the size of the electron. How is it possible that the huge experimental work that Science has been undertaking till now has not been able to obtain this datum, apparently so simple? Let us bear in mind that the dimensions of the atomic nucleus, the last and most unreachable redoubt of the atom, have been measured with great precision, in the range of a fermi = 10^{-13} cm. Why has this not been possible in the case of the electron, the most easily identifiable particle in the Universe? The only bases to determine the size of the electron are purely theoretical. But it is accepted that its size is larger than that of the nucleus "on some occasions", the nucleon mass being 1.837 times as large as that of the electron. It seems as if its size were something so difficult to define that it would depend on some strange circumstance outside the electron itself.

The conclusion of this Theory is that this is what happens: the size of the electron depends on a circumstance, which is its energy: this Theory maintains that, when energy increases, the size decreases proportionally.

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