VithA

Version 0.2 revision of 1 December 2018. equation 55 corrected (was wrongly inserted by text editor)

Article (theoretical research)

Principia Physica

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Abstract: A hypothetical phenomenon Bp is introduced as a building block of all physical reality. The Bp has a velocity, a charge and an inertia. The magnitudes of the charge and the velocity of the Bp are deduced from the behavior of the electrostatic force. The inertia to mass ratio of the Bp is deduced from the characteristics of a photon. There is also an a-symmetry between two types of Bp, namely B_h and B_l, resulting in a dependency of its velocity and charge on its mass. The nature of this dependency is deduced from the behavior of the neutron. Then the deduced properties are used to theorize about the structure, the dimension and the gyro-magnetic ratio of the electron, proton and neutron, as well as their anti-particles. It shows that particles that are constructed of Bp's conform to observed reality, such as their gyro-magnetic ratio and their behavior within the structure of an atom. In the course of former deductions, a number of theoretical innovations are developed and integrated in a coherent theoretical framework. There is for example a general formal relation between the mass of a particle and its size (any particle, not just the photon). As another example, the electrostatic as well as the electrodynamical interaction are modeled as phenomena that emerge from a common underlying dynamical interaction, integrating them in a more thorough manner than is currently the state of the art. The general significance of the proposed theoretical framework is in validating a significant theoretical simplification of particle physics, that can enable advancement in a number of disciplines, especially in nuclear physics, where contemporary modeling techniques are known to be very complex.

Keywords: particles; unification; nuclear physics; sub atomic modeling; simplification; phobject; gyro-magnetic ratio; new physics; matter anti-matter asymmetry; beyond the standard model;

Laymen Summary: The study of the very tiny world, smaller than the atom, the world of (sub)particles, has been understood as strange and complex since the first half of the 20th century. Theories like quantum mechanics use complex calculations of probabilities rather than simple physical principles to describe it. The result is that we do not really know how the subatomic world works anymore. Even the most educated in the field are puzzled and unable to deliver intelligible explanations to the point where intelligible descriptions of the tiny world are categorically distrusted as being "simplistic". This article shows that basic physical concepts of a semi-classical nature can be used to describe the tiny world in a far more intelligible manner than is currently the state of the art. Key to this simplification is the finding of a sub-particle coined a "Basic Phobject", that can be understood to be the building block of all known particles. We have put these findings into a concise and integrated theoretical framework, including all the necessary mathematical tools that will enable a far less complex modeling of the subatomic world. A number of scientific disciplines can benefit from this, especially nuclear physics, where modeling is specifically complex and cumbersome.

content

1. preface and introduction

1.1 preface

The research behind this article had the goal of finding a way of constructing physical reality out of only one type of basic building block that has only one basic interaction. As a personal note, I would like to share my motivation for doing such an ambitious research.

From even before the time I studied Physics, any textbook and article that I read on the microscopic world extruded the notion that the world of the very small, the wavy world, behaved completely different from our macro world. In physics, there seemed to be a consensus that particles behave in ways that are so exotic, that we can only use instruments of equal exotic proportions to understand them. Famous examples like the double split experiment of Thomas Young[1] showed how weird this micro world really was. Demarcation lines were drawn. The micro world was the domain of wave functions, probability and statistics. The laws that governed the macro world were not allowed there.

But the more I reflected about this, the more I had to think about the story of the garbage-collector who went from East to West Berlin for the first time in his life and concluded that West Berliners were strange people because they did not have any waste management. They would probably not produce any waste then and that meant they would have to be some very different sort of people. And so he developed a new theory on non-waste-producing-people. Meanwhile he simply failed to recognize the western waste bins because they were made of plastic instead of metal and had a different shape. So it showed that only some minor thing differed from what he was used to and all of a sudden he concluded that the western world must be weird in some very fundamental way. This analogy stimulated my suspicion against the *tiny world paradigm*. There were many theoretical constructs that looked very much like the theory of the non-waste-producing-people to me. Let me mention just two of them.

The first one is the idea that forces were mediated by gauge bosons. Yang and Mills[2] developed a highly complex theory that in essence formalized the behavior of hypothetical particles in a manner that they become messengers of attraction and repulsion. This theory is of such complexity that G. van 't Hooft[3] was rewarded a Nobel prize just for refining it (by adding a normalization method). Although I admire the virtuosity of this theory, I question its wisdom. To me it signals that the tiny world paradigm allows for theories to become as complex as one likes and that all types of explanatory constructs are allowed. The less intuitive they are, the better. This conflicts with my conception of a sound methodology.

The second example is the so called color confinement of quarks as postulated by K.G. Wilson[4]. The idea is that quarks cannot be detected in isolation because in case they are separated, the magnitude of their mutual attraction remains the same, leading in the end to the appearance of mesons and baryons instead of isolated quarks. Whereas I find this theoretical construct not very logical in itself, it also signals to me, that some contributors to the tiny world paradigm were moving to shift their theories behind the territory of falsifiability. Quarks, as a theoretical construct, have never been detected in isolation. The proposed theory had no other function than to explain why this is so and to uphold the notion of a quark, even against observation. It is a highly defensive strategy to explain why it is impossible to see what we think we should see. To me, this is not only unsound, it is plainly wrong as a methodology.

The tiny world had become a playground of complex and anti-intuitive theories to me. I felt like listening to a pianist with an abundance of bravado and virtuosity, but without much musical content, wondering what sort of feedback I should give to him afterward. And so as the years passed, my suspicion against the tiny world paradigm deepened and my conviction became stronger and stronger, that the rules, governing the world of the tiny were probably not at all so different from those of our macro world. If I could point out how small the differences really were, the schism would melt away. If I could show to the garbage collector that the west simply used another type of bin, he would suddenly have perfect understanding of the western world again. And so I set out to go against the governing belief that the tiny is so very different from the huge and I started to apply the rules of the macro world to the tiny world and make a step by step effort to conclude what the differences really were.

In doing so, I travel into unchartered territory. And so I will not be able to reference to the work of my colleagues as much as I would like. They simply have not expressed their view on the issue of a *basic phobject* that I postulate because it wasn't there before for them to express their views on. And it doesn't always make much sense to compare the views of colleagues on quarks, to give an example, with my views on these basic phobjects, simply because they are incomparable to a high degree. So I will give reference to the work of others where it is possible and where it is necessary, but I cannot do more than that.

1.2 introduction

The title of this article may seem a bit pompous, as it is in part a wink to the famous work of Newton, often named by its shortened title: "principia mathematica". The statement, made by this title, is that the use of mathematics in physics, as rightly advocated and promoted by Isaac Newton, may have become a bit overstretched in recent decades. Many of the modern interpretations of the physical world rely heavily on complex mathematical formalisms. This article is in part meant to be an antidote to this trend in that it envisages the basic structure of nature to be understood in basic physical concepts rather than in advanced and refined mathematics (without disregarding the latter).

In physics, it is often hard to discern an object from a phenomenon. The sun may be an object in the sky, but it is also a phenomenon. One may perhaps discern an object from its phenomena. So we may say that the sun is an object, and that all sorts of phenomena go on *inside* and *around* this object, like heat generation. But in many cases this is ambivalent. Are solar flares for example part of the object sun? Or are they phenomena outside of the sun? In the end, it is an arbitrary distinction. And even for an object as unambiguous as a stone it can become strenuous to discern the object from the phenomenon as soon as we zoom in to its boundaries and see many dazzling phenomena going on there, such as radiation coming from it, or being reflected by it. In all cases, the object *does* something to. And in all phenomena, there are objects *involved*.

And so, as a basis for theorizing about nature, it seems prudent to introduce the concept of a "*phobject*". It is object and phenomenon at the same time. We might not know if the electron is a phenomenon (more like a wave), or an object (more like a particle), but we can always call it a phobject. In this manner, we incorporate the blurred line between the two into our language. This reminds us that we can neither reduce the phobject solely to an object nor to a phenomenon. We are then always obliged to explain what is phenomenal about it, and what is objective about it. A physical "thing" can therefore be a phobject, carrying attributes of an objective nature, like its size as well as of a phenomenal nature, like its velocity.

The phobject under consideration in this article is coined *Basic phobject* (Bp, or in many cases, for practical reasons, just B). The term "fundamental" is evaded, since that term has some reserved meaning in Quantum mechanics, that could confuse the reader. It is basic in that is has attributes, of which all natural phenomena can be considered to emerge from. So Bp is the basic building block of the universe and all its matter and energy as we know it.

There are two types of Bp's, namely a B_h and a B_l. The h is for high and the l is for low. B_h is associated with a positive charge, and B_l with a negative charge. The Bp has a velocity, a charge and an inertia. The magnitudes of the charge and the velocity of the Bp are deduced from the behavior of the electrostatic force in section 2.1. The inertia to mass ratio is deduced from the characteristics of a photon in section 2.2 and 2.3. There is also an a-symmetry between B_h and B_l, resulting in a dependency of its velocity and charge on its mass. The nature of this dependency is deduced from the behavior of the neutron in section 2.4. Then these properties are used to theorize about the structure, the dimension and the gyro magnetic ratio of the proton and the neutron, as well as their anti-particles in section 2.5. The results are then presented in section 3 and a discussion of the results follows in section 4, ending with the conclusions in section 5.

2. Materials and Methods

2.1 charge and velocity of a Bp

The electro*dynamical* properties of a Bp are considered to be causing the electro*dynamic* as well as the electro*static* properties of charged particles. We will first look at the known dynamical behavior of a static charge, like the electron, and then propose a manner in which the dynamical behavior of a Bp has to **necessarily** deviate from it in order to be the cause of the electrostatic force as we know it. In the process, the strength of the charge and the magnitude of the velocity of a Bp are deduced.

The electro-dynamical force between two moving charges has been researched by Ampère [5] and others and is very well known. Let us consider the following configuration.

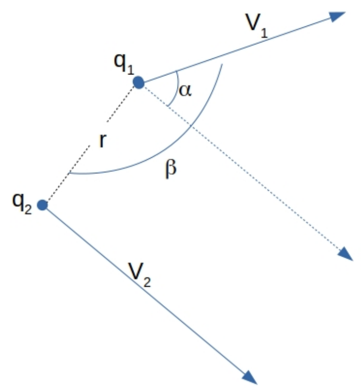

figure 1: two moving charges

For two moving charges q_1 and q_2, at a distance r, having velocity vectors v_1 and v_2, the quantity of the force of q_1, acted on q_2 can be written in the manner of Maxwell as cross products of velocities:

$$F = \frac{\mu_0}{4\pi} \frac{q_1 q_2}{r^2} \vec{v}_2 x \left(\vec{v}_1 x \hat{r} \right) \quad (1)$$

The r with the hat (circumflex) is a unity vector, pointing from q_1 in the direction of q_2. This can also be written as:

$$F = \frac{\mu_0}{4\pi} \frac{q_1 q_2 v_2 v_1}{r^2} \hat{v}_2 x \left(\hat{v}_1 x \hat{r} \right)$$

The right part now has three unity vectors. These can be regarded as determining the effectiveness of the charges in creating a force and in determining the direction of the force on q_2.

It is now proposed that we replace the two moving charges with Basic phobjects B_1 and B_2. The assumption is, that these carry a charge that creates the same effect as the normal basic magnetic “forcefield” that we know of. Only that the reaction of these basic phopjects to this forcefield differs from what we are used to from a normal charged particle. The magnitude of this *basic force* is now proposed to be a result of the dot product (and not a cross product) in the following manner:

$$F = \frac{\mu_0}{4\pi} \frac{Q_1 Q_2 v_1 v_2}{r^2} \hat{v}_2 * \hat{v}_1 \sin\beta \quad (2)$$

This formula gives the magnitude of the basic force. The angle β is the angle between the unity vectors *r* and V_1 (see figure 1), so that *sin β* can replace the cross product of these unity vectors. The normal charge *q* is now replaced with the charge *Q* of the phobject. It has no electrostatic properties, only electro-dynamic. So it only acts on the direction of the velocity, not on its magnitude. If we consider only two dimensions, we can replace the dot product in equation 2 with a *cos α*, so that the operation of the basic force can be more easily pictured in the mind of the reader, like in figure 1. Thus we can get a two dimensional description of the basic force between two Bp’s:

$$F = \frac{\mu_0}{4\pi} \frac{Q_1 Q_2 v_1 v_2}{r^2} \left(-\cos\alpha \right) \left| \sin\beta \right| \quad (3)$$

The most right part of the equation does still give the efficiency of the charge in creating a force, but it does not give a direction for that force anymore. We therefore have to redefine it in such a manner, that the behavior of a charged particle comes out as a result. A large portion of the time invested in this research was spend evaluating various alternative behaviors of the Basic interaction, with respect to the direction of the resulting force. The following description of that direction is not proposed ad-hoc. It is the only one found, that allows for the basic interaction to be the source of as well the electrostatic and the electrodynamic interactions of charged particles. Proof that the electrostatic force can be regarded to emerge from the electrodynamical behavior of a Bp is given in this chapter. Later on in this article (in appendix A) it is also shown that charged particles, constructed of such Bp's are showing electrodynamic behavior in accordance with equation 1. For now, the reader is asked for a leap of faith.

If the velocity of a Bp's is in upward direction, we define a positive force as directed to the left (perpendicular to its direction). The minus sign in equation 6 now indicates that the force is turned to the right in case the two velocity vectors are both in upward direction and so make an angle of 0 degrees. And the force will be turned to the right side again in case the velocity vector have an angle of 180 degrees. So the force switches polarity at an angle of 90 degrees. The effect of this is, that unlike Bp's will turn towards each other and alike Bp's will turn away from each other (opposites attract, as with static forces). The $\sin \beta$ can considered to be always positive. It has no bearing on the direction of the force, and can therefore be taken at its absolute value.

It has to be stressed that this direction of the basic force differs in a fundamental way from the known behavior of charged particles. Electrodynamical interactions of two charged particles can be attractive as well as repulsive for any combination of charges (like and unlike), depending on their angle of approach (or recession). Such interactions cannot - in itself - produce stable configurations of particles. The electrodynamic properties of a Bp however are such that like Bp's always repulse and unlike Bp's always attract. This seemingly small distinction makes a big difference. Interacting Bp's can now form stable configurations solely on the basis of their electrodynamical interaction!

Now let us consider a charged particle – like an electron – made of B_1, and another particle made of B_2, both carrying a basic charge Q_B as depicted in figure 2.

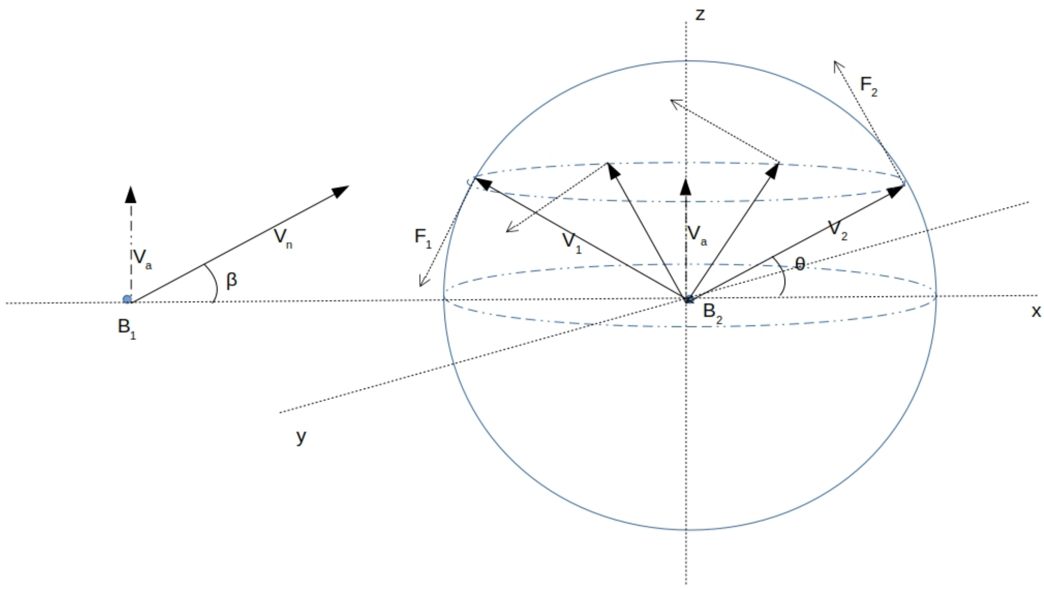

figure 2: two basic phobjects 3D view

Through some mechanism that will become clear to the reader later on in this article (see chapter 2.5, just before 2.5.1), Bp is moving in (semi) random directions during (semi) random intervals. The result of all these movements is that the Bp's remain within their sphere. So their movements are localized. If we regard the Bp as in the center of a sphere, we can take the arrow ends of all possible velocity vectors to picture the sphere. Figure two gives an impression as to how the basic force operates and of its direction. To complement this impression, there is also a top view of the same situation.

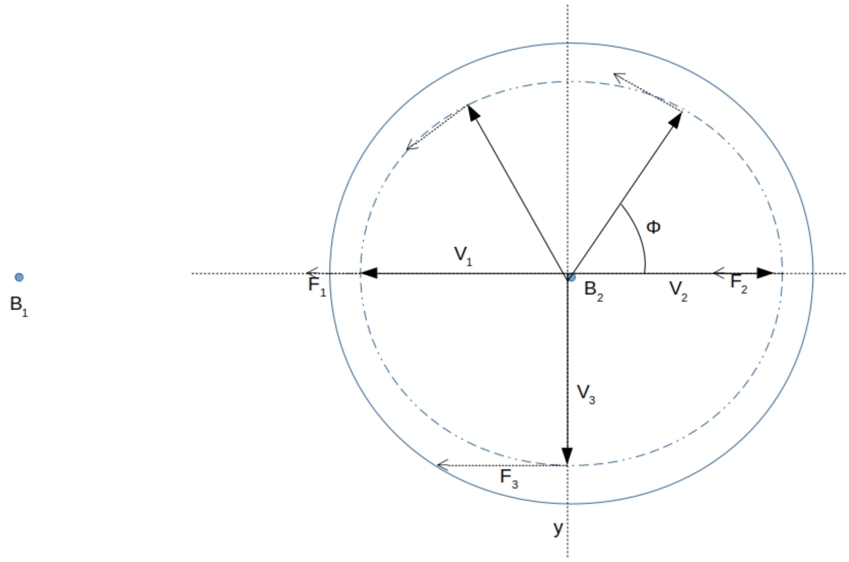

figure 3: two basic phobjects top view

An extra velocity vector V_3 is added for further clarity. We can now look upon the sphere as divided in two halves. Due to the specific symmetry of this system, the basic force (equation 2) works the same for both halves of this sphere, *as long as the x-axis is on the plane of intersection of both halves*. This is because the basic force will then be symmetrical for both halves of the sphere. And so the forces in the x-direction will add-up for both halves of the sphere. From a mathematical point of view, we can then just as well regard all velocity vectors for both spheres as in one half of their spheres, for example the upper half. That will make our calculations less complex.

If we want to know if charged particles can be build from such Bp's, we first have to know how efficient the Bp is in creating a (semi-)static force. Then we can calculate what the properties of the Bp have to be, in order to match the strength of the static force.

There are three phenomena that affect the efficiency of the basic force in creating a static force:

- the **mean velocity V_a** (in upward direction) will be a fraction of the absolute velocity of the Bp. Since there are two of these average velocity vectors in equation 2, this has a considerable impact on the efficiency.
- the **mean value of sinβ** in equation 2 (visible in figure 2) will be smaller than one.
- the **mean direction of the force**. We are only interested in the x-component of that force, while the force has also components in y and z direction (as can be seen in figures 2 and 3).

An efficiency factor for each of these three phenomena will now be determined.

The **mean velocity V_a** can be found by thinking of any velocity vector as a composition of x, y and z velocities. Due to the symmetry, we can easily see, that all average velocity vectors in x and y direction will cancel out. So we need only be concerned with the z direction (V_a). For finding that average velocity component, we need the average angle θ. Spatial considerations lead to the conclusion that the mean angle θ can be found at the intersection where the upper half of the sphere is divided in two equal surface areas. Basic trigonometry tells us then that the mean angle is at 30 degrees and that thus the mean velocity in the upper direction is 0,5 *(=sin 30°)* times the actual velocity of the Bp. So:

$$V_B = 2\ V_a$$

Because there are two independent V_a's in equation 2, namely V_1 and V_2, we now know that these will reduce the efficiency by a factor 0,25.

The angle β can be considered as completely independent of θ. And so the assessment of the **mean value of sinβ** can also be done independently from the value of θ. This means that we can also use another symmetry for finding the mean angle, like this:

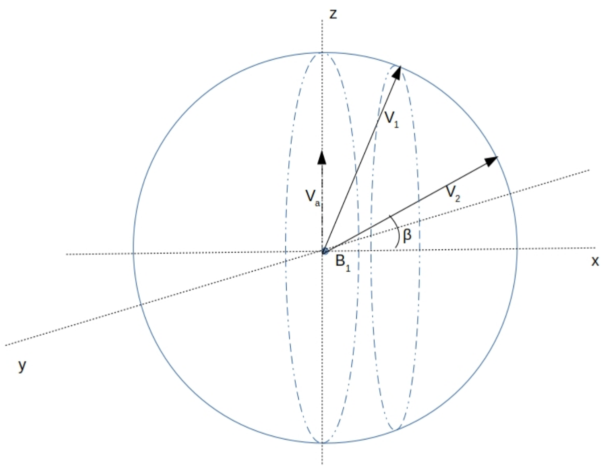

figure 4: another symmetry for finding the mean angle β

In analogy with the method for finding the mean angle of θ, we can now regard only the right side of the sphere and see that for every vertical intersection of the sphere, the angle β is a constant. This shows why this symmetry is valid. Via the same method as with θ, we can now conclude that the mean angle β is 60 degrees. Thus the average value of $\sin\beta = 0{,}8660254$.

For the **mean direction of the force**, we need not only know the average of θ but also of Φ (see figure 3) because that angle will also affect the direction of the force, and therefore affect the part of the force that is in x-direction. Figure 3 shows, that the x-component of the basic force meanders between a low point at the x-axis to a maximum point at the y axis. The minimum force in x-direction (F_m) is at the x-axis and can be described as:

$$F_m = \sin\theta\, F_B$$

Then, apparently, Φ adds as much to that x-component as that the complete force F_B is in x-direction at the point where Φ is at 90 degrees. Then the force is down to its minimum at a Φ of 180 degrees and back to its maximum at 270 degrees again. Thus, the x-component of the force could be *approximated* as:

$$F_x = F_B - (F_B - F_m)\,|\cos\Phi| \qquad (5)$$

The average angle of θ was already found to be 30 degrees and $F_m = \frac{1}{2} F_B$. So for this specific situation we can also write:

$$F_x = F_B - (F_B - \tfrac{1}{2} F_B)\,|\cos\Phi|$$

The mean value of $|\cos\Phi|$ is $\frac{1}{2}\sqrt{2}$. So if we abstract from the actual forces, we will find that the efficiency factor F_x/F_B here is $1 - \frac{1}{2}\,\frac{1}{2}\sqrt{2} = 1 - \frac{1}{4}\sqrt{2} = 0{,}6464461$

So now we have all three efficiency factors. The first factor is ¼. The product of the last two factors is rather a strange number: 0,5598392. For theoretical reasons, which will become apparent later on in this paragraph, the expectation is for this value to be exactly 0,5. The weakest point in former calculations is the mean direction of the force. The description of the basic force in a 3D situation is still not complete in that aspect. It is expected that the calculations will become more exact upon completion of the model. However, the exact direction of the basic force, in the case where these angles go farther away from their optimum, is of no consequence for the rest of this article. This means that we can continue without compromising the integrity of the rest of this article by now accepting the theoretical value of 0,5 for the product of the last two efficiency factors. Ans so we arrive at a total efficiency that is a factor *½ times ¼ = 1/8*. This means that the basic force is eight times stronger than the resulting static force.

We could now try and compare the electromagnetic force with the electrostatic force. The static force is known to be:

$$F=\frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

If we now want to find the ratio R of the static force (equation 7) versus the basic force (equation 3) as would be generated under assumption that $Q_B = q_e$, we can write:

$$R=\mu_0\,\varepsilon_0\frac{\frac{q_1q_2v_1v_2}{r^2}}{\frac{q_1q_2}{r^2}}(-\cos\alpha)\sin\beta$$

If we now consider the situation as in figure 2, where two Bp's move in the same (average) direction, the cosα and sinβ will have a unity value, so they can be taken out of the equation. The ratio can be simplified further by basic calculus and by substituting $\mu_0\ \varepsilon_0$ with $1/c^2$ (c being the velocity of light) to:

$$R=\frac{v_1}{c}\frac{v_2}{c} \tag{7}$$

This means that two Bp's, moving in the same uniform direction must have an elementary charge of e and a velocity of c in order to produce the static force. But as we have seen, the actual Bp does not move in some uniform direction. The randomness of its directions amount to an efficiency of 1/8. Consequently, the basic force must be 8 times stronger than a normal electromagnetic force, otherwise the Bp will not be able to produce a static force. And so its charge is bigger than e and its velocity exceeds c. this can also be written as:

$$F=\frac{\mu_0}{4\pi}\frac{q_1q_2c_1c_2}{r^2}8$$

And so it looks like we could disperse that factor of 8 over the available charges and velocities. That would then reveal how much bigger the *basic charge* Q_B is, in comparison to the elementary charge. And that would also reveal the basic velocity V_B in comparison with the velocity of light. But this theoretical framework does not give a direct clue as to how this factor should be dispersed over the charge and velocity. There is an important clue in reality however. We can explain why the so called g-factor of a Dirac particle is exactly the number of two, in case of $Q_B=2q_e$. This will be discussed in detail in chapter seven. And the symmetry of a photon, as will be discussed in chapter 3, makes much more sense of we assume that $V_B = \sqrt{2}\,c$. Together, these considerations can be formalized as follows:

$$F=\frac{\mu_0}{4\pi}\frac{2q_1 2q_2\sqrt{2}c_1\sqrt{2}c_2}{r^2}=\frac{\mu_0}{4\pi}\frac{Q_1Q_2V_1V_2}{r^2}$$

Note that $2*2*\sqrt{2}*\sqrt{2} = 8$. So this covers for the total inefficiency. And so we have:

$$V_B = \sqrt{2}c \tag{8}$$

And

$$Q_B = 2\,q_e \tag{9}$$

H. Lorenz[6] (1904) sought to prove that many electromagnetic actions are entirely independent of the motion of the system (in which they move). His proof depended on the restriction that the velocity of a charged object did not exceed the velocity of light. From then onward many have argued that no type of matter or energy can have a velocity that exceeds the velocity of light. As a consequence, it could be argued that equation 8 is therefore invalid. But we are not dealing with matter or energy here. We are dealing with a basic building block of universe. We do not know anything of it yet. We can only infer its properties out of the phenomena that we observe. Equation 8 therefore cannot be dismissed on the basis of observed behavior of matter and energy, since a Bp is neither mass nor energy.

2.2 bp's as building blocks of particles

It is theorized by M. Planck [7] (1901), that heat radiation could be considered as an oscillator that has an energy that was proportional to its frequency, and so inverse proportional to its wavelength in case of a moving oscillator. This concept, applied to a photon, makes a photon with higher energy smaller than the one with a lower energy. This goes somewhat against intuition, in that we normally expect bigger objects to be heavier. In particle physics, this is exactly the other way around. Heavier particles are smaller than lighter particles. For particles to be constructed of Bp's, the interaction between the Bp's must be as such, that this law of reversed dimensions is obeyed. It is therefore proposed that particles in general are built from 2 (or more) Bp's. Consider the following configuration:

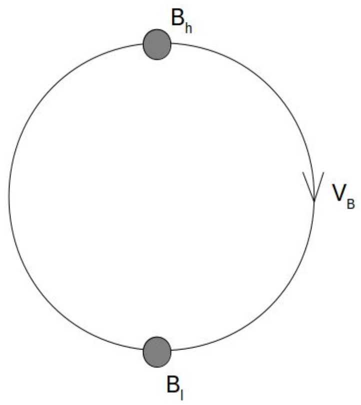

figure 5: a basic particle model

There are two types of Bp's , namely a B_h and a B_l . B_h is associated with a positive charge, and B_l with a negative charge. They are not really classical charges though, since they do not attract as static charges, but only through electro-dynamical interaction (see equation 2). They only affect direction of motion, not the magnitude of motion. To mark the distinction, the Q capital letter is used, instead of the small q. Since the velocities of the proposed particle in figure 5 are in an opposite direction, their interaction only depends on their mutual distance (as -cosα will then be 1). And thus we can have an equilibrium of forces, in case the attractive force matches the centrifugal force. This equilibrium can be written as such:

$$\frac{\frac{1}{2} I_B V_B^2}{\frac{1}{2} D} = \frac{\mu_0}{4\pi} \frac{Q_h V_h Q_l V_l}{D^2} \tag{10}$$

D is the diameter of the particle. On the left side of this equation is the centrifugal force and on the right side is the Basic force. Instead of using the mass m of the particle, we use I_b as a measure of the inertia of a Bp. This is because we do not know if this inertia equals its mass yet. If we now consider that the value of Q for a single Bp does not change with an increase of its mass, we can consider most part of the equation to be a constant. So we can define a constant k as:

$$k = \frac{\mu_0}{4\pi} \frac{Q_h V_h Q_l V_l}{V_B^2} = \frac{\mu_0}{4\pi} Q_h Q_l \tag{11}$$

Substitution of k in equation 10 and simplifying a little gives:

$$I_B D = k \quad = 1{,}026790299\ 10^{-44}\ (kg*m) \tag{12}$$

This proves, that we can build particles from Bp's that have diameters that are “in principle” inverse proportional to their mass. And so, the general direction is right. As a consequence, we must accept that nature is apparently constructed as such, that every Bp, no matter its mass, carries a charge of Q_B. That would be like a mouse making as much noise as an elephant, or like a tiny seahorse displacing as much water as a huge whale. Still, we must accept this for a fact, or we could not envisage a particle being built from Bp's. Apparently, a Bp is constructed as such, that its interaction with another Bp is always of the same intensity, no matter its mass. It is hard to conceive though, that this also goes for Bp's that have infinitesimal small masses. Obviously, there must be some threshold value for a Bp to attain this charge. If we apply this consideration to a photon, an electromagnetic wave must have a minimum frequency (or maximum wavelength) for it to be a Bp.

2.3 calibrating the inertia to mass ratio of a Bp

In equation 10, we use I_B for the inertia of a Bp. This is because we cannot assume that the inertia of a Bp is even somewhere near the value of normal mass. So we need a method for calibrating the inertia of a Bp. In this theoretical framework, all particles are constructed of Bp's, so this must also be the case for the photon. Since the energy versus size (wavelength) ratio of a photon is known very precisely, we can use the photon for this calibration. To this end, a circular polarized photon can be depicted as in figure 6:

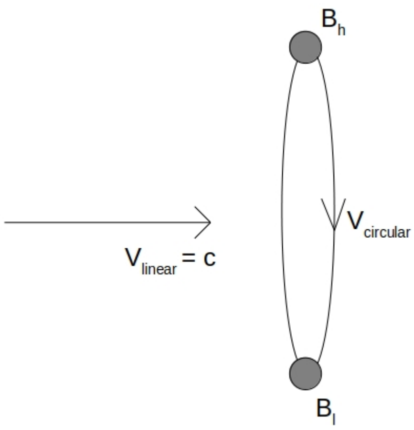

figure 6: a schematic photon

The linear displacement velocity is obvious c. But since the absolute velocity V_B of the Bp is √2 *c*, it can be calculated with the help of the Pythagorean theorem, that the circular velocity V_c is also *c*. For this system, we can look for an equilibrium. There is now an attracting force working on B_h and B_l as a result of two components of velocity (linear and circular), whereas the countering centrifugal force is generated only by the circular velocity. This can be formalized in the following manner:

$$\frac{\frac{1}{2} I_B V_c^2}{\frac{1}{2} D} = \frac{\mu_0}{4\pi}\left(\frac{Q_f V_{linear} Q_s V_{linear}}{D^2} + \frac{Q_f V_{circular} Q_s V_{circular}}{D^2}\right) \tag{13}$$

Note that we use ½ I_B instead of I_B. This is because the particle is separated in two parts, each of which can be considered to carry half of its inertia. If we use the constant k again and write the velocities as multiplications of c, we can write this equation as:

$$I_B c^2 D = \frac{\mu_0}{4\pi}(Q_h c\, Q_l c + Q_h c\, Q_l c) = k\, 2\, c^2 \tag{14}$$

If we bring some left side variables to the right side, a simple equation for the diameter can be obtained:

$$D = \frac{k\, 2\, c^2}{I_B c^2} = \frac{k}{I_B} 2 \tag{15}$$

or

$$\frac{D\, I_B}{k} = 2 \tag{16}$$

The number at the right side of the equation can now be considered as an attenuation of the size of the diameter of the photon. Due to the specific configuration of the photon, the diameter is a factor 2 bigger than expected, compared to the basic particle configuration of figure 5. Therefore we call this number, the *form-factor* of the specific particle type.

Now all things are set for a calibration. If we take the mass equivalent of a photon with an arbitrary λ value of 1 nm (nanometer), we can use the Planck constant h to attain the value of $E=hc/\lambda$. In case we maintain mass-energy equivalence, we can obtain the mass of the photon by $m=E/c^2$. Such a photon has a mass of

$$m_p = 2{,}210219057 \ \ 10^{-33}\, kg.$$

If we bring that mass value into equation 16, as a value for I_B, we receive a value for D of

$$D_{calculated} = 9{,}291298939 \ \ 10^{-12}\ m.$$

Because the mass m is used instead of the I_B we have now found the diameter of the photon on the assumption that $I_B=m$. Based on elementary spatial considerations on the schematic photon of figure 6 however, we will find that $D=2\lambda/\pi$. Because we used a photon with a wavelength of 1 nm, this yields the following reference value for D:

$$D_{reference} = 3{,}183098861\ 10^{-10}\ m$$

The ratio between the reference diameter and the calculated one is then:

$$D_{reference}/D_{calculated} = 68{,}51784412$$

This means, that we have established the ratio between the inertia of a Bp and that of normal mass.

$$m = 68{,}51784412\ I_B \tag{17}$$

Or, in words, the Inertia of a specific mass is about 68 times greater than that of a Bp, carrying that same mass. If we introduce a constant K, such that $K = k * 68{,}51784412$ we can rewrite equation 12 as:

$$mD = K = 7{,}035345766 \ \ 10^{-43}\,(kg*m) \tag{18}$$

Consequently, the form factor of equation 16 can now also be written as

$$\frac{D I_B}{k} = \frac{Dm}{K} \tag{19}$$

2.3.1 a first approximation

Using the value of K, found at equation 18, the expected Diameters of three particles can be found, assuming that these particles have no form-factor. We then get:

particle	Mass (kg)	$D_{calculated}$ (m)	$D_{reference}$ (m)	ratio calculated/ reference
electron	$9{,}10938291\ 10^{-31}$	$7{,}72318590\ 10^{-13}$	$2{,}6\ 10^{-15}$	297
proton	$1{,}67262177\ 10^{-27}$	$4{,}20617850\ 10^{-16}$	$8{,}4\ 10^{-16}$	0,50
neutron	$1{,}67492735\ 10^{-27}$	$4{,}20038860\ 10^{-16}$	$8\ 10^{-16}$	0,53

The proton and the neutron are rather well on target, but the electron is a bit off course. In light of the ongoing debate on the size of the electron, that might not prove to be a great problem. There are even advocates of the idea that the electron is without size. In this table, the so called “theoretical size” of the electron is used as a reference measure.

2.4 a relation between mass, velocity and charge

We can depict the neutron again as a standard particle, as in figure 5. If we calculate the electromagnetic moment *Em* for such a particle, the result will be exactly zero. The B_h and the B_l will create *Em* of opposite sign and they will therefore cancel each other out. The *Em* of the neutron however is inferred to be:

$$Em_n = -\ 9{,}66236 \ \ 10^{-27} \ \ (J/T)$$

This value however cannot be entirely trusted. It is not measured directly. All so called “one-particle measurements” as done by Smorra C. et al (2017)[8] of the *Em* actually measure the so called “Larmor frequency” of the particle. That frequency gives us the ratio of *Em/Mm* (where *Mm* is the moment of inertia). The *Em* is then derived under the assumption that Mm is known (on theoretical grounds, namely because of its “spin”). A basic theoretical framework like this should stay as close to the actual measurement as possible. And so we will direct our attention to the *Em/Mm*, also known as the gyromagnetic ratio of the neutron (γ_n). According to NIST, its value is:

$$\gamma_n = -183247172 \quad (s^{-1}\ T^{-1})$$

A valid theoretical framework must include a mechanism why this ratio is not zero. And so we need some kind of a-symmetry. The problem is though, that if the B_l or a B_h would be allowed to have a higher charge or a higher velocity, we would create a difference in the magnitudes of positive versus negatively charged particles. That is counter to all observations. So we must define a form of asymmetry that explains the neutron’s *Em* while leaving the force of interaction of Bp’s amongst each other intact.

The force $F_{l,h}$ of B_l on B_h in figure 5 can be written as:

$$F_{l,h} = \frac{\mu_0}{4\pi}\frac{Q_h V_h Q_l V_l}{D^2} \tag{20}$$

If we do not want to change the magnitude of the force, the product *QV* for a Bp has to remain a constant. The only option left for defining asymmetry is to allow for *Q* to increase in the same amount as *V* is decreased (or vice versa). Like this:

$$F_{l,h} = \frac{\mu_0}{4\pi D^2}\frac{Q_B}{\alpha_h} V_B \alpha_h \frac{V_B}{\alpha_l} Q_B \alpha_l \tag{21}$$

In this manner, a correction factor α can have any value, and not alter the magnitude of the interaction between two Bp’s. Note that the convention is thus, that an increased α leads to an increased velocity V_h and a decreased velocity for V_l. Vice versa, an increased α means an increased Q_l and a decreased Q_h. Furthermore, in case the α values are smaller than one, the B_l is faster than the B_h. In case the values are higher than unity, the α values are considered to be *reversed*.

If we now establish a form factor for the neutron, incorporating α, we get the following equilibrium of forces equation for B_h :

$$\frac{\frac{1}{2} I_B \alpha_h^2 V_B^2}{\frac{1}{2} D} = \frac{\mu_0}{4\pi D^2}\frac{Q_B}{\alpha_h} V_B \alpha_h \frac{V_B}{\alpha_l} Q_B \alpha_l \tag{22}$$

And this will be the equilibrium equation for B_l :

$$\frac{\frac{1}{2} I_B \frac{V_B^2}{\alpha_l^2}}{\frac{1}{2} D} = \frac{\mu_0}{4\pi D^2}\frac{Q_B}{\alpha_h} V_B \alpha_h \frac{V_B}{\alpha_l} Q_B \alpha_l \tag{23}$$

This means, that the conditions for satisfying an equilibrium of forces differ between B_l and B_h with a factor $\alpha_h^2\ \alpha_l^2$. This cannot produce a stable particle. There is a solution however. In a configuration where α > 1, the slow moving B_l will not be able to go any faster. It has a fixed velocity. Although B_h cannot go any slower in an absolute sense either, it can decrease its *effective velocity* by not only moving along its circular orbit, but by also oscillating perpendicular to its relative position (in and out of the paper at figure 5). It would then move in and out of equilibrium, thus satisfying the condition for a (quasi) equilibrium of the system it is part of. In such a situation, and if the oscillating movement is relatively small in comparison to the diameter of the neutron, the attained quasi-equilibrium is according to equation 23, but now we have to change the velocity of B_h on the right hand side of the equation to adapt to the effective velocity of B_h. As follows:

$$\frac{\frac{1}{2} I_B \frac{V_B^2}{\alpha_l^2}}{\frac{1}{2} D} = \frac{\mu_0}{4\pi D^2} \frac{Q_B}{\alpha_h} \frac{V_B}{\alpha_l} \frac{V_B}{\alpha_l} Q_B \alpha_l \tag{24}$$

And so, after some reordering and substituting *K*, we obtain a form factor as follows:

$$D = \frac{K}{m} \frac{\alpha_l^2}{\alpha_h \alpha_l} \quad \text{or} \quad \frac{Dm}{K} = \frac{\alpha_l^2}{\alpha_h \alpha_l} \tag{25}$$

This means that the form factor of a neutron is exactly 1 in case both α values are equal. Note that the latter assumption is not necessarily a fact and that further theorizing is necessary to sub-construct it. For now, we will ignore this eventuality and look upon the neutron as an ideal candidate for establishing a link between the value of α, needed to create the known gyro magnetic ratio of the neutron. Starting with the *Em*:

$$Em = \frac{1}{2} Q_h V_h r + \frac{1}{2} Q_l V_l r = \frac{1}{2} \frac{Q_B}{\alpha_h} \frac{V_B}{\alpha_l} r - \frac{1}{2} \alpha_l Q_B \frac{V_B}{\alpha_l} r \tag{26}$$

Note that the + sign has changed into a – sign. This is because, by convention, Q_B is positive, whereas Q_l is associated with the negative charge. Now we can rewrite to:

$$Em = \left(\frac{1}{2\alpha_h \alpha_l} - \frac{1}{2} \right) Q_B V_B r \tag{27}$$

In a similar fashion, the moment of inertia *Mm=mVr* can be written as:

$$Mm = m_h V_h r + m_l V_l r = m_h \frac{V_B}{\alpha_l} r + m_l \frac{V_B}{\alpha_l} r \tag{28}$$

and so

$$Mm = \frac{1}{\alpha_l} m V_B r \tag{29}$$

Dividing the two yields:

$$\frac{Em}{Mm} = \frac{\left(\frac{1}{2\alpha_h \alpha_l} - \frac{1}{2} \right)}{\frac{1}{\alpha_l}} \frac{Q_B V_B r}{m V_B r} \tag{30}$$

Simplifying it a bit:

$$\frac{Em}{Mm} = \left(\frac{1}{\alpha_h} - \alpha_l \right) \frac{Q_B}{2m} \tag{31}$$

and thus, if we assume that both α values are equal, α can be isolated,

$$\frac{2m}{Q_B} \frac{Em}{Mm} = \frac{1}{\alpha} - \alpha \tag{32}$$

In this way, using the reference value for the *Em/Mm* of the neutron, as mentioned before, a value for α can be found:

$$\alpha_{neutron} = 2{,}342 \tag{33}$$

Note that the precision has been reduced. This is to mark an uncertainty in the amplitude of the oscillation of the B_h. Its effects on the diameter of the neutron and the effectiveness of the interacting force have been neglected. With these α values, the oscillation must be significant in comparison with the diameter of the neutron, so a refinement of the value of α will become necessary in the future development of this theoretical framework. In the context of this article it will have to suffice to ignore it, since there is currently no viable modeling technique available for the oscillating movement of B_h.

If we also want to know the value of α for other Bp's in other particles, then we need to establish the relationship between the mass of a Bp and α. To this end we can define a variable *β* as follows:

$$\alpha = 1 + \beta \tag{34}$$

As *β* is related to the velocity of a Bp, we could consider a relation between energy, velocity and mass as in $E=mc^2$ or as in $E_k=½\,mv^2$. If we take the standard velocity of a Pb and regard it as a kinetic energy, than we end up with $E_k=½\,m\,(\sqrt{2}c)^2 = m\,c^2$. This comparison suggests that V_B can be regarded as a form of kinetic energy. But it takes some intense theorizing before such an energy relation can be formalized. Such theorizing lay outside the context of this article. For now a crude approximation will have to do. And it seems best, to start with the simplest option, namely a straight forward proportional relation.

$$\beta = Rm \quad \text{or} \quad \alpha = 1 + Rm \tag{35}$$

In this, R is a constant of which the magnitude yet has to be established. This can be done as follows, using the now known α value of the neutron and the mass of one of its Bp's.

$$R = \frac{(\alpha - 1)}{m} = 1{,}603(1292)10^{27} \tag{36}$$

important: Note that the m in this equation is not the mass of the particle, but of only one Bp.

2.5 theorizing the proton and electron

An isolated neutron is not stable. Its halftime is around 15 minutes. A reason for this could be that the oscillating movement pattern of the B_h provides for a decay mechanism. It is proposed that there is a threshold level for the amount of oscillation that is sustainable, rendering the Bp unstable above that threshold. And so its oscillating Bp can break in two (or split in two). On the basis of this assumption, the proton and the electron can be depicted as the following structures:

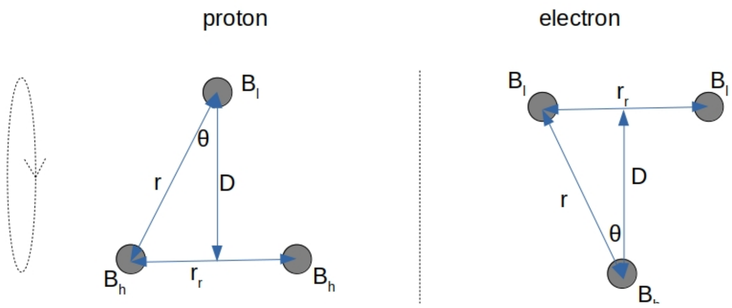

figure 7: charged particles

The convention is that the B_l move out of the paper and the B_h move into the paper. So an observer at the left sees a right hand rotation.

The neutron has shown to have α values above one, so that the B_h is faster than the B_l. Before we continue to theorize the proton, it is necessary to know whether this is also the case for the proton. An important clue comes from the antiproton. The antiproton is known to have the exact same magnitude of its gyro magnetic moment (be it reversed). And so we could try and find out which α values conform to this. For this, we can write the gyro magnetic ratio of the proton in a similar manner as for the neutron (see equation 31):

$$\frac{Em}{Mm} = \left(\frac{2}{\alpha_h} - \alpha_l\right)\frac{Q_B}{2m} \tag{37}$$

If we now define the antiproton as the same particle as the proton, but now with the B_l and B_h reversed, so that there are two B_l and one B_h, than we can do a similar procedure for the anti-proton, yielding:

$$\frac{Em}{Mm} = \left(2\alpha_l - \frac{1}{\alpha_h}\right)\frac{Q_B}{2m} \tag{38}$$

And so if we then equate both formulations for the gyro magnetic ratio and simplify it a bit, we get:

$$2\alpha_l - \frac{1}{\alpha_h} = \frac{2}{\alpha_h} - \alpha_l \tag{39}$$

This equation cannot be interpreted in any other meaningful way than that in the anti-proton, not only the B_l and B_h have changed position, but that the α values have reversed also. The fastest Bp in the proton will be the slowest in the anti-proton. This reveals something fundamental about nature (and the word fundamental is used deliberately here). It means that the velocity of a Bp is not directly linked to its mass and to its sign (either B_h of B_l). It is the result of interaction between the Bp's in a particle. The result of their interaction can be described as that the heavier Bp is either slower or faster than the other. This theoretical framework does not provide a theoretical basis for a choice between those two possibilities, but the research showed that the heaver Bp is the faster of the two. The other way around does not conform to neither the measured value of the gyro magnetic ratio of the proton, nor to that of the electron or of their antiparticles. So the general rule is:

The heavier Bp will become the fastest, through its interaction with the lighter Bp('s). (40)

And so, in a proton, the α values are below one and the B_l is the fast one.

Please note, that in an isolated charged particle like in figure 7, the effects of two Bp's will cancel each other. The particle will not have a stable position in space. Only the slightest asymmetries in its construction or the smallest influences from outside will make it turn. Alongside with its rotating movements, this makes that the remaining Bp can be regarded from afar as moving in random directions. Such a charged particle was proposed in chapter 1, necessary in the deduction of the standard velocity and the basic charge of a Pb.

2.5.1 three equilibrium states for charged particles

In contrast with the neutron, there are now three equilibrium states that have to be satisfied.

1. The center of mass is consistent with the ratio of the upper versus lower mass.
2. The repulsive force of the like Bp's has to be countered by the attractive force of the other Bp in the same **(horizontal) direction**.
3. The attractive forces in **vertical direction** have to match the centrifugal forces of each Bp.

The **first equilibrium** can be satisfied by introducing a ratio. In case the masses are divided so that the bottom side has the same mass as the top side, the center of rotation will be exactly halfway the diameter D. In case the matter distribution differs from this, the center of mass will shift towards the heavier side. We will then have two diameters instead of one. In case of the proton, their *ratio* γ will be (by definition):

$$\gamma = D_l/D_h = 2m_h/m_l \tag{41}$$

or $\gamma = D_l/D_h = m_h/2m_l$ for the electron

In all cases,

$$D_{total} = ½\, D_h + ½\, D_l \tag{42}$$

so that

$$D_{total} = r \cos\theta \tag{43}$$

In a classical system, this would probably not have to be made explicit as an independent equilibrium state. It would follow from the third equilibrium (see below). But this is a semi-classical model, where the velocity of the Bp's is not a normal variable. They are fixed for every particle under consideration. And thus a Bp cannot follow paths that have variable velocities, while exchanging kinetic energy into potential energy and vice versa.

The **second equilibrium** state for the proton can be written as

$$\frac{\mu_0}{4\pi r_r^2} Q_h V_h Q_h V_h = \cos\theta \frac{\mu_0}{4\pi r^2} Q_h V_h V_l Q_l \tag{44}$$

Here the left hand side is the force between the like Bp's and the right hand side is the force between the unlike Bp's. Substitution of α, r_r (= 2 tan θ D) and r (= D / cos θ) gives:

$$\frac{\mu_0}{4\pi 4 D^2 \tan^2\theta} \frac{Q_B}{\alpha_h} V_B \alpha_h \frac{Q_B}{\alpha_h} V_B \alpha_h = \cos\theta \frac{\mu_0}{4\pi \frac{D^2}{\cos^2\theta}} \frac{Q_B}{\alpha_h} V_B \alpha_h \frac{V_B}{\alpha_l} Q_B \alpha_l \tag{45}$$

The α values cancel out on both sides, so after some simplification:

$$\frac{1}{\tan^2\theta} = 4\cos^3\theta \quad or \quad \frac{\cos^2\theta}{1-\cos^2\theta} = 4\cos^3\theta \quad or \quad \frac{1}{4} = \frac{1}{\cos\theta} - \cos\theta \tag{46}$$

and so we arrive at an angle θ of

$$\theta_{min} = 28{,}0201761 \text{ degrees.} \tag{47}$$

In some cases though, as has been shown with the neutron, it is necessary to bring the faster moving Bp down to the velocity of the slower one ($V_h = V_B * \alpha_h$). In such cases, the equation would show α as a factor in the following way:

$$\frac{1}{\tan^2\theta} = 4\cos^3\theta \alpha_h \alpha_l \quad \text{or} \quad \frac{1}{4\alpha_h \alpha_l} = \frac{1}{\cos\theta} - \cos\theta \tag{48}$$

This is a more general formulation of equation 46 with the outcome of 46 as the minimum value, since an α value further away from 1, increases the value for θ as an equilibrium. For the proton, this leads to a value of *θ*, above 50 degrees!

The **third equilibrium** can be formalized for both B_h and B_l as such:

$$\frac{\frac{1}{4} I_B V_h^2}{\frac{1}{2} D} = \cos^3\theta \frac{\mu_0}{4\pi D^2} Q_h V_h V_l Q_l \tag{49}$$

The ¼ I_B on the left hand side corresponds with the one quarter of the proton's mass that this B_h carries. For B_l, this number would be ½. But then again, the right side of the equation would in that case be multiplied by 2, since there are two B_h's interacting with it. The net result would thus yield the same equation for B_h and B_l. Also, since the center of mass would be in the middle, both Bp would have the same diameter and so only one equation is necessary for both. Further simplification of this equation leads to:

$$I_B D = 2\cos^3\theta \left(\frac{\mu_0}{4\pi} \frac{Q_h V_h V_l Q_l}{V_h^2}\right) \tag{50}$$

The part between brackets could be expressed as the constant K, if it weren't for the factor α. In this case, there is a difference between α_h and α_l because B_h has less mass than B_l. In analogy with the neutron, we have two B_h's, now circling around in a lower velocity than the B_l. So for the the fast moving B_l, we have to define the *effective velocity* again, which equals the absolute velocity of the slower $B_h (= V_B * \alpha_h)$. This would lead to:

$$I_B D = 2\cos^3\theta \left(\frac{\mu_0}{4\pi} \frac{Q_B V_B V_B \alpha_h Q_B \alpha_l}{V_B^2 \alpha_l^2}\right) \tag{51}$$

and so the reader can see that the α_f factor does not fall out of the form factor again, as with the neutron:

$$I_B D = k\, 2\cos^3\theta \frac{\alpha_h}{\alpha_l} \quad \text{or} \quad \frac{D\,m}{K} = 2\cos^3\theta \frac{\alpha_h}{\alpha_l} \tag{52}$$

2.4.2 The electron

The reader is now acquainted with the procedure for the proton. The same procedure can also be followed for the electron. The only difference now is, that the α values are reversed, so above unity. This means that the equilibrium for the angle θ will be at:

$$\frac{\alpha_l\,\alpha_h}{4} = \frac{1}{\cos\theta} - \cos\theta \tag{53}$$

and the form-factor will be

$$\frac{D\,m}{K} = 2\cos^3\theta \frac{\alpha_l}{\alpha_h} \tag{54}$$

So there are really only small differences between the proton and the electron in terms of their equilibrium equations. These differences will however have a large impact, because the α values for the electron are much closer to one, due to the mass of the electron being so much smaller than the proton's.

2.4.3 antimatter

The **anti-proton** can be regarded as a proton in which B_h and B_l have switched position. And as per rule 40, the α values are reversed, with respect to the proton. This means that it has α values above unity, as the electron, and that, as a consequence, equation 53 and 54 are applicable to its equilibrium angle and its form factor. This leads to a particle that is in all aspects identical to the proton, except that its charge and Em are reversed.

The same can be said about the **anti-electron**. It has in fact the configuration of a proton, albeit that its mass is far smaller and so its α values are far closer to 1. And there we have the perfectly similar anti particle to the electron, with only charge and Em reversed.

Now the question about why nature prefers matter of anti-matter is still open. As the rule is apparently, that heavier Bp's in a particle move faster, this question can be reduced to why there is an apparent preference for the neutron to have its B_h move faster, since that is what will cause the B_h to oscillate, split and create a proton (instead of an anti-proton). This question cannot be answered in full by this theoretical framework in its current crude state. But the road to that answer has been laid open wide by it. The B_h and B_l apparently differ in another aspect than only the sign of their resulting charge. The B_h must have a different relation with the space it is traveling through than the B_l has. And this difference results in a preference for the B_h to become faster in the interaction with a B_l of (almost) same mass. So basically, the question is, what is the physical difference between B_h and B_l?

As a consequence of these considerations, the **anti-neutron** is identical to the neutron, apart from the B_l now being the fastest of the two. This will cause the B_l to be the one in oscillation and as a consequence to be the one to split up in two, hence creating an anti-proton in stead of an proton.

We might look upon the formation of particles as a process of lighter particles merging into heavier particles. Somewhere in this process of becoming heavier, one of the two Bp's take the upper-hand in velocity. This process creates the preference of matter over antimatter. It could be influenced by circumstance though. The generation of an anti-neutron over a neutron may thus (in part) be a matter of circumstance, either created by chance or by an experimental setup.

3. results

Former paragraphs have given enough tools now, to start calculating the actual diameters and gyro magnetic ratios of the particles. As a general rule for validation of the attained particle models, the gyro magnetic ratio is used, since these values are precisely known. This in contrast with their diameters of which many are still largely open for discussion.

All properties of the proton follow necessarily from the theoretical framework. The angle θ however, needs some extra explanation. If θ becomes wider, the diameter of the particle will become smaller and – as a general trend - the *Em* moment will become smaller. And in case of the proton, there is ample reason for the angle to deviate from equilibrium, since its B_l will show significant oscillation and since its B_h's have a significant higher charge. This can be pictured as in figure 8

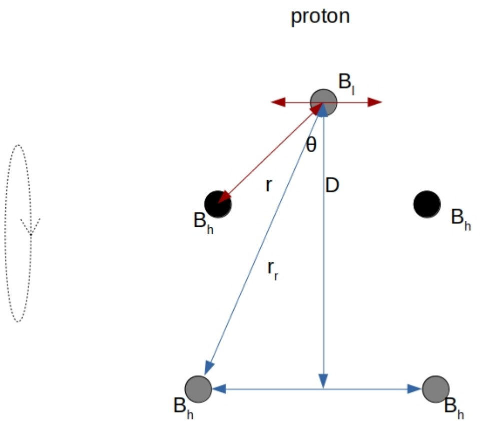

figure 8: angle variations in a proton

The grey B_h are in a position where the α values are unity. Since the proton has α values that deviate strongly from unity, the charge of the B_h increases sharply. And since these two repulse, the equilibrium angle θ will increase significantly. But this angle could possible also become wider because of the oscillations in B_l (as depicted by the arrow). Since there is currently no viable model for this oscillation, there is no way of telling how this oscillation affects the angle θ. As a consequence, the results in the table beneath are given for θ in its equilibrium for all charged particles (either matter or anti-matter).

It needs to be stressed that variations in θ have considerable impact on the diameter and the *Em* of a particle. These variations have however **no** impact on the gyro magnetic ratio. This is because if the diameter of the particle decreases, due to θ becoming wider, the *Em* of the particle will decrease proportional to the *Mm*. So the ratio *Em/Mm* will remain **unaffected** by the width of the angle θ!

The following results follow necessarily from the presented theoretical framework:

attribute	**Photon (1nm)**	**Neutron**	**Proton**	**Electron**	**antiproton**	**anti electr.**
$D_{reference}$ (m)	$6,3662\ 10^{-10}$	$8\ 10^{-16}$	$8,4\ 10^{-16}$	$2,6\ 10^{-15}$	$8,4\ 10^{-16}$	$2,6\ 10^{-15}$
form factor	2	1	0,6820	1,3758	0,6820	1,3758
D	$6,3662\ 10^{-10}$	$4,2004\ 10^{-16}$	$2,8685\ 10^{-16}$	$1,0625\ 10^{-12}$	$2,8685\ 10^{-16}$	$1,0625\ 10^{-12}$
ratio $D/D_{reference}$	1	0,5250	0,3415	408,67	0,3415	408,67
D/D_{proton}	2219327	1,4643	1	3704,15	1	3704,15
$\theta_{equlibrium}$	n.a.	n.a.	51,3684	28,0104	51,3684	28,0104
α_l	1,00000177	2,342562	0,427220	1,000365	2,340714	0,999635
α_h	1,00000177	2,342562	0,598674	1,000730	1,670357	0,999270
γ (gyro magnetic ratio Em/Mm)	$2,5684\ 10^{8}$	$1,8324\ 10^{8}$	$2,7907\ 10^{8}$	$1,7623\ 10^{11}$	$2,7907\ 10^{8}$	$1,7623\ 10^{11}$
$\gamma_{reference}$	n.a.	$1,8324\ 10^{8}$	$2,6752\ 10^{8}$	$1,7608\ 10^{11}$	$2,6752\ 10^{8}$	$1,7608\ 10^{11}$
$\gamma/\gamma_{reference}$		1	1,0432	1,000846	1,0432	1,000846
Em	$7,6612\ 10^{-26}$	$-1,1666\ 10^{-26}$	$1,6993\ 10^{-26}$	$-3,6141\ 10^{-23}$	$-1,6993\ 10^{-26}$	$3,6141\ 10^{-23}$
$Em_{reference}$	n.a.	$-9,6623\ 10^{-27}$	$1,4106\ 10^{-26}$	$-9,2847\ 10^{-24}$	$-1,4106\ 10^{-26}$	$9,2847\ 10^{-24}$
$Em/Em_{reference}$		1,2074	1,2047	3,8925	1,2047	3,8925
F (Newton)	$4,554\ 10^{-9}$	1906	2236	0,00127	2236	0,00127

All reference values in this table are from NIST[8]. *D* stands for the diameter of the particle. A comparison is made with a reference diameter, as found in literature, as well as with the theorized size of the proton. For the reference value of the electron diameter, the so called "theoretical diameter" is chosen. Then the angle θ is given, necessary for the particle to be in equilibrium (and this value is also used for calculation of *D* and *Em* of the particle). Further down, the α values are shown and the gyro magnetic moment. The last one is then compared with reference values. The *Em* moments are then given in comparison with reference values. At the end, the force in newton between two opposing Bp's are given within the particle.

4. discussion of results

In this theoretical framework, there is no modeling done for the oscillation that is proposed to exist in particles. For the dependence of the velocity/charge of a Bp and its mass, the simplest of thinkable relations has been assumed, namely a straightforward proportional relationship. Still, the gyro magnetic ratios are surprisingly good on target. It may come as no surprise that the gyro magnetic ratio of the neutron is precisely correct, since the neutron is used to calibrate the α values with respect to the experimental gyro magnetic value. But that the proton then follows with only a 4 percent deviation and the electron within a per-thousand deviation can hardly be a coincidence. The deviation of the proton could even be smaller in case the system were tuned in a manner as to disperse the errors over the neutron and the proton. But that would compromise the method, which is to let all values flow necessarily from the theoretical framework, as it is.

An interesting result might be, that the currently inferred *Em* values are predicted to be incorrect. This theoretical framework predicts the *Em* to be about a factor 1,2 times the current values for the neutron and the proton and even a factor 4 for the electron. Note that the Em values do not have the theoretical significance as the gyro magnetic ratios have. Even so, it has to be admitted that the exact value of the basic velocity $V_B = \sqrt{2}c$ has not yet been fully proven in chapter 1, only approximated. And a deviation of V_B from that exact value would have impact on the values of *Em* and on the calculated diameters of the particles (not on the gyro magnetic ratios!). But even given the uncertainty in the basic velocity, the deviations of the *Em* values from their given reference values are significant. So some explanation is due. As argued before, in contemporary experimental setups, the *Em* is inferred from the gyro magnetic ratio, on the assumption, that the *Mm* of the particle is known from its spin number. And so a comparison of this theoretical framework with concepts from Quantum mechanics and the standard model becomes inevitable. This article however is not meant as an explanation of Quantum concepts, nor of the Standard model. The comparison must therefore be extremely brief.

A comparison between the Planck constant *h* and the constant *K* in this article yields that $K = 1{,}0617674\ h$, so they are only 6 percent apart. The Planck constant is in effect a proportionality constant as *K*. *K* proportions the diameter of a particle to its mass and *h* proportions the wavelength of a standing wave (as a particle) to its energy content. For *K*, the physical process behind the proportionality is precisely described. For *h* it is not. In the first half of the 20th century, this gave room to the interpretation that *h* is an energy quantum of some sort. And in this context *h* has been linked to the *Mm* of the electron also. In the manner, known as the Bohr magneton, this shows as:

$$Em = \frac{q_e \hbar}{2 m_e} \tag{55}$$

Here *Em* is the value of the Bohr magneton, q_e is the elementary charge of the electron, $\hbar$ is the reduced Planck constant ($h/2\pi$) and m_e is the electron rest mass. Let us compare this to equation 38 for the electron (repeated for readability):

$$\frac{Em}{Mm} = \left(2\alpha_l - \frac{1}{\alpha_h}\right)\frac{Q_B}{2m} \tag{38}$$

We can now write equation 55 in the form of 38 as follows:

$$\frac{Em}{\hbar} = \frac{q_e}{2 m_e} \tag{56}$$

This shows that ħ functions as a moment of inertia of some sort. Assuming that both equation 56 and 38 are true, and remembering that $Q_B = 2q_e$ the following must also be true:

$$\hbar = Mm\left(4\,\alpha_h - \frac{2}{\alpha_l}\right) \tag{57}$$

In the special case, where the α values are very close to unity, ħ will have a value of *2Mm* (or *Mm* = ½ ħ). And so the electron can be regarded as a spin ½ particle. The value between brackets is known in Quantum physics as the *g-factor*. In case the α values deviate from unity, this g-factor will deviate from the exact number of 2. This deviation is known as the *Anomalous magnetic dipole moment*, for which the theory of quantum electrodynamics of Schwinger, J, [10] is constructed as an explanation.

So this theoretical framework provides for the same mechanisms as quantum mechanics does. But it adds something to it, namely an exact mechanism for calculating as well the *Em* as the *Mm*. This mechanism is not present in quantum physics, and therefore, the assumption that ħ is some sort of quantum for the electrons' moment of inertia remains a bit of a gamble. But this gamble nevertheless became the basis for defining the so called "intrinsic" moment of inertia of the electron (and through extrapolation for all particles). Since we have only the gyro magnetic ratio to confirm this experimentally, the actual *Mm* (along with the *Em*) could be off by a ten-fold. We would not know it. And since this theoretical framework is the first one to actually define a mechanistic model for the *Mm*, its predictions with respect to the actual values of the *Mm* and the *Em* are meaningful.

Please note also, that the unexpected high efficiency of the electron charge in creating an *Em* is explained in quantum mechanics, by supposing that the *Mm* is half its expected value (hence the spin ½ denomination). This theoretical framework however, suggests that the charge Q_B of a standard Bp is twice that of the electron as a particle (equation 9). These two assumptions are mathematically equivalent for the gyro magnetic ratio, but can lead nonetheless to different values for *Em* and *Mm*.

A remarkable result of this research is the high α-values for the neutron and the proton. In the neutron, the B_l actually travels at a velocity under the velocity of light, and its counterpart travels over 5 times faster. This result was far more extreme than expected. If this is true, normal matter as we know it, could not travel faster than about *0,6 c*, simply because the neutron could not retain any form of structure at velocities above *0,6 c*. It would become some sort of light ray, not a neutron anymore. This is of course under the assumption that there is not some sort of yet unknown mechanism present in nature that takes care of this deficit in case the particle moves at higher velocities. The proton has a comparable problem. Its slowest Bp runs at about *0,85 c* and so it cannot retain its structure under velocities that are near the velocity of light. So if these particles actually travel above these velocities inside accelerators, their must be some yet unknown mechanism in place and some other formulation of equation 35 is necessary for higher particle velocities.

The high α values are a significant result and present an opportunity for explaining or discovering natural phenomena. On the other hand, they also present a problem, namely that the oscillating movement of the fast moving Bp must be extraordinary, by either its frequency or its amplitude. Creating a viable model for this could prove to be a challenge, especially, since this theoretical framework claims that all natural interactions must emerge from the basic interaction of Bp's. Note, that in case the amplitude of the oscillation is big, compared to the diameter of the particle, the particle may look more like a thin cylinder than a particle and could resemble in part (dare is say?) a sort of "oscillating string".

This leads to another comparison, namely with the standard model. The standard model arose from the inability to explain why the neutron has an Em, whereas it does not have a charge. Speculations about the internal structure of such particles as the neutron led to the postulation of quarks by Zweig and others [11]. In a manner of speaking, these quarks have the same function as the Bp's in that they explain the anomalies in gyro magnetic ratios of the various particles. Then all sorts of other elementary particles have been introduced to explain nuclear force, week interaction, etc.. This theoretical framework does not need all such extra particles. Forces are not transmitted, they simply emerge from the basic interaction. The basic interaction can be regarded as the strong nuclear force as it acts between Bp's in a particle. It can be regarded as the electromagnetic force for moving particles. It can be regarded as the electrostatic force in a manner as discussed in chapter one of this article. And interactions between particles in a nucleus arise from their asymmetries, as will be discussed below. So in essence, there is no need for a myriad of particles within this framework. Of course, this framework, in its present crude form cannot yet sub construct this claim with detailed calculations for all natural forces, but that is the basic line of thinking.

A matter of interest may also be, that the diameter of the proton is predicted to be about a third of the latest measurements of A. Antoningi et al [12], (amounting to a size of 8,4 10^{-16} meter). This result may seem a bit odd at first sight. But as the charge of the Bp's inside the proton is, according to this framework, twice the charge that these researchers were expecting for the particle as a whole, and considering that this charge is entirely on the outskirts of the particle, it may not come as a surprise that the diameter in this framework is a lot smaller. Also, in this framework, the form of the proton is not that of a sphere, but more or less that of a cylinder of which the length exceeds its diameter. And so there could be some discussions as to what would constitute its size.

5.1 The atom

The structure of the atom will not be discussed at length. The goal of this part of the discussion is mainly to highlight that the a-symmetric topology of the particles has the potential to explain their behavior in a more intelligible manner than the standard model or quantum mechanics does (which was a main motivator of this research).

A remarkable result of this research is the size of the electron. It is about 1265 times as big as what is currently thought of as the size of a proton. And you need only about 50 electrons to cover the diameter of a Bohr Hydrogen atom. It is about 6 percent above the Compton wavelength of the electron and about 409 times the so-called classical electron radius. Beneath, there is a picture of an electron.

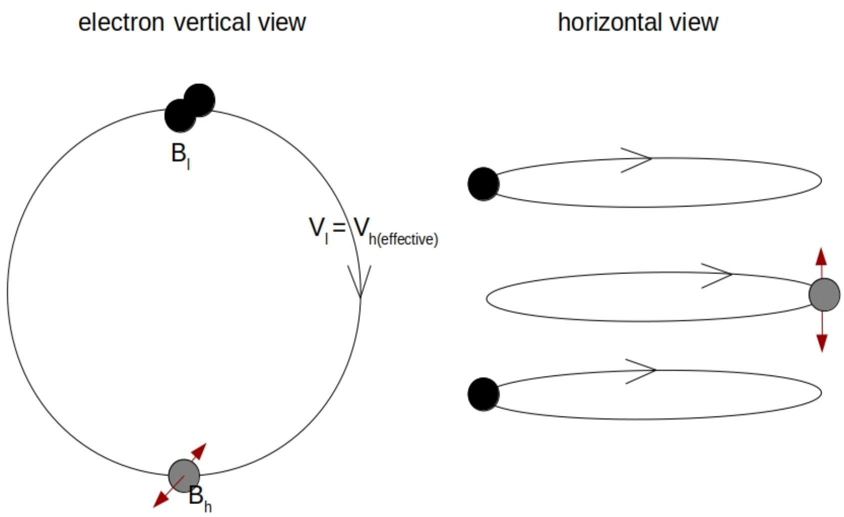

figure 9: the electron from two angles

The single B_h has twice the mass of its counterparts and thus moves a bit faster. It has to come down to an effective velocity and therefore exhibits an oscillation (depicted as a small double arrow through the B_h). Since the B_l's have a slightly higher charge than the B_h, whereas they move at the same (effective) velocity as viewed from its vertical side, the electron is actually more negative from its vertical view than from its horizontal view. And so the electron will have a preferred position with respect to the proton. The same will be the case for the proton. And so preferred positions in space exist for the proton and the electron with respect to each other. Such preferences can eventually shown to be the cause of the Pauli exclusion principle.

The Q_l in the **neutron** is about five times stronger than the Q_h, whereas they make the same orbit. So the neutron might be neutral from afar (due to the velocity differences that compensate the charge differences), but at close range and approached from its horizontal side, it will look strongly negative. That is why it is an ideal companion of the proton. It can sit comfortable next to the proton. The binding force within the proton and the neutron are in the order of 2000 Newton. A neutron's attractive force towards the proton could therefore be in the order of about thousand Newton if it were positioned in the right angle at a distance of about 1.5 times the diameter of the neutron. Those forces present the strong nuclear force and it would be enough to allow for another proton positioned on the other side of the neutron. Note that the neutron may look negative from the horizontal view, but positive from other angles. And so two neutrons can also connect with each other, and create 3D like structures. So there could be flat nuclei, but also 3D nuclei. Note also that these forces are not at work outside of the nucleus, since the differences between the various particles inside the nucleus will largely cancel each other.

And so it shows that a lot of peculiar interactions between particles can be understood in an intelligible manner, accessible to the human mind, as soon as the actual configurations and forms of the particles are known.

5.2 general topics of discussion

It is inevitable to mention, that relativistic effects play no role in this theoretical framework whatsoever. This is because relativistic effects are thought to appear in the realm of mass only. They are the end product of a system of Bp's that starts to move (as a whole system). There is no evidence and no working theory yet to support that relativistic effects would also be in place for a Bp. It might be, that in the future, the basic force between two or more Bp's could be explained as a result of some principle of delayed interaction or that relativistic machinations are behind the interaction that causes the heavy Bp to move faster than the other. For now, it is thought of as not very wise to go into such speculations. They could only hinder the research into such a new realm op physics. It is considered better practice to just state the possible laws that govern the tiny world in a manner as straightforward and intelligible as possible. A rule of thumb is: "if you can do without it, than do it".

The muon has a mass of about 200 times that of the electron. This theoretical framework would predict that its α values would be much higher than those of the electron and that consequently, the anomalous magnetic moment should be far greater. Yet, research shows that such is not the case. The g-factor does not differ very much from that of the electron. This fact is mentioned here to be ahead of potential criticism that this research has been done in ignorance of it. In the context of this theoretical framework, the muon, and all other "instable" particles must have other configurations than the stable ones that are discussed here. Before being able to say anything serious about the muon, its configuration must first be found. Possibly, it has a γ-factor which deviates from unity (see equation 41). This could be a good topic for follow up research.

As a final element of this discussion, it seems worthwhile to mention that this theoretical framework points at a rather robust construction of the universe. If the standard velocity would be missing a percentage or ten, the universe would not function a bit different. In fact, if the standard velocity would be down to the velocity of say two meter per second, the diameters of the particles would be exactly the same. Only the binding forces would be far less. But then again, all forces would be far less, since all forces emerge from the same basic interaction. And the velocity of light would then be only a little above one meter per second, and nobody would notice that a second had become a decade! In all, this theoretical framework misses all those natural constants that quantum mechanics and the standard model so precisely need, in order to explain why the universe functions as it does.

6. conclusions

The proposed theoretical framework shows that the tiny world paradigm, or the belief that the microscopic world of particles is totally different from our macroscopic world, could very well be wrong. In fact there is only one tiny world rule found that is very different from what we are used to, and that is that a Pb has a peculiar relation between its mass, velocity and charge. Apart from that, the tiny world is not much different from our macro world, having inertia, attractive and repulsive forces as well as centrifugal forces in place.

The proposed theoretical framework presents a valid modeling technique of physical reality since it conforms to all undisputed parameters of physical reality, among these the Planck constant, the standard charge, the strength of the electrostatic force and the giro magnetic ratios of the particles.

The proposed theoretical framework creates opportunities for a more refined and/or simplified modeling in nuclear physics, chemistry, particle physics and possibly also in a number of other area's of expertise. Such developments will also enhance and refine the framework itself.

The proposed theoretical framework provides explanations or point in the direction where explanations can be found for a number of yet unexplained phenomena in physics such as:

- why is there a preference of matter over anti-matter,
- are properties of particles related (to an unknown phenomenon) or are they intrinsic to the particle.

The proposed theoretical framework has a number of consequences that can eventually be verified (or falsified) like for example the diameter of the electron and the proton, the Em values of the particles.

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Appendix A: on the electromagnetic field.

The following proof contains an intuitive calculation of a torque. In that sense, it is not entirely formally descriptive as a model. It is therefore placed outside of the main text of this article. The researcher is nonetheless very sure of the correctness of this proof and invites others to discuss it.

Now that the behavior of particles is explained in this article, it can also be explained how the direction of the Basic force is so different from that of the electromagnetic interaction of particles that we know of. In essence, particles show other effects than the Bp's they are made of. This is as logical as it would be to expect a married couple to show different behavior as if both were still in their bachelor state. Let us go back to the two dimensional representation of the basic force and imagine two particles aligned like this:

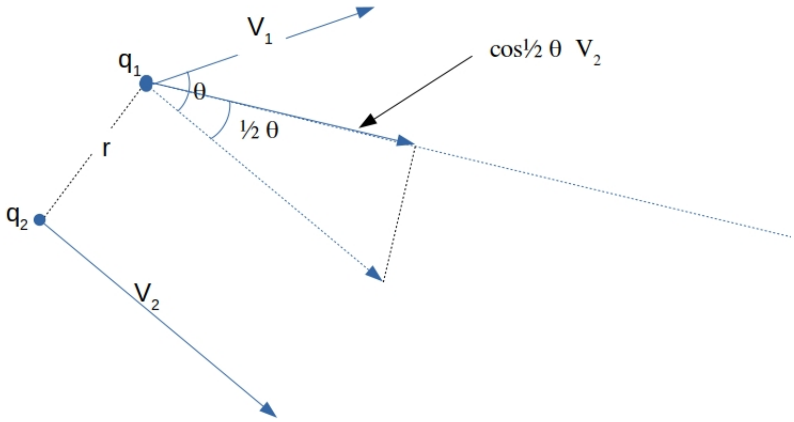

figure 10: two moving charges

There are two physical processes going on at the same time. The first is that the charged particles have a velocity v. And so they act like a Bp and have an interaction as Bp's would have. But from the viewpoint of the particle, its Bp's have a higher velocity in backward direction (V_B+v) and a lower velocity in forward direction (V_B-v). So there is a velocity differential of $2v$. This differential will create a "torque" on the particle. Because the velocity differential is twice the size of the velocity itself, the magnitude of the torque is twice the magnitude of the basic interaction. The dependency of that torque on the angle theta differs from that of the basic force. If we have two vectors for V_1 and V_2 as in the picture, the magnitude of the resulting force would be (ignoring the $sin\beta$ in equation 3):

$$2\,(V_1\ \cos\tfrac{1}{2}\theta)\ (V_2 \cos\tfrac{1}{2}\theta)\ =\ 2\,(V_1\ V_2)\ \cos^2\tfrac{1}{2}\theta \qquad (58)$$

The brackets are for readability only. So if we abstract from the actual velocities, we have two forces, the one is of the magnitude $-\cos\theta$ (the minus sign comes from the definition of its direction as explained in chapter 1) and the other of $2\cos^2 \tfrac{1}{2}\theta$. The latter can also be written as $1 + \cos\theta$. So the addition of these two forces renders:

$$-\ \cos\theta + 1 + \cos\theta = 1 \qquad (59)$$

This unity result indicates that the force of particle 1 on particle 2 is always of the same magnitude and always in the same direction (perpendicular to its velocity vector), independent of the direction of particle 2 (in that specific point in space and on that specific plane). This is exactly how the electromagnetic force works! And so it shows that the electromagnetic force is an emerging property of the basic force in the special case where Bp's interact as (semi static) particles.

Note that this explains why there is a physical process of magnetic induction. If a first particle moves with a certain velocity, it will create a torque on any particle in its environment which does not move in precisely the opposite direction. And so there will be a tendency in its environment, to redirect the already existing velocities in that opposite direction until the effect of such a first particle is canceled out. Of course, in metals, there is a lot of movement of electrons going on already and so this induction will show up.

Also note, that this encourages two electrons, circling around a nucleus, to move at the far ends of the nucleus, since that will cause their velocities to have opposite direction and, as a consequence, have the torque reduced to zero. Note also, that this would make it complicated for more than two electrons two move about in (exactly) the same orbit.

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