Contents

The Daon Theory

A Unified Framework for Fundamental Physics

J.E.S. Gustafsson

January 24, 2026

Preface

This book presents the *Daon Theory*, a unified framework for fundamental physics that seeks to explain natural phenomena—from electromagnetism to gravity—through a single model.

The theory is built from first principles, using Euclidean geometry and classical mechanics, and is designed to be accessible to readers with a basic understanding of physics. All constants are derived numerically, and the resulting theory agrees with experimental data.

Introduction

The purpose of this book is to present a comprehensive theory that explains all fundamental natural phenomena. We aim to guide you through this complex subject in a clear and step-by-step manner, making it accessible to anyone with a basic understanding of physics.

All laws and formulas in physics must align with observations and experimental data, which are fundamental to understanding the subject. Applied physics uses these laws and formulas for technological development and data analysis, with practical applications evident in technology and engineering.

Fundamental physics should aim to provide a comprehensive understanding of nature. One major issue is the reliance on constants within mainstream theories that lack adequate explanation. How can we claim to understand the phenomena described by these theories without addressing the origins and values of these constants?

Our knowledge of the world around us remains superficial in many respects. For instance, we struggle to answer foundational questions like the ones presented below.

- In modern physics, charges are thought to interact through "virtual photons." These photons supposedly carry the information needed for attraction or repulsion. However, challenges arise when considering the interaction between moving charges, which must take into account the position and velocity of the charges, not to mention acceleration and multi-charge interaction, as presented in figure 1. How is it possible that a charge knows the position, velocity, and acceleration of the surrounding charges and sends information in the correct direction at the correct time? In fact, you would need a small computer to be even closely correct in calculating such an interaction.

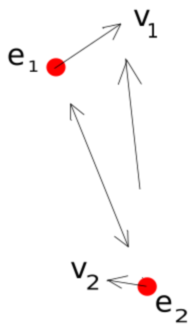

Figure 1: Scenario of interaction between moving charges.

- Consider the equations for force and potential between an electron and a charge q, separated by a distance r. When the distance r becomes infinitely small, the force and potential energy go to infinity, which is obviously incorrect. That is, these formulas are valid only at a sufficiently large distance between the charges.

$$F = C_k \frac{eq}{r^2} \tag{1}$$

$$V = -C_k \frac{eq}{r} \tag{2}$$

- We also have that the E-field and the potential energy are spread out around the electron, implying that the field and its associated energy are distributed in the surrounding space. Energy and mass associated with natural phenomena are often viewed as equivalent, perhaps two expressions of the same concept. If the potential energy surrounding an electron equates to mass, this implies that space itself possesses mass—a notion that contradicts Einstein's theories of relativity, which states that space must be empty.

- If space is truly completely empty, there shouldn't be any limit to velocity, i.e., **space must contain something**!

In this book, we aim to explain fundamental natural phenomena in simple terms. Using basic Euclidean geometry and time, we will present a theory that aligns with experimental data and observations. By exploring this framework, readers will gain a foundational understanding of key concepts in physics. We will explain the main natural phenomena using simple words and explanations, making them accessible to anyone with basic knowledge. All pertinent constants will be explained and numerically calculated.

The difficulty with any revolutionary new concept is always to overcome old beliefs. We are all impressed by the complex mathematics and nice videos presented by theoretical physicists explaining various theories. But, as presented above, there are serious problems with all these theories, and they have no experimental evidence to prove their case. So, let us start from the cornerstone of physics, i.e., space, and from there develop a logical and simple theory of everything.

Chapter 1

Challenges in Relativity Theory

In the introduction, we argued that theoretical physics has deviated from fundamental principles and that space cannot be empty. This raises questions about the validity of relativity theory, which assumes space to be devoid of any medium. To investigate this, we examine experimental evidence that challenges this assumption.

1.1 Bragg Reflection

To address this issue, we begin with a perfect crystal, where atomic positions are known with high precision. When a photon beam—with energy in the X-ray range—is directed at such a crystal, Bragg reflection occurs (see Fig. 1.1). The intensity of the reflected beam increases due to the cumulative reflection from successive planes in the crystalline lattice, leading to Bragg's law:

$$n\lambda = 2d \sin\theta \tag{1.1}$$

Here, n is the number of planes, λ is the wavelength of the incoming photons, d is the distance between planes and θ

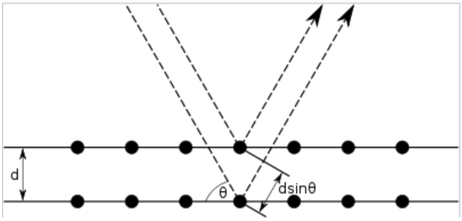

Figure 1.1: Photons scattered from lattice planes separated by a distance d between successive atomic layers. The scattered waves remain in phase.

is the angle between the photon beam and a plane, as defined in Fig. 1.1.

1.2 Low-Energy Electron Diffraction

To further explore this phenomenon, we replace the photon beam with an electron beam. According to Louis de Broglie, an electron in constant linear motion has an associated wave described by:

$$m_e v\lambda = h \tag{1.2}$$

where m_e is the electron mass, v is its velocity, λ is its wavelength, and h is Planck's constant.

By using a low-energy electron beam with a wavelength corresponding to the interplanar distance in the crystal, we observe an interference pattern similar to that of photons. This phenomenon is known as Low-Energy Electron Diffraction (LEED) [4]. The resulting LEED pattern, shown in Fig. 1.2, exhibits perfect symmetry.

In the laboratory reference frame, the LEED detector confirms de Broglie's law, yielding:

$$\lambda = \frac{h}{m_e v} \tag{1.3}$$

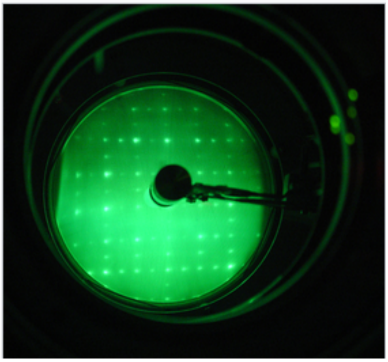

Figure 1.2: LEED pattern of a Si(100) reconstructed surface. The electron gun, generating the primary beam, partially obscures the screen (Wikipedia).

Since the electron beam velocity is approximately 1×10^7m/s, relativistic effects are negligible.

1.3 Postulates of Special Relativity

The special theory of relativity [2] is founded on two postulates:

- The laws of physics are identical in all inertial reference frames.
- The speed of light in a vacuum is constant in all inertial reference frames.

We will demonstrate that both postulates are invalid.

1.4 Demonstration

An inertial reference frame can be defined as any observer (or detector) moving at a constant linear velocity.

According to special relativity, any inertial system is a valid reference frame. If we select the electron as our inertial frame, the electron is stationary relative to itself. Consequently, according to Eq. (1.3), the associated wavelength of the electron must be infinite.

Special relativity implies that if the electron is stationary, the atoms in the crystal must produce the oscillation. However, atoms are significantly heavier than electrons, resulting in much shorter wavelengths. Thus, no interference pattern would appear on the LEED detector.

Alternatively, if the electrons surrounding the atoms oscillate, their varying velocities and directions—due to different energy levels—would prevent the formation of a coherent pattern.

Suppose an oscillation occurs between different crystal layers. The resulting wavelength would correspond to the interlayer distance, but such an oscillation would be independent of the angle relative to the velocity vector, contradicting Bragg's reflection formula (Eq. (1.1)).

Finally, how can a crystal interacting with stationary electrons produce an interference pattern? For coherent interference to occur, both the crystal and the electrons must share a corresponding characteristic. This implies that the incoming electrons must have an associated wavelength matching the interatomic distance in the crystal.

Thus, the laboratory frame is the only reference frame consistent with experimental results [1].

1.5 Implications

This analysis suggests the existence of a local reference frame surrounding the laboratory (and, by extension, the Earth). The electron's velocity must be measured relative to this local medium.

For experiments conducted on Earth, the local medium dominates, making the Earth's reference frame the only relevant one. This explains why Earth-based experiments align with special relativity since the inertial and local reference frames then coincide.

1.6 Discussion

All masses must be surrounded by a neutral medium. However, smaller masses have a "weaker" medium. For example, a small mass on Earth's surface has a negligible medium compared to Earth's. This hierarchy implies that Earth's medium is enclosed by the Sun's medium, which is in turn enclosed by the galaxy's medium, and so on.

This demonstration refutes both postulates of special relativity, indicating that **Einstein's special relativity theory is fundamentally flawed**.

Chapter 2

The underlying structure of space

We have shown that a local reference frame must exist around all masses. We will now examine how this local medium acts and what it is made of.

The medium must be without resistance to any electromagnetic force; otherwise, the EM-energy would be transmitted to the medium and therefore quickly reduce the intensity of any such signal to zero.

The medium must therefore be constituted by some sort of objects that offer no resistance to changes, i.e., there is no force acting between them.

We can examine Isaac Newton's second law (see equation 2.1) to obtain a better understanding.

$$\vec{F} = m\vec{a} \tag{2.1}$$

$\vec{F}$ is force, m is mass, and $\vec{a}$ is acceleration.

Since the force must be zero, we have three possibilities: the mass is zero, the acceleration is zero, or both are zero.

The potential energy around a charge indicates that space must have some energy-mass. Therefore, the only possible solution is that these objects interact without acceleration.

This means that all interactions within such a medium must happen without acceleration, i.e., with a constant velocity in all directions!

That's interesting since this could be the explanation for the speed limit c (the speed of light)!

We propose the following basic hypothesis:

The medium constituting the local reference frame is made up of a unique object.

The name **Daon** [1] is chosen for this specific object.

2.1 The Daon: A Fundamental Building Block

A daon must have specific characteristics to explain the different interactions:

- A daon must be associated with a direction, which is necessary to explain the interaction between different charges. Such a direction can only be a rotation around an axis. Therefore, a daon must be a rotating entity.

- There is no privileged direction in space; therefore, all possible directions of a daon's rotational axis must be equally represented. These disordered daons will have growing importance and thus deserve a specific name. Henceforth, they will be called free daons.

- The action becomes a force when several daons are attracted towards each other and interact with an external field. In this case, the total action must be divided between the participants, leading to resistance, i.e., a mass (as defined in equation 2.1).

[1] Dao (Tao) is a fundamental concept in the old Chinese culture, representing the path to universal harmony. It is constituted by Yin (darkness, cold, contraction, rest) and its opposite, Yang (light, warmth, expansion, activity)

- The attraction or repulsion between two daons must depend on the relative direction of motion of their respective substances in the zone of interaction.

We can therefore identify four specific situations between identical daons, as proposed in figure 2.1:

a) Their axes of rotation are parallel so that, in the zone of interaction, their respective substances move in opposite directions at the same speed. The relative velocity of the daon substances is maximal in the zone of interaction, leading to an attraction.

b) Their axes of rotation are parallel but opposite in direction, so that the substances of the respective daons are, in the zone of interaction, moving in the same direction at the same speed. The daons experience a repulsion.

c) Their axes of rotation have an angle, but the substances of the respective daons are, in the zone of interaction, moving in the same or opposite direction. In this situation, the respective daon substances still have parallel velocities in the zone of contact. The attraction between the daons along a line passing their centers is identical to the situation in a) and b).

d) Their axes of rotation have an angle so that their substances, in the zone of interaction, are rotating with an angle relative to each other. In this situation, the velocity vectors of the daon substances have an angle ψ between them. The attraction between the daons along a line passing their centers is then proportional to $\cos\psi$. We also have an action perpendicular to the line of attraction and in a direction symmetric relative to their rotational axis, proportional to $\sin\psi$.

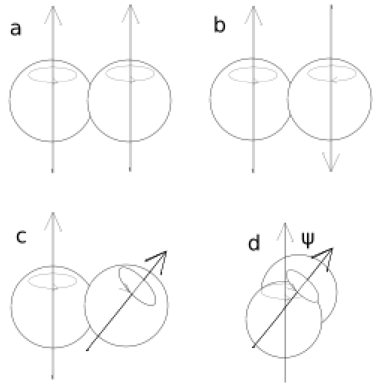

Figure 2.1: Four representative positions of interaction between two daons.

The attraction-repulsion between identical daons in a situation of equilibrium can then be written,

$$a_{d_{\parallel}} = -C\frac{v_d^2}{r_d}\cos\psi \tag{2.2}$$

$$a_{d_{\perp}} = C\frac{v_d^2}{r_d}\sin\psi \tag{2.3}$$

The first equation is the action along a line connecting the center of the two daons, whereas the second is the action directed perpendicular to the same line and directed symmetrically relative to their rotational axis. ψ is the angle between the directions of the two Daon-substances velocities in the zone of contact. ψ is zero when the two axes of rotation are parallel and in the same direction. v_d is the velocity of rotation at the equator, and r_d is the Daon radius. C is an unknown constant.

2.2 The Electron

If space is filled with daons, then the space around an electron must also be constituted by daons. The potential energy of an electron (E_p) is distributed around it, even at great distances.

It follows that the daons must (see equation 2.4) make up most of the electron. Let us take a further step and propose that **the electron is constituted entirely by daons**.

$$E_p = \frac{e}{4\pi\epsilon_0 r} \tag{2.4}$$

The daons surrounding the electron must increase their "order" as they close in on the electron's center, which is necessary to create a radial equilibrium. There is therefore a gradual passage from disorder to order as one moves from far away toward the center of the electron.

Assuming that the electron is constituted by daons, make it necessary to believe that the positron, its antiparticle, is constituted by objects identical to the daons of the electron but with some characteristic giving it the opposite effect in the radial sense. An anti-daon could be suggested, but the interaction between daons must be such that an anti-daon is the daon turned around into the opposite direction. Therefore, the daon must be identical to its anti-daon. The action between daons comes from their rotation, i.e., the substance of a daon rotates around an axis, giving a direction to the daon.

The only possible difference between an electron and a positron must then be that if the positron daons point inwards, the daons of an electron must point radially outwards from the center.

A daon must be much smaller than the electron since no granularity has been noticed in the various interactions.

Imagine daons constituting a shell around an electron, all pointing in the radial direction relative to the center of the electron. Around this daon shell is another one, constituted by daons again pointing in the same radial direction as the daons in the previous shell, and so on. The result will be something similar to the schematic cut of an electron in figure 2.2. The same should be true for a positron, except that the direction of its daons is inverted relative to the center.

All physical characteristics of an electron must then be due to the collective action of the daons constituting it.

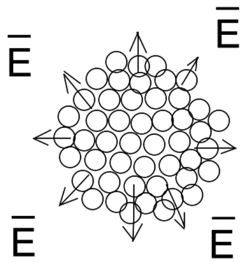

Figure 2.2: Schematic picture of a cut through the center of an electron.

We now have a somewhat vague picture of an electron, which we will use in the next chapter to explain the electric phenomenon.

Chapter 3

Charge and Fields from Daons

The consequences of Maxwell's equations indicate that the source of the electromagnetic field is the charge. It is therefore necessary to focus our efforts on a charged particle to obtain a basic understanding of the corresponding physical phenomena. The electron seems to be the simplest construction in nature but at the same time contains most of the basic unknowns in today's physics, such as charge, mass, and field.

3.1 The characteristics of an electron

Let us imagine a concentric shell filled with daons kept together by an attraction between daons with quasi-parallel rotational axes, all pointing, on average, in the radial direction, as presented in figure 3.1. The daons within such a shell must be kept together due to their mutual attraction. The daons must also be attracted to the daons of the upper and lower neighboring shells, since these must also have the same quasi-parallel direction of their rotational axes.

The strongest attraction between daons from different shells is found in the middle of a triangle of daons in a shell. The daons belonging to neighboring shells therefore

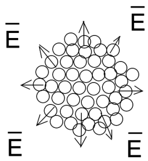

Figure 3.1: Schematic cut through an electron

place themselves preferentially into these positions. The attraction/repulsion of each daon must, on average, be zero in any static situation. In the case of the electron, each daon is necessarily in equilibrium within its own shell since the daons are identical and placed symmetrically around it.

The number of daons in a shell is given by:

$$N = \frac{4\pi r^2}{\pi r_d^2} \frac{\pi}{2\sqrt{3}} \tag{3.1}$$

$\frac{\pi}{2\sqrt{3}}$ is the 'filling factor' of circles on a plane surface. The number of daons in a shell is very high, except in the last couple of shells at the electron's center, so the curvature has been neglected.

Each daon has three interaction zones with the daons of the next neighboring shell. The examined daon and three daons in the next shell have the geometry of a regular pyramid, as presented in figure 3.2.

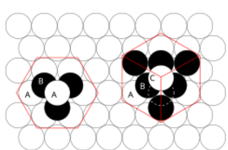

Figure 3.2: Schematic detail of a daon in a close-packed shell

The daons can move around freely in a region where the order is very low, meaning that the shells have no 'rigidity.' The total attraction between neighboring shells, far from the electron's center, is then almost constant. The radial component of interaction between daons in the same shell becomes important when closing in on the electron's center since the size of the daons is continuously decreasing. A daon must adapt its radius so that its attraction is constant in all directions. Equilibrium is obtained when the attraction is balanced around each daon.

The radial component of attraction on an individual daon from the upper layer must be equal to the attraction from the lower layer plus the radial component of attraction coming from the daons of its own shell. The total radial attraction between two shells can then be written as:

$$f_n = 3Na_d \cos\phi + 6Na_d \sin\chi \tag{3.2}$$

a_d is the action between two daons, whereas ϕ is the angle between the electron's radius and a line passing the center of two interacting daons in neighboring shells ($\cos\phi \simeq \sqrt{\frac{2}{3}}$). The second term is the radial component of interaction between each daon and its six neighbors within the same shell, giving an increase of action from one shell to another. χ is defined in figure 3.3.

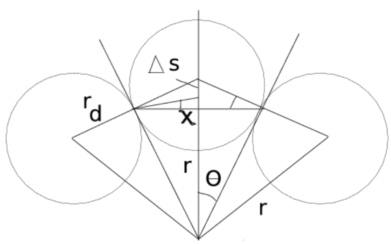

Figure 3.3: Schematic detail of a daon in a shell close to the electron's center

The attraction between two shells *far* from the electron can, with the help of equations (3.1) and (3.2), be expressed as:

$$f_n = N\ 3a_d \cos\phi = C\sqrt{8}\pi \frac{r^2}{r_d^3} < \cos\psi > v_d^2 \tag{3.3}$$

Where $< \cos\psi >$ is the average coupling in the interaction between daons.

3.2 The Order

The disorder produced by the surrounding free daons must pass through the ordered daons since the number of surrounding free daons is much larger than the ordered ones. The equilibrium around an electron can therefore be written as a number of perfectly ordered daons placed on a sphere around the electron, subtracting the action from completely disordered free daons placed on the same sphere. We get:

$$
\begin{aligned}
NC\frac{v_d^2}{r_d} < \cos\psi > &= NC\frac{v_d^2}{r_d} - N_{fd}C\frac{v_d^2}{r_{d_{fd}}} \\
\Rightarrow < \cos\psi > &= 1 - \frac{r_d^3}{r_{d_{fd}}^3} \qquad (3.4)
\end{aligned}
$$

$r_{d_{fd}}$ is the radius of a free daon. The index *fd* is hereafter used for free daons.

The daons are attracted to each other due to their order, whereas disorder produces an irregular action in all directions.

The order must become very low at a distance sufficiently far from the electron's center, i.e., a shell has no "rigidity" there. The daons within such a shell are constantly replaced by the surrounding ones, but the shells remain always in position so that each shell remains in equilibrium. The radial action must therefore be constant 'far away' from the electron's center. We get, using equations (3.3) and (3.4):

$$
\frac{r^2}{r_d^3} < \cos\psi >= \frac{r_e^2}{r_{d_{fd}}^3} \qquad \Rightarrow \qquad < \cos\psi >= \frac{r_e^2}{r_e^2 + r^2} \qquad (3.5)
$$

r_e is a reference radius that is constant when the shells have no rigidity. This radius will henceforth be called the electron's reference radius and denoted r_{e_∞}. However, the above equation can be used at any distance, although r_e varies close to the electron's center, where the radial force is reduced.

The radial force, i.e., the action between two shells, far from the electron ($r >> r_{e_\infty}$) can now, by using equations (3.3) - (3.5), be expressed as:

$$f_s = C\sqrt{8}\pi \, \frac{r_{e_\infty}^2}{r_{d_{fd}}^3} \, v_d^2 \tag{3.6}$$

To make the equations more readable, we define the Order (O) as the medium coupling between daons i.e.

$$O = <\cos\psi> = \frac{r_e^2}{r_e^2 + r^2} \qquad 0 < O < 1 \tag{3.7}$$

$$r_d^3 = r_{fd}^3(1 - O) \tag{3.8}$$

$$\frac{O}{1 - O} = \frac{r_e^2}{r^2} \tag{3.9}$$

3.3 The Coulomb interaction

Let's imagine two electrons without any movement relative to the surrounding free daons, placed at a distance $a >> r_{e_\infty}$ from each other. The shells start to deform and the reference radius (r_e) is reduced if the electrons are very close, so we will therefore calculate the force at a distance between the two electrons much larger than r_{e_∞}. We can then make the integral over any shell since 'far away' all the shells have a constant reference radius ($r_e = r_{e_\infty}$). We can then use a simple approximation of the geometry, as presented in figure 3.4.

The action between two shells associated with different electrons will result in a repulsion since the rotational axes of their respective daons are opposite in direction ($\cos\psi < 0$) at the side seeing each other, whereas on the opposite side the daons have the same direction, pulling the two electrons apart.

The force between two electrons at a distance a can now be obtained by integrating the action between daons associated with the source electron over the daon shells of the

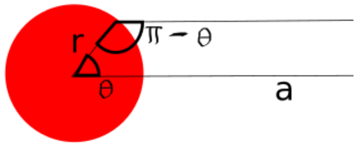

Figure 3.4: Schematic view of two electrons under interaction.

target electron. This follows from the fact that each electron must maintain its radial equilibrium, necessary since the surrounding free daons always have the same constant disorder, independent of the situation. The resulting force on a shell s can therefore be obtained using equations (3.6) and (3.7) as follows:

$$\begin{aligned} f_s &= \frac{m_d}{4\pi} \int_0^{\pi} \int_0^{2\pi} f_s \; O \cos(\pi - \theta) \cos\theta \;\; \sin\theta \; d\theta \; d\phi \\ &= m_d \frac{f_s}{3} \frac{r_{e\infty}^2}{(r_{e\infty}^2 + a^2)} \end{aligned} \tag{3.10}$$

m_d is the daon mass and O is the Order, whereas $(\pi - \theta)$ is the angle between the average direction of the rotational axis of the daons in the selected shell and the average direction of the superimposed daons of the source electron (see figure 3.4). f_s is the force between daon shells at a 'far away' distance.

The force acting on an electron is the action between daons belonging to different electrons, summed over a shell. We obtain the Coulomb force as:

$$F_C = \int_0^a \frac{f_{n+1} - f_n}{\Delta r_n} \; dr \tag{3.11}$$

$\Delta r_n = \sqrt{\frac{8}{3}} \; r_{d_n}$ is the radial distance between two shells.

The distance between shells is very small compared with the shell radius, so we use the integral directly. We get the force acting between the two electrons as:

$$\vec{F}_C = \frac{f_s}{3} \frac{r_{e\infty}^2}{r_{e\infty}^2 + r^2} \frac{\vec{r}}{r} \simeq \frac{f_s}{3} r_{e\infty}^2 \frac{\vec{r}}{r^3} \qquad r >> r_{e\infty} \qquad (3.12)$$

If we compare this equation using equation (3.6) with the classical electrostatic formula:

$$\vec{F}_C = \frac{e^2}{4\pi\epsilon_0} \frac{\vec{r}}{r^3}$$

we get the definition of the Coulomb constant as:

$$k_c = \frac{1}{4\pi\epsilon_0} = \frac{r_{e\infty}^2}{e^2} \frac{f_s}{3} \qquad (3.13)$$

i.e., the Coulomb constant is proportional to the radial force of the electron.

It is now possible to redefine the concepts of force-field, charge-potential, and energy-mass of an electron.

- The charge is just an integer number; it is the number of 'positive' radial equilibria minus the 'negative' ones, e.g., in the case of the electron, it is -1.
- The electrostatic force $\vec{F}$ is the force acting between the external superimposed order daons and the radial equilibrium of the daons contained in the target shells.
- The electrostatic field is directly proportional to the order and an 'electric force line' coincides with the average direction of the daons' rotational axis.
- The electrostatic energy is just the number of 'effective' daons that have been added or subtracted due to the interaction, multiplied by c^2.

$E = 1$ MV/m corresponds to an Order ($O \simeq \frac{r_e^2}{r^2}$) of around 10^{-15}!

A picture of the electric field between an electron and a positron is shown in figure 3.5.

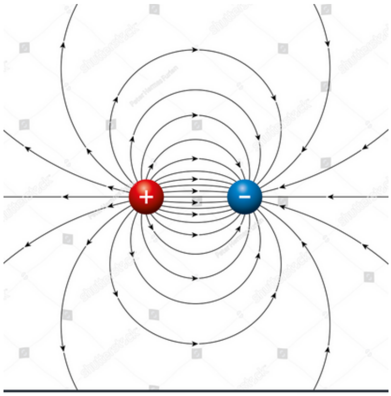

Figure 3.5: The electric field in an interaction between an electron and a positron.

3.4 The Electron's Mass and Potential energy

We can now calculate the electron's mass as follows:

$$m_e = m_d \int_0^\infty \frac{4\pi r^2}{\pi r_d^2} \frac{\pi}{2\sqrt{3}} O^2 \frac{dr}{\Delta r} \tag{3.14}$$

i.e., the number of daons in a shell multiplied by the interaction (the Order or the average action $O =< \cos\psi >$), giving the number of effective daons (the mass) of the shell, which is again multiplied by the order O to obtain the tendency of the daons to follow the electron in its movement. The electron's reference radius (r_e) varies with its radius close to the electron's center, so we do not have an exact analytical expression.

However, we can calculate, at a radius $r >> r_{e_\infty}$, the difference in mass due to the added order coming from the interaction between two electrons, i.e., the potential energy. We can then make a precise calculation of the added mass. If we use equations (3.10) and (3.13) with equation (3.14), using the corresponding missing mass of the classical potential energy, we get:

$$\begin{aligned}\Delta m &= m_d \int_a^\infty \int_0^\pi \int_0^{2\pi} \frac{r^2}{\pi r_d^2} \frac{\pi}{2\sqrt{3}} \cos\theta' \sin\theta \; O_1 O_2 \; d\phi \; d\theta \frac{dr}{\Delta r} \\ &= m_d \frac{\pi}{\sqrt{2}} \frac{r_{e_\infty}^4}{r_{d_{fd}}^3 a} = \frac{e^2}{4\pi\epsilon_0 a c^2} \qquad a >> r_{e_\infty} \qquad (3.15)\end{aligned}$$

giving

$$C = \frac{3}{2} \frac{c^2}{v_d^2} \qquad (3.16)$$

The radial and transverse action between identical daons can now be written as:

$$a_d = \frac{3}{2} \frac{c^2}{r_d} \cos\psi \qquad (3.17)$$

$$a_d = \frac{3}{2} \frac{c^2}{r_d} \sin\psi \qquad (3.18)$$

which gives the radial equilibrium of force, *far* from the electron's center, as:

$$f_\infty = 3\sqrt{2}\pi \frac{r_{e_\infty}^2}{r_{d_{fd}}^3} m_d \; c^2 \qquad (3.19)$$

The Coulomb's law within the daon theory, using equation (3.13), is therefore:

$$\vec{F}_C = m_d \frac{q_1 q_2}{e^2} \sqrt{2}\,\pi \frac{r_{e_\infty}^4}{r_{d_{fd}}^3} \; c^2 \; \frac{\vec{r}}{r^3} \qquad (= \frac{q_1 q_2}{4\pi\epsilon_0} \frac{\vec{r}}{r^3}) \qquad (3.20)$$

$\frac{q}{e}$ is the number of radial equilibrium within a particle.

Each radial equilibrium must be identical due to the disorder of the surrounding free daons, i.e., the force fields can simply be superimposed at a distance where the reference radius r_e becomes constant, i.e., $r >> r_{e_\infty}$.

3.5 Internal characteristics of the Electron

A better understanding of the electron is necessary to complete the analysis. A computer code called EP was therefore developed to examine the electron's internal equilibrium. The electron is perfectly spherical, so it is enough to optimize the radial position of each shell of constant order ($O = \frac{r_e^2}{r_e^2+r^2}$). The equation of radial equilibrium (3.2) can then be used to calculate the order in each shell. Starting far away from the electron, where the radial equilibrium has an asymptotic constant value, we proceed in iterations step by step, closing in on the electron's center, finally obtaining a mesh with a radial equilibrium of force.

It is thereafter necessary to normalize the radii relative to a true electron. This is done in two steps: first, we vary the value of $r_{e\infty}$ until the total mass of the simulated electron agrees with the true value. This is done using equation (3.6) within the code EP. We obtain:

$$r_{e\infty} \simeq 1.23 \times 10^{-15} \qquad \text{m}$$

We thereafter examine the electron's center, where the number of daons goes to zero, and we obtain the size and mass of the daons:

$$m_d \simeq 3.5 \times 10^{-40} \qquad \text{kg}$$

$$r_{d_{fd}} \simeq 1.1 \times 10^{-18} \qquad \text{m}$$

.

We now have a mesh with a radial equilibrium of force as well as an agreement between its mass and the true electron mass. It should be noted that the precision for $\frac{m_d}{r_{d_{fd}}^3}$ is three digits, whereas it is much less for the individual components due to the complex 3D geometry at the electron's center.

The action-reaction between daons must be independent of the position of the zone of interaction. If the attraction were stronger on the daon's equator, then the size of the daons would be locally reduced, i.e., the form of the daons would become ellipsoidal, which would give serious problems at the center of the electron.

The space is filled with 'free daons,' which must have the same average size. This is possible only if an isolated daon expands, i.e., the daons must always be in contact with other daons. Each daon is normally in contact with 12 neighboring daons, so on average, its attraction is equal to its repulsion, and its expansion is equal to its contraction.

It should be noted that a daon's substance velocity must be faster than the speed of its rotation since the interaction between two daons must modify their size. It is therefore necessary to include a radial velocity of the daon's substance, leading to a reduction of the azimuthal velocity of rotation. Such a radial velocity must also be constant, necessary to explain that the acceleration between daons is zero. It is therefore the effective velocity of rotation that we use in our calculations.

Imagine a daon as a sphere of some substance wanting to expand but stopped by the surrounding neighbors from doing so. A daon's surface can then be separated into zones of interaction and zones of non-interaction. Some zones are alternating between compression and expansion since the daon is rotating. There are also zones having no interaction besides a 'will' to expand. This means that a daon is kept together by some sort of elasticity; otherwise, the continued expansion of non-interacting zones would make it 'explode.'

In figure 3.6 is presented a graph showing the radial variation of the simulated electron's main parameters.

We are now ready for the next step, which is to examine an electron at constant velocity, i.e., an inertial electron.

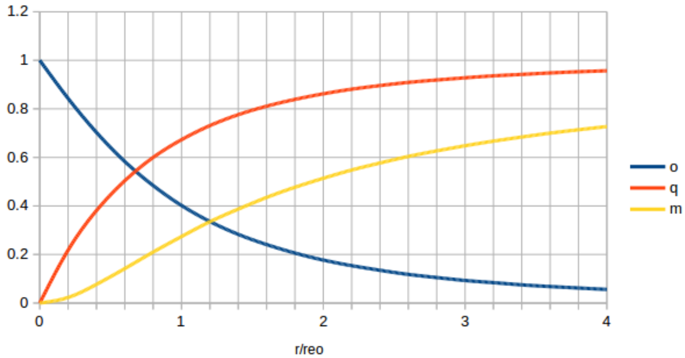

Figure 3.6: Graph showing the radial variation of the order (O), the normalized charge ($\frac{r_e^2}{r_{e\infty}^2}$) and the normalized mass ($\frac{m}{m_e}$), relative to the normalized electron radius $\frac{r}{r_{e\infty}}$.

Chapter 4

Magnetism

Before trying to understand the magnetic interaction, we will examine an electron having a constant velocity **v** and study the reaction of the daons surrounding it.

4.1 An electron at constant velocity

The shells are attached to the electron through the order of their daons, which is constant for each shell. The velocity of a daon, relative to the free daons, can therefore be written:

$$v_d = vO = v\frac{r_e^2}{r^2 + r_e^2} \tag{4.1}$$

v is the velocity between the electron and the free daons. O is the order of the daons within the selected shell.

The shell of daons, around the electron, is always there but the daons constituting it are gradually replaced by new ones, depending on the strength of their attraction relative to the electron. These daons come from the free daons in front of the electron, which obtain a growing order depending on their position relative to the electron. In the same way, the daons left behind will reduce their order and finally join the free daons.

The velocity of a signal, extending from the electron, becomes an important parameter; it will in the following be called the signal velocity. The signal velocity must be constant in all directions, so we can write

$$c_s = K v_d \tag{4.2}$$

v_d is the daon's *effective* velocity of rotation at its equator, whereas K is an unknown constant.

The signal from the electron's center reaches, at the same time, the surface of a sphere around the electron, having the form presented in figure 4.1,

$$r = r_0(\cos\alpha - \beta(1-O)\cos\theta) \tag{4.3}$$

$$\cos\alpha = \sqrt{1-(1-O)^2\beta^2\sin^2\theta}$$

$$\beta = \frac{v}{c_s}$$

r_0 is the radius of a shell without velocity relative to the free daons.

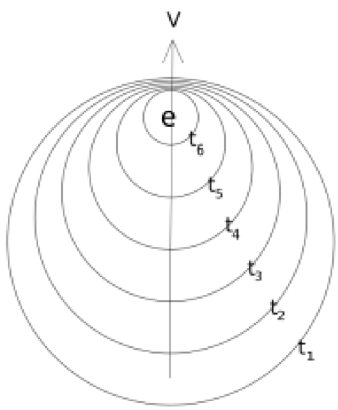

Figure 4.1: Spheres reached, at the same time, by the "delayed" signal coming from the electron's center

Looking at the inclination of the daons at a fixed angle (θ), we find a different angle (α) of inclination for daons in different shells. The relative inclination δ between daons from neighboring shells, due to the delayed potential, can be expressed as:

$$\sin\delta = \frac{v(O^+ - O^-)\sin\theta}{c_s} \tag{4.4}$$

This difference in angle, of the daons axis of rotation, produces a rotation of the electron and its associated daons (see eq. (3.18)), giving a relative difference of rotational velocity between neighboring shells, which can be written:

$$\Delta v_\phi = \omega_d r_d \sin\delta \tag{4.5}$$

The daons rotational velocity, around the center of their respective sphere, as seen from the surrounding free daons, is then

$$v_\phi = \frac{v}{K} O_n \sin\theta \tag{4.6}$$

4.2 Inertial movement of the electron

The relative velocity between daons, in the direction of the electron's velocity vector, gives a sliding movement between the daon shells that can be written in exactly the same way as in equation (4.6).

$$v_\parallel = \frac{v}{K} O_n \sin\theta \tag{4.7}$$

If we then look at the limit $v = c$ we get, since $O_n = 1$ at the electron's center, that $K = 1$ and therefore (from equation (4.3)) $c_s = c$. This means that **a daon's effective velocity of rotation is equal to the light speed** (it is of course the other way around).

It follows that **the velocity of rotation and the velocity of propagation are perpendicular in direction but have identical speed, within each shell.**

$$v = v_\phi \tag{4.8}$$

The daons, in front of the electron, will be compressed, which must reduce the force between the shells, but this compression is compensated by a reduction of the daon's size, with the same factor. The same type of compensation will happen behind the electron, so that the force, in the direction of velocity, becomes zero.

It follows that the radial velocity of the daons also must be equal to the light speed c.

This is the reason for the electron's inertial movement, since there is no force acting on an electron with constant linear speed.

4.2.1 An inertial electrons rotational energy

We can calculate the total rotational energy of the inertial electron as follows, using equation (3.14),

$$\begin{aligned} E_M &= m_d \int_0^\infty \int_0^\pi \int_0^{2\pi} \frac{r^2}{\pi r_d^2} \frac{\pi}{2\sqrt{3}} (vO)^2 \sin^3\theta \; d\theta d\phi \frac{dr}{\sqrt{\frac{8}{3}} r_d} \\ &= m_d \, \frac{2}{3} \, m_e v^2 \qquad\qquad v << c \end{aligned} \tag{4.9}$$

i.e., *an electron's rotational energy is in the same order as its kinetic energy*!

4.3 Loi de Biot-Savart

The basic equation of magnetism shows that the force is proportional to the velocity of the electron and to a "magnetic field".

$$\vec{F} = e\vec{v} \times \vec{B} \tag{4.10}$$

This magnetic field can only be a flux of daons, as presented in figure 4.2a. Imagine an electron with a velocity $\vec{v}_1$, at a distance r from another electron, which has a velocity $\vec{v}_2$. The daons circulating around the source electron will influence the examined electron. The examined electron will then adjust the direction of its daons rotational axis so that its velocity will be matched relative to the surrounding flux of free daons. We have the velocity of the daon flux around the source electron as

$$v_{\phi_2} = v_2 \frac{r_{e\infty}^2}{r_\infty^2 + r^2} \tag{4.11}$$

v_2 is the velocity of the source electron and r is the distance between the two electrons.

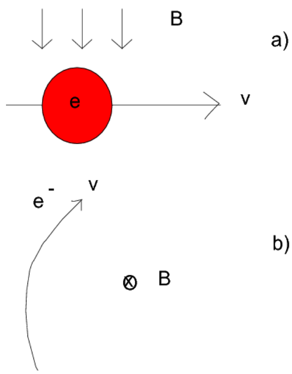

Figure 4.2: Phenomenon of magnetism.

A constant flux of free daons will make the rotational axis of the target electron's daons bend in the direction opposite to the flux i.e. only a slight adjustment of the rotational axis will be necessary, without further consequences. But, if the daon flux, surrounding the target electron, has a gradient then this will produce a difference in the interaction over the target electron's shells. Such a difference will lead to a rotation of the electron, around an axis parallel to the daon flux, where the velocity of rotation must correspond exactly to the velocity of the daon flux. This is the same mechanism as the rotation around an inertial electron.

We have then (eq. (4.11)) that the target electron starts to rotate with the velocity v_{ϕ_2} around an axis parallel to the flux produced by the source electron.

We'll start by calculating the intrinsic force, corresponding to an electron's velocity, in the direction of flight. This can be calculated by imagining that the electron is fixed relative to its surroundings but has a velocity of rotation. The inherent force parallel to the velocity vector $\vec{v}$ can then be calculated to be

$$\begin{aligned} F_{\|} &= m_d \int_0^{\infty} \int_0^{\pi} \int_0^{2\pi} \frac{r^2}{2\sqrt{3}r_d^2} C a_d O \sin\delta \sin\theta \sin\theta d\phi d\theta \frac{dr}{\Delta r} \\ &= \frac{f_\infty}{3} \frac{v}{c_s} \end{aligned} \quad (4.12)$$

a_d is the action between daons, whereas $\Delta r = \sqrt{\frac{8}{3}}\, r_d$ is the distance between shells. The C comes from the interaction between each daon and the three daons in the neighboring shell, as indicated in figure 4.3.

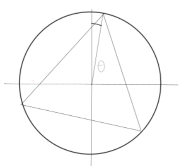

Figure 4.3: The geometry of the interaction, tangential to the electron's shell, between each daon and the daons in a neighboring shell.

$$C = \cos\eta \frac{1}{\pi} \int_0^{\pi} (\cos^2\phi + \cos^2(\phi + \frac{2\pi}{3}) + \cos^2(\phi - \frac{2\pi}{3})) d\phi = \sqrt{\frac{3}{2}}$$

This is the medium action from three zones of contact between a daon and the daons in the next shell. η is the angle between the electron's radius and a line connecting the centers of two daons in interaction, belonging to neighboring shells ($\cos\eta = \sqrt{\frac{2}{3}}$ since the geometry is a regular pyramid). The force is here directed *tangential* to the shell.

If we examine a case where the velocity of the target electron $\vec{v}_1$ is perpendicular to the flux of daons produced by the source electron $\vec{v}_2'$, we obtain the velocity of the flux around the target electron, which must bend the electron's velocity vector in the direction of rotation, leading to a change of the electron's direction of flight, as presented in figure 4.2b.

The perpendicular magnetic action does not change the absolute value of energy or momentum of the electron, it only deviates its trajectory!

This corresponds to the intrinsic force in equation (4.12), multiplied by the angle of rotation, we get

$$F_M = \int_{r_e}^{\infty} \frac{f_n}{3} \frac{v_1}{c_s} \frac{v_{\phi 2}}{c_s} ((1-O)^- - (1-O)^+) \frac{dr}{\Delta r} \qquad (4.13)$$

$+$ indicates the outer shell, whereas the $-$ indicates the inner shell.

Introducing the velocity from the source electron's circulating daons, from equations (4.6) and (4.9), into equation (4.13), we get,

$$\vec{F}_M = \frac{q_1 q_2}{e^2} \frac{f_\infty}{3} r_{e\infty}^2 \frac{\vec{v}_1}{c_s} \times (\frac{\vec{v}_2}{c_s} \times \frac{\vec{r}}{r^3}) \qquad r >> r_{e\infty} \qquad (4.14)$$

θ_2 is the angle between the actual position of the source electron and the position of the target electron, relative to the velocity vector $\vec{v}_2$.

The rotation of the electron corresponds exactly to the rotation created by the daon flux. Comparing this with the corresponding classical expression,

$$F_M = q_1 q_2 \frac{\mu_0}{4\pi} \frac{\vec{v}_1 \times (\vec{v}_2 \times \vec{r})}{r^3}$$

there is perfect agreement, if the signal velocity is equal to the light speed,

$$c_s = \omega_d r_d = c \tag{4.15}$$

The permeability becomes

$$\mu_0 = \frac{1}{\epsilon_0 \; c^2} \tag{4.16}$$

Notice that, according to the definition of the direction of the magnetic field, the daons must be directed away from the electron's center, respectively towards the center for a positron.

Chapter 5

Electromagnetic Induction

An electron has its daons' rotational axis pointing outwards, according to the right-hand rule, whereas an electric field is positively defined as going from plus to minus. It follows that if you apply an external electric field on an electron, its field lines (the daons rotational axis) will bend **against** the direction of the E-field (see figure 5.1).

We can write, using equation (3.20), the electric field in the following way,

$$\vec{E} = e\frac{\vec{r}}{4\pi\epsilon_0 r^3} = \frac{f_\infty}{3} O \frac{\vec{r}}{r} \tag{5.1}$$

f_∞ is the total radial force between two neighboring shells at a distance $r >> r_{e_\infty}$, whereas $O = \frac{r_{e_\infty}^2}{r_{e_\infty}^2 + r^2}$ is the order of the daons associated with the E-field.

An electron at constant velocity obtains a deformation of its shell (see figure 5.2), due to the delayed potential (the limit c). This deformation leads to an inclination of the daons, producing a rotation of the electron so that the electron's velocity of rotation becomes equal to its velocity v.

These two sets of field lines are exactly equal if $O = \frac{v}{c}$, as was already demonstrated in the explanation of magnetism.

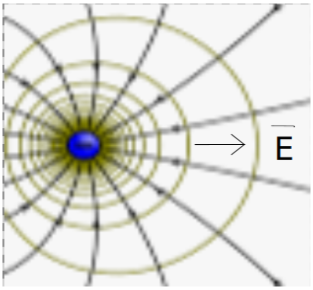

Figure 5.1: The inclination of the electric field lines.

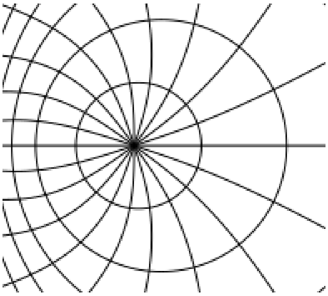

Figure 5.2: The equipotential and potential lines around a moving charge.

If there is a difference between the rotational velocity v_ϕ and the electron's velocity v (see eq. (4.10)), you obtain an inclination of the daons in the direction perpendicular to its velocity, as presented in figure 5.3. This inclination leads to an **induced** electric field (acceleration) in the direction parallel to $\vec{v}$, which can be written as

$$\vec{E} = e\frac{\vec{r}}{4\pi\epsilon_0 r_{e\infty}^2 r}\frac{\Delta\vec{v}}{c} = -e\frac{\vec{r}}{4\pi\epsilon_0 r_{e\infty}^2 r}O \tag{5.2}$$

$\Delta v = v - v_\phi$, i.e., the difference between the electron's velocity and its rotational velocity whereas O is the corresponding order.

This means that a mismatch between the electron's velocity and its rotational velocity bends the daons' rotational axis in the direction of the electron's rotation, as visualized in figure 5.3, producing an acceleration in the direction parallel to its velocity. This has therefore the same effect as an external electric field.

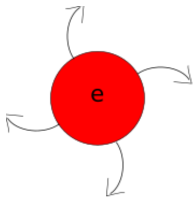

Figure 5.3: A right-handed inclination of the daons pushes the electron in the direction perpendicular to the bend.

The daons making up an electron can have their axis of rotation "bent" in different directions depending on the external influence.

If you apply an external *electric* field (see fig. 5.1), you bend the daons' rotational axis in the direction opposite to the E-field, producing a right-handed rotation of the electron and its daons around an axis parallel to, and in the direction of, the E-field.

If you apply an external flux of daons (a *magnetic* field) to our electron, the electron feels an increased velocity in the direction opposite to the flux of free daons. The daons bend their rotational axis in the direction opposite to the flux, producing a left handed rotation, in the direction opposite to the flux. If the flux is varying in time, you will also have a transverse bend, producing an electric field to oppose the imposed rotation.

We will add a more general consideration: The electric and magnetic actions are directly coupled; you can't have one without the other. If you change one of them, the other one will adapt. If you take an electron at constant velocity (v) as an example, you'll find the magnetic energy in the rotation of the electron and its surrounding daons, whereas the same amount of electric energy is found in its mass increase. In the case of the electron, the action of induction is equally strong for electric or magnetic fields.

You can **not** add energy through a magnetic action perpendicular to the velocity. The magnetic flux, perpendicular to the velocity vector, only deviates the electron's trajectory, whereas the flux parallel to the velocity modifies the relative speed of the electron, inducing an "electric" field.

Chapter 6

The Electro-Magnetic Wave

An electro-magnetic wave is the transmission of an electro-magnetic signal through space. A very simple antenna is a perfectly straight conductor, so thin that the transverse dimension can be neglected. An oscillating sinusoidal current is imposed on such an antenna. The source of the EM-field is then the electrons' oscillation along the conductor.

There is no electric field around the antenna since the wire is neutral, having an equal number of positive and negative charges. It must therefore be the "flux" of free daons circulating around the antenna, coming from the acceleration/deceleration of the electrons, which is the source of the radiation. We can express the velocity of the free daon flux around an ideal antenna by summing up the contribution from all electrons within the conductor:

$$v_\phi = qv_c \int O dr = 2I \frac{r_{e\infty}^2}{a} \tag{6.1}$$

$$\Rightarrow B = \frac{\pi}{\sqrt{2}} m_d \frac{r_{e\infty}^4}{a r_{dfd}^3} I = \mu_0 \frac{I}{2\pi a} \tag{6.2}$$

q is the number of electrons per meter, v_c is the mean velocity of an electron within the conductor, and the order from an individual electron is $O \simeq \frac{r_{e\infty}^2}{r^2}$. a is the distance perpendicular to the conductor. The flux of daons is circulating around the wire according to the right-hand rule. The first equation for **B** is the daon theory formula.

The magnetic field is imposed by the electric field, i.e., the magnetic field follows the electric field so that their phases are locked together. In this zone, we have the "near field" which is completely dominating. This field is gradually replaced by the induced magnetic and electric field at some distance from the antenna.

It is the radial **variation** of the free daon flux which is the source of the EM-wave. We must first recall how the daons interact with each other, as presented in figure 6.1,

Figure 6.1: Interaction between two daons.

This interaction produces a force between daons as follows:

$$a_{d_{\|}} = \frac{3}{2}\frac{c^2}{r_d}\cos\psi \qquad (3\text{-}17) \qquad (6.3)$$

$$a_{d\perp} = \frac{3}{2}\frac{c^2}{r_d}\sin\psi \qquad (3\text{-}18) \qquad (6.4)$$

Depending on the orientation of its axis of rotation, a daon can be attracted/repelled or get an impulse in the direction parallel to the relative velocity $\vec{v}$, as demonstrated in figure 6.1.

If a daon's axis is perpendicular to the direction of the surrounding daons' movement, it will be pushed to or from the antenna, depending on the direction of its axis relative to the conductor, according to equation (6.3).

If its axis is parallel to the movement of the daons around the conductor, it will be pushed in the direction of the daon flux, according to equation (6.4).

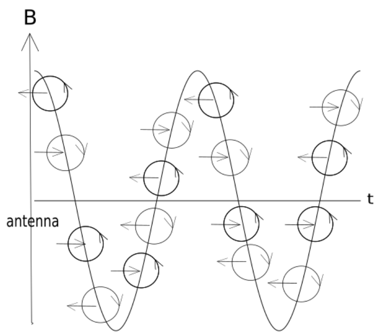

Figure 6.2: Phenomenon separating the daons due to the relative velocity of the free daon flux (the magnetic field).

The radial variation of the flux of daons therefore separates the daons having their rotational axis parallel to the conductor. They will be attracted or repelled according to the direction of their axis, as presented in figure 6.2.

It follows that the daons in between these two ordered regions, in the next half period, will obtain a velocity in a direction parallel to the shells and perpendicular to the conductor, according to equation (6.4), as schematically presented in figure 6.3.

This phenomenon therefore leads to a sinusoidal behavior of both the order and the rotational velocity of the daons but displaced with $\frac{\pi}{2}$ radians in time and radial position relative to each other. It means that the magnetic flux creates an "electric order" corresponding to the magnetic one, which is the reason why an oscillation is produced, creating the electromagnetic wave, as you can see in figure 6.4.

The action-reaction, once produced, cannot be lost in dis-

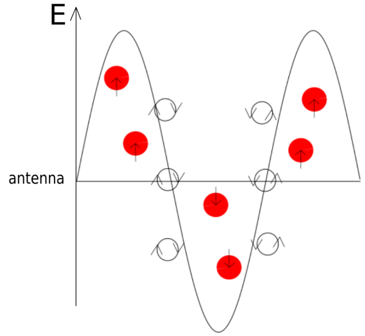

Figure 6.3: Phenomenon accelerating the daons (magnetic flux) due to the separation of the daons with different axial directions.

sipation since the action-reaction between daons is without loss of energy. So the electromagnetic wave must continue to expand away from the antenna to infinity with the signal velocity c.

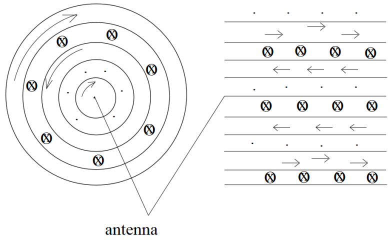

Figure 6.4: Phenomenon of EM-waves.

The electric and magnetic forces acting on an electron can be written as:

$$F_E = \frac{f_\infty}{3}\frac{vO}{c^2}\cos(\omega(t+\frac{r}{c})) \tag{6.5}$$

$$F_B = \frac{v}{c}\frac{f_\infty}{3}\frac{vO}{c}\sin(\omega(t+\frac{r}{c})) \tag{6.6}$$

v is the rotational velocity of the daons around the antenna, whereas O is the order of the same daons. Both the electric and magnetic forces are produced in the same manner, one in the radial sense and the other in the azimuthal sense.

These equations give Maxwell's equations since;

$$\nabla \times E = -\frac{\delta B}{\delta t} = -\frac{f_\infty}{3}\frac{vO}{c^2}\,\omega \sin(\omega(t + \frac{r}{c})) \quad (6.7)$$

$$\nabla \times B = \frac{\delta E}{c^2 \delta t} = \frac{f_\infty}{3}\frac{vO}{c^2}\,\omega \cos(\omega(t + \frac{r}{c})) \quad (6.8)$$

We have also that the minimum wavelength of an EM-wave must be larger than some free daon radii, i.e., around $10^{-17}m$, while there is no upper limit.

Chapter 7

Mass, Time and Length

The characteristics of any lump of matter, closing in on the limit of velocity c, has been a mystery from the start. How is it possible that mass, time or space, can be modified because of high speed?

We will continue to use the electron, since we know that it has the characteristics we want to examine, it is also the most simple particle to treat. We will later on generalize the results to any particle.

7.1 Relation between mass and velocity

Let us suppose that the electron has a velocity $\vec{v}$ relative to the surrounding "free daons" (i.e. daons being completely disordered). The daons associated with the electron will orient themselves relative to the position of the electron, at the moment it was sending its "signal of existence" (delayed potential). The geometrical situation of some shells of daons, reached at the same time by the "signal of existence" from the electron, is indicated in figure 7.1.

The distance between the electron's center and one of these spheres is

$$
\begin{aligned}
r &= r_0(\sqrt{1-\beta^2(1-O)^2\sin^2\theta}-\beta(1-O)\cos\theta) \\
&= r_0 f(\theta) \qquad (7.1)
\end{aligned}
$$

$\beta = \frac{v}{c}$ and θ is the angle relative to the velocity vector ($\vec{v}$), whereas O is the order of the surrounding daons (proportional to the electric field). Notice that the daons start to follow the electron in its movement, with increasing Order.

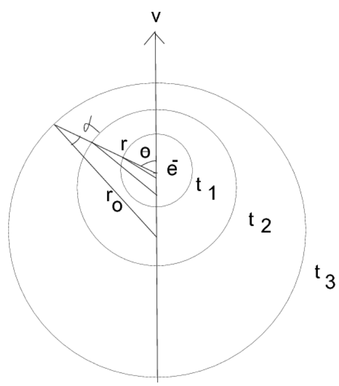

Figure 7.1: Spheres reached, at the same time, by the "delayed" signal coming from the electron's center

We have already seen this situation, when we examined the magnetic phenomena. But now, we'll study the response from the external shells of the electron. We then have to start from a sphere around the electron ahead relative to the electron's center, so that the signal from any point of the sphere will reach the center of the electron at the same time, as presented in figure 7.2.

Such an arrangement will give the same equation (7.1) but now in the opposite direction i.e. $f(\pi-\theta)$.

We can now write, using equation (7.1), the mean path a signal must go, back and forth to a given shell,

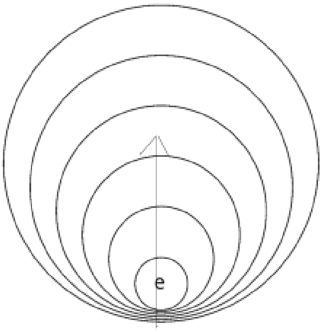

Figure 7.2: Schematic description of the shells around un electron, which actions, will reach the electron's center at the same time.

$$
\begin{aligned}
r_m &= r_0\sqrt{f(\theta)f(\pi-\theta)} = r_0\sqrt{1-\beta^2(1-O)^2} \\
&= r_0\sqrt{1-\beta^2} \qquad \text{if } r >> r_{e_\infty}
\end{aligned} \tag{7.2}
$$

r_0 is a shell radius for an electron at zero velocity, relative to the surrounding free daons.

The reduction of the shell size is due to the deformation of the daons since, the interaction (acceleration a) between daons of different size, is

$$a = \frac{3}{2}\frac{c^2}{\sqrt{r_d^- r_d^+}} \tag{7.3}$$

i.e. the action between daons with different size is proportional to the inverse of their geometrical mean, as presented in figure 7.3.

The electron's ordered daons must create a radial equilibrium, the daons therefore must adapt as indicated in equation (7.2). We have then that the distance between neighboring shells becomes shorter i.e., the daons are reduced in size.

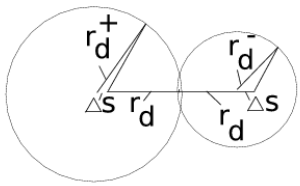

Figure 7.3: Geometry of the interaction between two daons having different size.

Leading to a reduction of size of the shells surrounding the electron.

But, the size of the *free daons* is always the same so, since the radial force equilibrium must be maintained, you obtain an increase of the number of shells and therefore an increase of the electron's mass.

This phenomenon is exactly the same, as if we increased the free daon size! We can therefore use the EP-code to examine the electron mass (exact numerical calculation), varying the free daons *size* (over a wide range), while the daon mass is kept constant, the following law emerged,

$$m_e = K_e r_{d_{fd}} \quad (7.4)$$

$$\Rightarrow m_e = m_{e_0}\gamma \qquad r >> r_{e_\infty} \quad (7.5)$$

i.e. the electron's **rest mass** is directly proportional to the free daon size, whereas the electron having a speed, **increases** its mass $m = m_e\gamma$ where $\gamma = \frac{1}{\sqrt{1-\beta^2}}$, as presented in equation (7.2).

If you take a closer look at this phenomena, you see that the electron has a minimum mass when it's shells are perfectly spherical i.e., *if the shells obtain a distortion of any kind, the mass of the electron will increase!*

7.2 Time dilation

If the mass is increasing, we get from Newton's second law, that

$$a = \frac{F}{m_e \gamma} \Rightarrow t = \frac{v}{a} = \frac{m_e \gamma v}{F} \tag{7.6}$$

Notice that the force F must be constant since the surrounding free daon don't change and therefore, the charge and potential around the electron must be independent from velocity.

The time dilation is therefore just a general reduction of "activity" (acceleration and velocity) between all charged particles.

7.3 Length contraction

The delayed potential (see fig.7.1 and eq.(7.1)) has also another consequence, that is the difference in the angle (α) between different shells, of the rotational axis of the daons. This angle can be written as

$$\cos\alpha = \sqrt{1 - \beta^2 (1 - O)^2 \sin^2\theta} \tag{7.7}$$

This means that the radial force is reduced by a factor $\cos\alpha$, but, since the radial equilibrium must be maintained (due to the free daons which always have the same disorder), this impose an increase of the radial force by a factor $\frac{1}{\cos\alpha}$. The size of the daons within an electron's shell must be constant, the shell radius increase therefore with a factor $\frac{1}{\sqrt{\cos\alpha}}$, to maintain the constant order within each shell. This means that the form of the shells must be flattened out in the direction of velocity since the expansion of the shells of constant order must be adapted to the radial equilibrium, as can be seen in figure 7.4. We obtain that the total deformation of a given shell as

$$\begin{aligned} r &= r_0 \frac{\sqrt{1-(1-O)^2\beta^2}}{\sqrt{(1-(1-O)^2\beta^2\sin^2\theta)}} \qquad (7.8) \\ &= r_0 \frac{\sqrt{1-\beta^2}}{\sqrt{(1-\beta^2\sin^2\theta)}} \qquad \text{if } r >> r_{e_\infty} \end{aligned}$$

r_0 corresponds to the shell radius at zero velocity relative to the free daons.

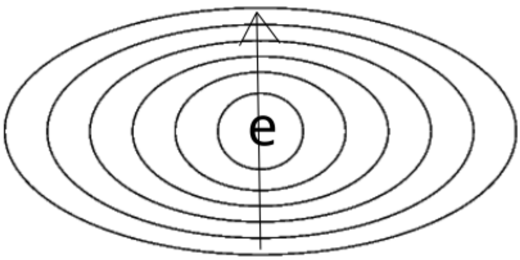

Figure 7.4: Schematic description of the deformation of the shells of constant order around un electron, at constant velocity.

The electron's radial equilibrium remains always spherical, independent from the velocity, even when the shells, of constant order, are deformed. The discussion leading to the mass formula $E = m_e c^2$, is therefore still valid.

Chapter 8

The Basic Particles associated wave

We start by examining an electron with a velocity **v**. The electron's rotational axis wobbles around immediately after its emission, leading to an erratic trajectory since the inherent force, in the direction of the electron's axis of rotation, will obtain an active transverse component.

We can now define such a transverse force (see magnetism) in the following way:

$$F = \frac{e^2}{4\pi\epsilon_0\rho^2}\frac{v_\perp}{c} \tag{8.1}$$

ρ is the electron's transverse radius of curvature. $v_\perp$ is the transverse velocity relative to the main velocity vector.

8.0.1 The Associated Wave of the Electron

The transverse characteristics must become smooth because the interaction with the surrounding daons must be smooth. The only possible such motion is therefore a spiraling trajectory, which can be imagined as being placed on a cylinder with a radius (ρ). The wavelength (λ) corresponds to a piece of a cylinder containing one complete turn, as shown in Figure 8.1.

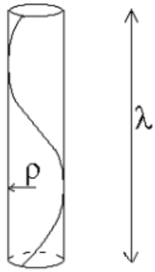

Figure 8.1: Schematic presentation of the spiraling movement of the electron.

The electric field of the electron will create an image charge at the position of its mean trajectory. This corresponds to a positive charge placed on the main trajectory. The value of this "image" charge can be written as

$$q = e\frac{v_\perp}{c} \tag{8.2}$$

where $v_\perp$ is the transverse velocity.

The **transverse** force of the electron, using equation (8.1), can now be written as

$$\begin{aligned} F_\perp &= \frac{e^2}{4\pi\epsilon_0\rho^2}\frac{v_\perp}{c} = m_e\frac{v_\perp^2}{\rho} \\ \Rightarrow m_e v_\perp \rho &= \frac{e^2}{4\pi\epsilon_0 c} = \alpha\hbar \end{aligned} \tag{8.3}$$

This transverse angular momentum has a constant value, so **the transverse action must be the real source for the law of Louis de Broglie**.

The frequency of oscillation is given by

$$\nu = \frac{v_\perp}{2\pi\rho} = \frac{v_\parallel}{\lambda} \tag{8.4}$$

$v_\parallel$ is the electron's velocity parallel to the axis of the cylinder, whereas $v_\perp$ is the transverse velocity.

If we now introduce equation (8.4) into equation (8.3), we obtain

$$\alpha h = m_e v_\perp 2\pi\rho = m_e v_\parallel \ \lambda \ \frac{v_\perp^2}{v_\parallel^2} \tag{8.5}$$

giving the definition of the fine structure constant as

$$\alpha = \frac{v_\perp^2}{v_\parallel^2} \tag{8.6}$$

i.e., **the fine structure constant is the square of the ratio between the transverse and the longitudinal velocities**.

We obtain the reduced constant of Planck from equation (8.3) as,

$$\hbar = \frac{e^2}{4\pi\epsilon_0 c\alpha} = m_d\sqrt{2}\ \pi \frac{r_{e\infty}^4}{r_{fd}^3}\frac{c}{\alpha} \tag{8.7}$$

where the last term is the Daon Theory expression.

It should be noted that the electron's spiraling trajectory (associated wave) can only be left-handed since the electron's inherent force, the daon's rotational axis, obtains an added angle producing a force in the left-handed sense around the velocity vector, due to the left handed rotation around the axis of the velocity vector. The transverse velocity becomes

$$\vec{v}_\perp = -\frac{\sqrt{\alpha}\ \vec{v}_\parallel \times \vec{\rho}}{\rho} \tag{8.8}$$

Notice that the transverse movement is perfectly equilibrated, i.e., the transverse action does not change the velocity $v_\parallel$ of the electron (which would require added energy), i.e., the electron is displaced in the transverse sense without any change in its mean velocity.

Notice that the electron (as any charged particle) has an integer spin! The spin $\frac{1}{2}$ will be explained when we examine the atoms.

8.1 The Photon

The mysterious photon has very strange characteristics: it moves only at the speed of light, has some energy but no mass, and exhibits wavelike behavior. If we use some logic and look at this object through the eyes of the daon theory, we can remove the mysteries and obtain a particle with much simpler and clearer characteristics.

- A photon created inside an atom must have a low velocity while it is collecting the excessive energy within the atom. Its characteristics must therefore be such as to obtain a strong acceleration until it reaches its final speed in an asymptotic manner. There is no immediate action; everything happens during a time interval.

- The photon has energy, so it must contain something, i.e., it must have mass.

- Its mass does *not* depend on velocity.

A photon's structure must be very simple and made up of daons (in the same way as the electron). One possible structure is one where daons are aligned relative to the medium direction of their rotational axis. You can imagine a lump of daons kept together by the interaction between daons with quasi-parallel rotational axes. Such a lump of daons must take a spherical form, like the electron, since the radial equilibrium must be maintained relative to the surrounding free daons, as presented in figure 8.2.

The parallel rotational axes of its daons are the source of an electric field across the lump, while the interaction between the ordered daons and the free daons will give rise to a rotation of the lump. This rotation produces a magnetic field rotating around the electrical field.

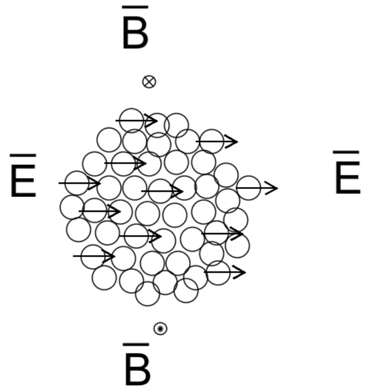

Figure 8.2: Schematic view of a photon.

The velocity of rotation must be such as to produce an equilibrium, which happens when the following equation is valid:

$$v_\phi = cO \sin\theta \tag{8.9}$$

where θ is the angle relative to the rotational axis of the photon. O is the order, i.e., the medium interaction between the daons.

The photon must have the same equilibrium as the electron since both are spheres and the free daons surrounding them always give the same disorder. We can therefore keep the electron's reference radius r_{e_∞} also for the photon. The photon must be in equilibrium with the free daons while it has a sufficient number of ordered daons to sustain it. At a smaller radius, it will maintain all its daons with identical characteristics. Each photon therefore has a definite radius (r_{ph}).

The daons within a photon must, just like the electron, maintain a radial equilibrium. The photon's external mass can therefore be calculated in exactly the same way as for the electron, i.e., the mass corresponding to the potential energy of the electron. We obtain, from the radius of its surface to infinity:

$$\begin{aligned} m_{ph_{ext}} &= m_d \int_{r_{ph}}^{\infty} \frac{4\pi r^2}{\pi r_d^2} O^2 \frac{\pi}{2\sqrt{3}} \frac{dr}{\Delta r} \\ &= m_d \frac{\pi}{\sqrt{2}} \frac{r_{e_\infty}^4}{r_{d_{fd}}^3 r_{ph}} \qquad r_{ph} >> r_{e_\infty} \end{aligned} \tag{8.10}$$

$\Delta r = \sqrt{\frac{8}{3}} r_d$ is the distance between two adjacent shells.

The difference between an electron and a photon is found in the geometry of the daons in a shell around their respective centers. The electron has its daons placed exactly side by side within each shell, leading to an azimuthal force with a radial component due to the curvature of the shell. This leads to a reduced radial force closing in on the electron's center.

The photon's daons are placed parallel to each other in a closed pack structure, which means that they are *not* side by side in a shell. The result is that the radial force between shells is constant until the lack of daons imposes a central lump with identical daons.

The radius r_{ph} corresponds to a limit where the "normal" potential stops due to a lack of daons. We can calculate the internal mass, as follows

$$\begin{aligned} m_{ph_{int}} &= m_d \frac{r_{ph}^3}{r_{d_{ph}}^3} \frac{\pi}{3\sqrt{2}} O_{ph}^2 \\ &= m_d \frac{\pi}{3\sqrt{2}} \frac{r_{e_\infty}^4}{r_{d_{fd}}^3 r_{ph}} \qquad r_{ph} >> r_{e_\infty} \end{aligned} \tag{8.11}$$

The index *ph* means the values at the radius r_{ph}.

We then obtain the total mass of a photon as

$$m_{ph} = m_d \frac{\pi}{\sqrt{2}} \frac{4}{3} \frac{r_{e_\infty}^4}{r_{d_{fd}}^3 r_{ph}} \qquad r_{ph} >> r_{e_\infty} \tag{8.12}$$

We can now further develop this, using the photon energy, as follows

$$\begin{aligned} E_{ph} &= h\frac{c}{\lambda} = m_{ph}c^2 \\ r_{ph} &= 1.144\,\frac{4}{3}\frac{m_e c r_{e\infty}}{h}\lambda \qquad r_{ph} >> r_{e\infty} \end{aligned} \tag{8.13}$$

the number 1.144 comes from an exact numerical calculation of the electron mass, which you will find in equation (11.7).

8.1.1 The Acceleration

We now give a velocity $\vec{v}$ to the photon, lower than the speed of light, and examine the interaction between the surrounding free daons and the photon.

The photon must position itself so that the ordered daons *mean* rotational axis is perpendicular to the velocity vector; otherwise, the interaction between daons will reduce its velocity to zero.

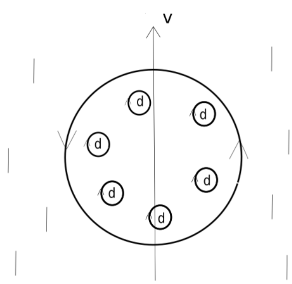

Figure 8.3: Schematic view of the rotation and velocity of the photon relative to the free daons.

The photon's velocity relative to the free daons produces a difference in relative velocity on the sides perpendicular to the photon's velocity vector and the mean direction of the daons' rotational axis. On one side, the ordered daons are rotating too fast relative to the free daons, whereas on the opposite side, the daons rotate too slowly, as presented in figure 8.3. The result is that the photon's velocity of rotation stays constant, independent of the photon's velocity. This dis-adapted action produces an equally strong repulsion on both sides of the photon, which therefore continues straight ahead without any deviation.

But, this phenomenon creates a repulsion between the shells (see figure 8.4), producing a force, from the surrounding daons, pushing the photon in the direction of its velocity vector.

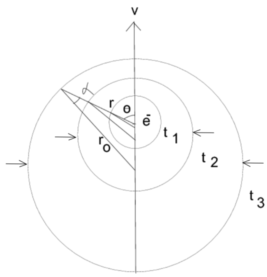

Figure 8.4: Schematic view of the repulsion between the daon shells leading to the acceleration of the photon.

We can calculate this force as follows:

$$F_{ph} = m_d \int_{r_{ph}}^{\infty} A^{+}_{ph} - A^{-}_{ph} \frac{dr}{\Delta r} \tag{8.14}$$

$$= m_d \int_0^{\pi} \frac{r_e^2}{r_{dfd}^3} \frac{3\pi}{\sqrt{2}} \; c^2(1 - \frac{v}{c}) O \sin 2\alpha \sin\theta \; d\theta$$

$$A_{ph} = \int_0^{\pi} \int_0^{2\pi} \frac{r^2}{r_d^2} O \frac{3}{\sqrt{8}} \frac{c^2}{r_d} \; O \frac{c - v}{c} \sin 2\alpha \sin\theta \; d\theta d\phi$$

$\pm$ means the outer and inner shell, whereas Δr is the distance between the two shells. θ is the angle relative to the mean direction of the photon whereas ϕ is the corresponding perpendicular angle, $\sin\alpha = \frac{v(1-O)}{c} \sin\theta$.

Thus the photon accelerates until the limit (c).

8.1.2 The Associated Wave of the Photon

The photon must also start wobbling immediately after its creation and, in the same way as the electron, it will produce a spiraling trajectory. The electric field of the photon will create an image charge at the position of its mean trajectory. The image charge can be positive or negative depending on the direction, relative to the mean trajectory, of the daons. This corresponds to a charge placed on the main trajectory. The value of this "image" charge can be written as

$$q = \pm e \frac{v_\perp}{c} \tag{8.15}$$

where $v_\perp$ is the transverse velocity.

The photon starts a spiraling trajectory, as shown in figure 8.1. The rotational axes of the daons associated with the photon are directed toward the main path when the spiral is left-handed and away from the main path when the spiral is right-handed.

The interaction in the transverse direction relative to the main velocity can be written in the same way as for the electron since the transverse electric force has the same value as for the electron.

$$m_d \sqrt{2}\, \pi \frac{r_{e\infty}^4}{r_{d_{fd}}^3} \frac{c^2}{\rho^2} \frac{v_\perp}{c} = m_{ph} \frac{v_\perp^2}{\rho} \qquad \rho >> r_{e\infty} \tag{8.16}$$

$v_\perp$ is the transverse velocity.

The equation for the radial equilibrium is identical to the corresponding equation for the electron. We can therefore write, in the transverse sense,

$$\alpha \hbar = m_{ph} \rho_\perp v_\perp \tag{8.17}$$

which in the longitudinal sense gives

$$h = m_{ph} v_\parallel \lambda \tag{8.18}$$

i.e., we obtain the equation of Louis de Broglie in the same way as for the electron. We know that the photon will accelerate until the limit $v = c$, so we can therefore write

$$E_{ph} = h\frac{c}{\lambda} = m_{ph}c^2 \tag{8.19}$$

The transverse velocity becomes $v_\perp = c\sqrt{\alpha}$, and the transverse bending radius $\rho = \frac{\lambda}{2\pi}\sqrt{\alpha}$.

Note that the mass/energy of the photon is constant, i.e., it is independent of its velocity; it only rearranges its daons to adapt. Also, for the photon, the transverse action does not modify its velocity.

There is obviously a confusion between the EM-wave and the photon since today it is believed that the EM-wave is made up of photons!

The photon has a spiraling trajectory, leading to a rotating EM-field where the E and B fields are constant in value, whereas the EM-wave is different since its magnetic field oscillates up and down while the electric field oscillates left to right; *these directions, once started, don't change.* The electric energy is transformed into magnetic energy and vice versa.

8.1.3 A photon's rotational energy

We can calculate the total rotational energy of a photon as follows,

$$\begin{aligned} E_{ph} &= m_d \int_0^\infty \int_0^\pi \int_0^{2\pi} \frac{r^2}{\pi r_d^2} \frac{\pi}{2\sqrt{3}} (cO)^2 \sin^3\theta \; d\theta d\phi \frac{dr}{\sqrt{\frac{8}{3}} r_d} \\ &= \frac{\sqrt{2}\pi}{3} \frac{m_d}{r_{d_{fd}}^3} c^2 \int_0^\infty r_e^2 O \; dr \end{aligned} \tag{8.20}$$

i.e., *a photon's rotational energy is an important part of its total energy*!

8.2 The Neutrino

The last possible geometry for a stable daon ensemble is a torus, as shown schematically in figure 8.5. In the same way as for the photon, the daons will interact with the free daons producing a magnetic field around the torus. This configuration has no electric field since the geometry is closed on itself. This means that such a completely neutral particle will have a very small interaction with other particles, leading us to believe that this configuration must be the neutrino.

The medium direction of the ordered daons (electrical field) can be right-handed or left-handed relative to the torus axis. However, if the neutrino has a velocity $\vec{v}$ relative to the surrounding free daons, it must be oriented so that the torus is perpendicular to its velocity vector.

The neutrino cannot have a spiraling trajectory since its electric field (ordered daons) is closed on itself; it therefore has no associated wave. The medium direction of the daons must be perpendicular to the velocity vector; otherwise, the interaction with the surrounding quasi-free daons will decelerate it.

The neutrino is a magnetic dipole where the magnetic field surrounds the torus. It has a similar engine as the electron, pushing it towards the limit of velocity, i.e., the neutrino also moves at "light speed". The interaction accelerating the neutrino is more complex than for the electron; we have therefore desisted from trying to obtain an analytical expression.

In a reaction producing a neutrino, the axis of the torus could be in any direction, but once it has obtained a velocity relative to the free daons, it will orient itself so that its symmetry axis is parallel with its velocity vector. There is no rotation of the torus around the velocity vector since the interaction between daons stops it.

The neutrino, like the photon, is a unique particle and has no anti-particle. The smallest possible mass for a neutrino can be estimated, through the minimum number of daons needed (around 5 meV). The neutrino does **not** follow the

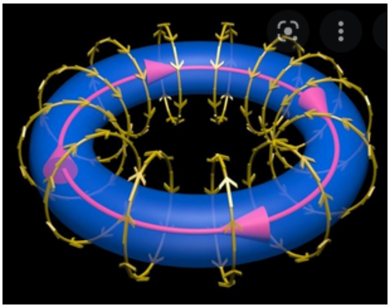

Figure 8.5: Schematic view of the neutrino.

law $E = mc^2$; it can have any energy above its minimum value.

The size of the neutrino must grow with energy-mass, this is important for the probability of a given interaction, i.e., a neutrino reacts within a certain mass-energy range. The different types of neutrinos proposed in today's neutrino theories must then be just neutrinos of different size and energy. The mass-energy of a neutrino is independent of its velocity.

Chapter 9

Atoms from Hydrogen to Neon

We have an electron in orbit around a nucleon, with a charge q and infinite mass m; i.e., an electron having a circular trajectory with radius r, which we'll call the classical orbit. Let's suppose that, in the case of our atom, there is no relative velocity between the nucleus and the surrounding free daons. The electron is then in equilibrium between the EM force and centrifugal force, i.e.,

$$F = \frac{qe}{4\pi\epsilon_0 r^2} = m\frac{v^2}{r} \tag{9.1}$$

9.1 The forces of deviation

An isolated electron, with zero velocity relative to its surrounding free daons, has the main direction of its electric field directed radially outwards. If we now apply the nucleus electric field over the electron, we obtain a bend of the electrical field lines (the surrounding daons' rotational axis) towards the nucleus, as presented in figure 9.1.

This creates a relative difference in velocities of the daons' rotation at the points of contact between the daons in neighboring shells, leading to a rotation of the electron around an

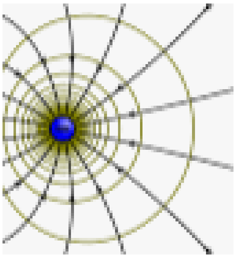

Figure 9.1: Schematic showing the electrical field lines surrounding an electron within an external electric field.

axis parallel to the nucleon's electrical field. The velocity of this rotation corresponds to the order (the electric field) produced by the nucleus at the position of the electron (see eq. (4.12)).

$$\frac{v_\phi}{c} = O = \frac{r_{e\infty}^2}{r^2} \qquad r >> r_{e\infty} \tag{9.2}$$

r is the distance between the nucleus and the electron.

If we now return to the classical orbit of the electron (9.1), we realize that the electron feels the electric field from the nucleus in the radial direction. So, the electron must have a rotation around an axis parallel to the radius of the nucleus. We therefore obtain a transverse force which can be expressed using equations (4.12) and (9.2) in the following way:

$$\vec{F}_\perp = \frac{qe}{4\pi\epsilon_0 r^3} \; \frac{\vec{v}\times\vec{r}}{c} \tag{9.3}$$

v is the velocity of the electron.

This force deviates the trajectory of the electron so that it moves away from the grand circle (the equator).

9.2 The most important force of deviation

If we take a closer look at this scenario, we find another important phenomenon! The electron has a stronger attraction on the side closest to the nucleon compared to the side further away; this produces a rotation of the electron such as to maintain the electron's rotational axis in a fixed position relative to the electrical field of the nucleus.

You can compare the situation with the moon orbiting around the earth; it has always the same side directed towards the earth (a phenomenon due to the *much weaker* gravitational force acting on the moon).

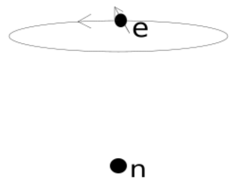

Figure 9.2: Schematic showing the direction of the rotational axis of the electron in its orbit around a Hydrogen-like atom.

But **the electron has an intrinsic force in the direction of its axis of rotation!** We therefore obtain a force which can be written as

$$\vec{F}_D = \frac{qe}{4\pi\epsilon_0 r^3} \frac{\vec{v} \times \vec{r}}{v \tan \eta} \qquad (9.4)$$

The angle η is the angle between the electron's "angular momentum vector" and the electric field vector acting on the electron.

The force of deviation expressed in equation (9.4) doesn't modify the electron's velocity or energy, since this action is perpendicular to the EM-field vector.

Why doesn't the electron find an equivalent orbit slightly displaced relative to the classical one? The answer is that the electron must be in resonance with the associated wave to obtain a closed orbit, i.e., an orbit with an integer number of spirals, which must be in agreement with Louis de Broglie's law.

9.3 Possible stable orbits for the electron

If we introduce the associated wave on the electron's trajectory, it is evident that a closed orbit is possible only if the electron is in resonance, i.e., the electron's spiraling trajectory must make an integer or half-integer number of spirals during one complete orbit of the electron. The electron must find a trajectory where it is in resonance on its orbit.

The force of deviation in equations (9.3) and (9.4) modifies the direction of the electron so that it moves on the potential surface towards a smaller radius. The first resonance must therefore be at a radius reducing the number of spirals by one half relative to the corresponding resonance for the classical orbit, i.e., the electron can place itself in an orbit where its angular momentum must be smaller than the classical one and having an integer or half-integer number of oscillations in one turn of its orbit! We obtain therefore the resonance condition for an electron within an atom as

$$\sin \eta = \frac{j}{n} \tag{9.5}$$

j is the number of spirals (of the associated wave) on the electron's orbit, whereas n is the number of spirals given by the use of only the classical E-field.

We can write the *ideal* characteristics of an electron within an atom as follows:

$$\begin{aligned} R &= R_0 \frac{nj}{Z} \\ v &= v_0 \frac{Z}{n} \\ j\hbar &= m_e v R \end{aligned} \tag{9.6}$$

Index $_0$ indicates the values for the lowest energy state of the Hydrogen atom, whereas Z is the *effective* charge seen by the electron.

The above equations are only approximately valid since the electric field, felt by an electron, is displaced relative to the position of the nucleus.

This gives us a limited number of possibilities to obtain a stable orbit:

- The number of spirals the electron does relative to its equipotential surface must be symmetric and therefore integer; n=1,2,3,.. This gives the number corresponding to the main energy level.

- An integer number of spirals would result in an unstable resonance since then the minima and maxima would stay in the same position on the electron's trajectory, resulting in a feedback loop of oscillation. A half-integer number of spirals gives an exchange between minima and maxima leading to a stable orbit.

- The number of spirals the electron does in one turn of its orbit must be lower than n and half-integer, i.e., $j = \frac{1}{2}, \frac{3}{2}, \frac{5}{2} \ldots n - \frac{1}{2}$. This means that **the electron always has to make two turns to obtain a closed orbit!**

- An electron can jump from one energy level to another but it must always find a closed trajectory at a specific angle η (eq. (9.5)).

- An electron has always a left-handed rotation around its axis, also its spiraling trajectory must be left-handed. But its trajectory around the nucleus can be either right-handed or left-handed relative to a given direction (for example, a magnetic field), since the difference is only a small correction of the angle η (spin flip).

- Notice that the distances between charges within an atom are much greater than the size of the electron

(r_{e_∞}), the interaction between charges is therefore straightforward electromagnetic, as presented in the previous chapters.

- The electron's spiraling trajectory will produce an important variation of the electromagnetic field around it. This produce an electromagnetic induction, acting against any variation of the surrounding EM-field. Remember that the magnetic and electric action has the same order of strength. We have therefore a perfect compensation, due to the electron's electromagnetic induction, so that the electron is displaced perpendicular to its trajectory, without any change of its velocity. This phenomenon is due to the short time period of the electron's oscillation, that doesn't allow the necessary time, for the electron, to modify its characteristics.

This seems rather simple, so a computer code (ATOMOL) was developed able to make a detailed calculation of the electron trajectories around a nucleus using the classical EM phenomena + force of deviation + associated wave.

What is important here is that the above-described theory can be applied to calculate the trajectory of any charged particle within an atom as well as a molecule.

9.4 Some of the lighter atoms

The usual terminology of atomic physics leads to some confusion; we have therefore chosen to use more general expressions.

9.4.1 Hydrogen

The ground state for the Hydrogen atom is obtained when its only electron is in resonance at its lowest level, i.e., when the electron's associated wave can make one half oscillation ($j = \frac{1}{2}$) in one turn of the electron's orbit. The electron has to make two turns to obtain a closed orbit, which corresponds to the classical orbit (n=1). The trajectory is **not** on the equator but displaced so that the radius of curvature is reduced by a factor of two relative to the equator radius as presented in fig. 9.3. The program ATOMOL gives an energy of 13.6 eV for the ground state. The equilibrium of the atom

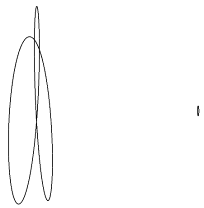

Figure 9.3: Trajectory of the **1H** electron.

is assured through the movement of the nucleus, which obtains an added action to compensate for the movement of the electron. The results from ATOMOL are presented in table 1,

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	2.19	26.5	30.0	13.6

Table 9.1: Result for the **H** atom.

- n is the principal level number (corresponds to the number of spirals the electron does during one closed orbit, i.e., two turns).
- l indicates the sub-level (s, p, d. . .)
- s indicates the number of oscillations during 1 turn.
- v is the velocity of the electron.
- ρ is the radius of the electron's path.

- η is the angle between the electron's angular momentum vector and the classical electromagnetic field vector acting on it.
- E is the total energy of the atom i.e., the sum of the ionization of each level (obtained from NIST) is 13.598.

The orbit of the electron is perfectly closed, whereas the path of the nucleus correspond to its reaction relative to the electron. The nucleus is too heavy to have an associated wave! This gives an action where the electron's energy is equally distributed between potential kinetic energy. The atom's binding energy is found (almost completely) in the potential energy of the nucleus with a small contribution from its kinetic energy.

The electron's trajectory can be right or left handed, relative to the radius of the nucleus (a shift between them is usually defined as a hyper-fine transition).

9.4.2 Helium

We get the ground state for the Helium atom when its two electrons both make two turns to obtain a closed orbit (the K-shell). The two electrons have both perfectly closed orbits, whereas the nucleus just moves linearly in response to the electrons' action. The experimental value of the total energy is 79.005 eV.

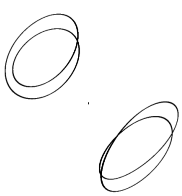

Figure 9.4: Trajectories for the two electrons of the **4He** atom.

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	3.48	16.6	32.05	78.76

Table 9.2: Result for the **4He** atom.

Para-helium has its electrons orbiting with the same handedness relative to the radius of the nucleus, whereas ortho-helium has its electrons orbiting with opposite handedness, which leads to an instability in the radial sense. This instability is due to the interaction between the electrons which, when they have a slight difference in velocity or radius, leads to a slip in position. This situation is then reinforced by the effective charge from the nucleus, which becomes stronger for the closest electron and weaker for the other one, increasing the slip .... The lowest energy state for ortho-helium is therefore two electrons in two different n-levels (1 and 2) moving with opposite handedness relative to the radius of the nucleus (ATOMOL gives an energy increase of 20.3 eV). The same phenomenon must exist in all Helium-like atoms.

Electrons within the same energy level must have the same handedness to avoid instability.

The electrons in the K-shell have some what higher probability to have right-handed trajectories (since they directly see the nucleus). But since the force in equation (9.3) is normally much smaller than the force in equation (9.4), the electron can have any direction of handedness relative to the radius. The difference is a small correction of the angle η in equation (9.4).

9.4.3 Lithium

There is no room for a third electron at the same level as the K-shell electrons (a test was made giving strong instability as a result). There is no other possibility at this n-level; it is therefore necessary to move outwards to the next n-level. The ground state of the Lithium atom is obtained by adding a third electron having a closed orbit after two turns ($j = \frac{1}{2}$) but now placed at $\sin\eta \simeq \frac{1}{4}$, as presented in Fig. 9.5. The experimental value of the total energy is 203.5 eV.

Figure 9.5: Trajectories for the three electrons of the **7Li** atom.

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	5.6	10.2	31.3	
2	-0	0.5	1.08	53.7	14.4	203.2

Table 9.3: Result for the **7Li** atom.

The two K-electrons are slightly displaced for reasons of electrostatic symmetry; the angle between their respective angular momentum vectors is 170 degrees. The indicated values are mean values, although the atom itself is a closed system with constant energy and angular momentum. An individual electron's modification of energy is compensated by the surrounding electrons to match the necessary equilibrium. For atoms heavier than Helium, the orbits are not anymore perfectly closed since the frequencies are different for each sub-level. Only the mean values of the orbits are "closed" (you can take the earth as an example; its orbit is not "closed" due essentially to the influence from the surrounding planets, although its mean orbit is stable).

9.4.4 Beryllium

We get the ground state of the Beryllium (**Be**) atom when the two external electrons both have $\sin \eta \simeq \frac{1}{4}$. The exact value of the total energy is 399.15 eV.

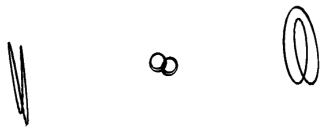

Figure 9.6: Trajectories for the four electrons of the **9Be** atom.

n	l	v $(10^6 \frac{m}{s})$	ρ (pm)	η (deg)	E (eV)	
1	0	0.5	7.8	7.4	30.9	
2	-0	0.5	1.7	33	15.3	398.3

Table 9.4: Result for the **9Be** atom.

The minus sign for the l values in $n = 2$ for Li and Be means that the handedness for these electrons is inverted, i.e., they turn in the opposite direction relative to the K-electrons. This gives more stability and lower energy. We find also here excited levels corresponding to different handedness in the same way as for ortho- and para-helium.

9.4.5 Boron

We add another electron to obtain the ground state of the Boron (**11B**) atom. The added electron has the same number of spirals per turn as before, but its orbit is right-handed.

The added electron places itself symmetrically (for electrostatic reasons) but further away where the effective charge is reduced, increasing the radius of the corresponding equipotential surface. A test was made making the added electron have the same handedness, but this was unstable and higher in energy.

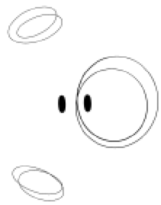

Figure 9.7: Trajectories for the electrons of the **11B** atom.

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	10.0	5.8	30.6	
2	-0	0.5	2.7	22	16.5	
2	1	0.5	1.3	42	18.2	667.5

Table 9.5: Result for the **11B** atom.

The two *s* electrons in the L-level have an angle of 175 degrees between their vector normal, whereas the *p* electron has its vector normal symmetrically placed relative to the other electrons. The experimental value of the total energy is 670.98 eV. Notice the difference in handedness between the 2s-electrons and the 2p-electron in the L-level.

9.4.6 Carbon

We can now add another electron into the L-shell to give carbon. The exact value of the total energy is 1030.1 eV.

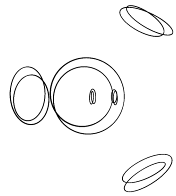

Figure 9.8: Trajectories of the electrons of the **12C** atom.

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	12.2	4.7	30.5	
2	-0	0.5	3.6	16	18.8	
2	1	0.5	1.9	30	18.8	1033

Table 9.6: Result for the **12C** atom.

The sum of the kinetic and potential energy of an individual electron is not zero, although relatively small. This is due to the effective charge seen by an electron, which is variable and not centered on the nucleus. It is in fact the potential of the **nucleus** which has almost all the energy.

9.4.7 Nitrogen

Nitrogen has a geometry where the mean positions of the p-electrons produce a perfect triangle necessary for electrostatic equilibrium. The experimental value of the total energy is 1486 eV.

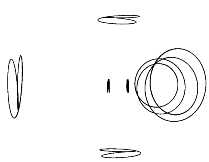

Figure 9.9: Trajectories of the electrons of the **14N** atom.

n	l	s	v ($10^6\frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	14.3	4.0	30.6	
2	-0	0.5	4.6	12	16.1	
2	1	0.5	2.4	25	16.3	1480

Table 9.7: Result for the **14N** atom.

We have now found the reason for $\Delta j = \pm 1$; this is due to the handedness of the electrons! Each sub-level has all its electrons having the same handedness, i.e., they turn in the same sense relative to the radius of the nucleus. This comes from the fact that an electron having the opposite handedness relative to the other electrons in its sub-level produces an excitation and therefore instability within the sub-level (see, for example, ortho- and para-Helium).

The probability of right-handed or left-handed rotation of an electron must be close to the same (with a slight propensity for right-handedness); this leads to sub-levels having alternating handedness. If the s-level is right-handed, then the p-level will have left-handedness...

An "allowed" electron transition is therefore between two levels having the same handedness. "Forbidden" transitions can happen if the electron is strongly disturbed so that its "orbit" rotates or if the electron, moving down to lower levels, passes through the atom, coming to the opposite side of the atom where its handedness then changes sign!

9.4.8 Oxygen

Oxygen has a geometry where the mean positions of the p-electrons produce an irregular square, i.e., the distance between the electrons in this level produces a too strong electrostatic repulsion, leading to a slight displacement in the perpendicular sense necessary for electrostatic equilibrium. The exact value of the total energy is 2043.8 eV.

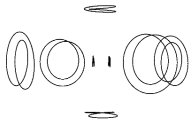

Figure 9.10: Trajectories of the electrons of the **16O** atom.

n	l	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)	
1	0	0.5	16	3.5	30.5	
2	-0	0.5	5.7	10	16.3	
2	1	0.5	2.5	18	16.5	2040

Table 9.8: Result for the **16O** atom.

9.4.9 Fluorine

Fluorine has a geometry where the mean positions of the p-electrons has equal distance between them but, there is no perfect symmetry in this configuration although, the electrostatic imperative tries to produce a symmetric stable configuration.

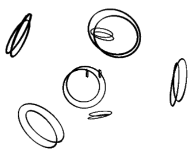

Figure 9.11: Trajectories of the electrons of the **19F** atom.

The experimental value of the total energy is 2715.9 eV.

9.4.10 Neon

Neon has a geometry where the mean positions of the p-electrons produce 2 triangles, inverted relative to each other,

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	18.8	3.1	30.5	
2	-0	0.5	6.15	9.4	16.3	
2	1	0.5	3.2	11	20	2700

Table 9.9: Result for the **19F** atom.

symmetrically placed one on top of the other. The experimental value of the total energy is 3522.7 eV.

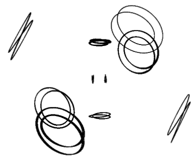

Figure 9.12: Trajectories of the electrons of the **20Ne** atom.

n	l	s	v ($10^6 \frac{m}{s}$)	ρ (pm)	η (deg)	E (eV)
1	0	0.5	21	2.76	30.5	
2	-0	0.5	7.15	8.08	17.8	
2	1	0.5	4.85	10.5	17.9	3450

Table 9.10: Result for the **20Ne** atom.

ATOMOL gives a demonstration of how an atom works, it's necessary to make a sufficient number of turns so that the *mean* value of all the electrons' characteristics are stabilized.

The force maintaining the electrons in their mean azimuthal position is rather weak; so if we impose a strong external magnetic field, we obtain that the electrons start a precession on the equipotential surface, which is the reason for the Paschen-Back effect.

9.4.11 Comments on the program ATOMOL

ATOMOL use a straight forward ray tracing method, which works well for a few charged particles but; it becomes unstable and highly sensitive when more electrons are added (especially the starting position and velocity). It follows that for a stable simulation, it will be necessary to use another method. For example; perfect circles as basic mean trajectories, followed by perturbation calculations. Stability will increase if just a limited number of turns are calculated followed by an optimization procedure and then restart et c..

9.5 Angular momenta

We will use a Hydrogen-like atom as an example, supposing that the nucleus has infinite mass since then a simple analytical approach can be made. We write the force acting on the electron as

$$\vec{F} = \vec{F}_E + \vec{F}_D = eq\frac{\vec{r}}{4\pi\epsilon_0 r^3} \tag{9.7}$$

F_E and F_D are the electric force from the nucleus and the force of deviation, respectively.

The force of deviation does *not* contribute to the electron's energy since it acts perpendicular to the trajectory; we therefore have the energy of the electron as

$$E_e = \frac{eq}{8\pi\epsilon_0 r} + m_e\frac{v^2}{2} = 0 \tag{9.8}$$

The electron's kinetic energy is, in the ideal case, equal to its potential energy. The potential energy is divided into two equal parts between the nucleus and the electron. The orbit of the electron has a radius of curvature half of the distance between the nucleus and the electron.

The electron's angular momentum is therefore (using equation (9.6))

$$mv_0r_0 = \frac{1}{2}\hbar \tag{9.9}$$

the index $_0$ means the lowest level of the ideal Hydrogen atom.

We have also

$$\hbar = \frac{e^2}{4\pi\epsilon_0 v_0}$$

9.5.1 The anomalous magnetic momentum

We apply an external magnetic field B over a Hydrogen atom, which defines a north and a south pole according to the direction of the magnetic field. The electron's mean angular momentum vector will be parallel to $\vec{B}$.

The force equilibrium becomes

$$2\frac{eq}{4\pi\epsilon_0\rho^2} + evB = m\frac{v^2}{\rho} \tag{9.10}$$

Our Hydrogen atom will adapt the electron's velocity and radius to maintain the resonance of the electron, i.e.,

$$\hbar = mv(1+\frac{\Delta v}{v})r(1-\frac{\Delta r}{r}) \qquad \Rightarrow 1+\frac{\Delta v}{v} = \frac{1}{1-\frac{\Delta r}{r}} \tag{9.11}$$

The force of deviation adapts itself to maintain the resonance; we therefore have the energy of the **electron** as

$$E = \frac{eq}{8\pi\epsilon_0(r-\Delta r)} + \frac{evrB}{2} = m\frac{(v+\Delta v)^2}{2} \tag{9.12}$$

We can now further develop equation (9.12) using equation (9.11); we obtain an equation of second order as follows,

$$\frac{eq}{8\pi\epsilon_0 r}x \pm \frac{eB\hbar}{2m} = m\frac{v^2}{2}(2x+x^2) \quad ; \quad x = \frac{\Delta v}{v} \tag{9.13}$$

$$\Rightarrow x = -\frac{1}{2} + \sqrt{\frac{1}{4} \pm \frac{eB\hbar}{m^2v^2}} \tag{9.14}$$

We then obtain the change of energy in our atom as

$$\Delta E = m\frac{v^2}{2}(2x+x^2) = \pm\frac{eB\hbar}{m} \Rightarrow g = 2 \tag{9.15}$$

Higher order

The experimental value of the g-factor is close to 2.00232. From the above, we can say that the g-factor should be exactly 2, so from where does this discrepancy come? The answer must come from the spiraling trajectory of the electron, i.e., the transverse component of the electron's trajectory (lowest energy level). The added transverse energy can be expressed with the help of figure 9.13 as

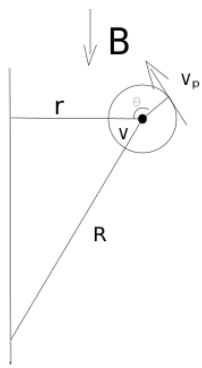

Figure 9.13: Schematics for calculation of the anomalous magnetic momentum.

$$\Delta E = \frac{eB}{2}\frac{1}{2\pi}\,2\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} v_\perp \cos\theta \;\rho \sin\theta \; d\theta$$

$$= \frac{eB\hbar}{m}\frac{\alpha}{2\pi} \qquad (9.16)$$

θ is the angle between the transverse velocity vector $v_\perp$ and the B-field whereas ρ is the radius of the trajectory in the transverse direction.

This gives a total correction for the Hydrogen atom's lowest level of

$$g \simeq 2(1 + \frac{\alpha}{2\pi}) = 2.00232 \qquad (9.17)$$

this will lead to higher-order correction terms and we should not forget the nucleus.

Chapter 10

What is a Particle?

It is known that the masses of all particles (besides photon and neutrino) follow the law of energy ($E = mc^2$). This was demonstrated to be the case for the electron/positron. The mass of the photon and the neutrino do not depend on velocity, which means that **the fundamental building blocks of particles must be electrons and positrons!**. The photon and the neutrino have no role to play in the construction of more elaborate particles.

The analysis of the electron/positron gave a better understanding of concepts such as mass-energy, charge-potential and force-field. We can now use this knowledge to obtain an understanding of how the particles are constructed.

The interaction between electrons/positrons having a distance much bigger than the electron radius was already examined, giving no (or very small) modification of their characteristics. We'll therefore examine what happens at much shorter distances.

10.1 PART

A computer code called **PART** was developed, which simulates the interaction between electrons and positrons.

First, we need a dedicated mesh representing the electron/positron. To obtain this, we start with a sphere made of a regular mesh of 20 triangles. Each triangle is divided into 6 new triangles, giving a total of 120 quasi-regular triangles representing a sphere. Then we produced many such spheres with growing radii so that a spherical mesh filling up all the volume of interest is produced. We thereafter use radial lines passing in the corners of each such triangle so that a 3D mesh is achieved, which then can be used in a numerical simulation.

The electric force lines are parallel to the mean direction of the daons' axis, as was explained analyzing electricity, whereas equipotential surfaces are perpendicular to the force lines.

The MESH obtained for an electron's equipotential surface is presented in figure 10.1.

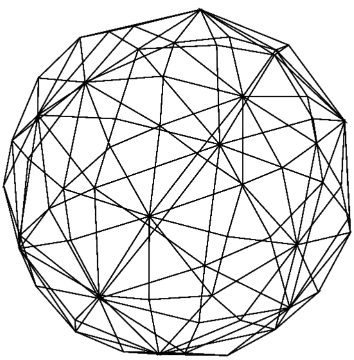

Figure 10.1: Schematic view of one equipotential surface of the electron mesh

The code PART has no parameters; the user can only place the constituents in any position, PART thereafter calculates mass and force felt by each constituent using the Daon-theory.

10.2 The Contraction

When we examine a sphere at constant radius under the influence from an external field, we obtain a modification of the daon size within the sphere due to the necessity to maintain the radial equilibrium around each charge. The interaction between daons with different sizes is

$$a = \frac{c^2}{\sqrt{r_d^+ r_d^-}} \cos\psi \tag{10.1}$$

This means that the *effective* daon radius is the geometrical mean value of the neighboring daons (see figure 10.2).

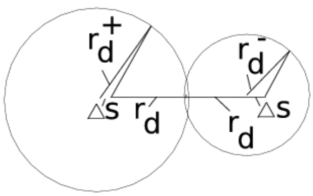

Figure 10.2: The deformation of interacting daons having different radii.

Δs is the displacement of the barycenter of the respective daon due to the interaction.

What is important to realize is that the interaction between daons of different size within a spherical surface leads to a supplementary azimuthal action reducing the daon sizes. The radial equilibrium must therefore adapt to take into account this "contraction", which becomes

$$\begin{aligned} C &= \frac{r_{d_g}}{r_{d_a}} \\ r_{d_g} &= (\Pi_{i=1}^n r_{d_i})^{\frac{1}{n}} \\ r_{d_a} &= \Sigma_{i=1}^n \frac{r_{d_i}}{n} \end{aligned} \tag{10.2}$$

i.e., the daon radii geometrical mean divided with the arithmetical mean of the daons within a shell.

The geometrical mean is always smaller than the arithmetic mean (besides when all daons have the same size), which leads to a reduction of the mean size of the daons. This reduced size is compensated by a corresponding reduction of the Order so that the radial equilibrium remains constant.

This contraction within a spherical shell is rather small but should be multiplied by the number of shells, which can be very high. This can lead to a strong reduction of the daon size closing in on the electron's center and therefore an increased number of daons leading to a mass increase.

10.2.1 e-e

Let us start by examining the interaction $e^- - e^-$ at small distances. Part of the mesh can be seen in figure 10.3, where the lines parallel to the mean direction of the daons' axis and one equipotential surface are presented.

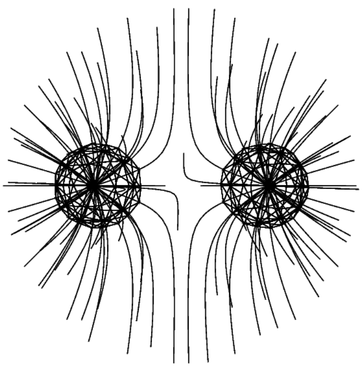

Figure 10.3: Two electrons

The force and mass variations relative to the distance between them are presented in figure 10.4, compared with the same value for the classical case. The classical values are cut when the distance between the electrons is shorter than the classical electron radius (their values have no sense thereafter). We start from a sufficiently large distance to show that the classical and simulated values agree.

The classical values are defined as:

$$F = \frac{e^2}{4\pi\epsilon_0}\frac{\vec{r}}{r^3}$$

$$m = m_e + \frac{e^2}{8\pi\epsilon_0 r c^2}$$

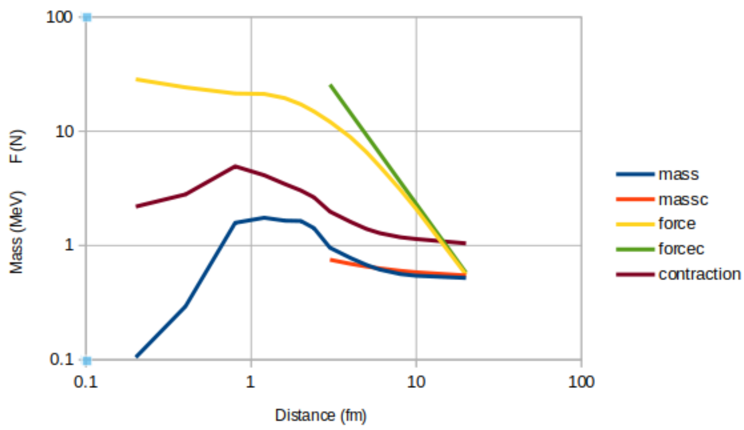

Figure 10.4: Mass and force variation (simulated and classical) relative to the distance between the two electrons and the contraction of a daon at the center of the electron.

Notice that all the graphs are presented with logarithmic scales so that the totality of the data can be presented.

If you start "far away," you see the mass increasing compared to the classical mass due to the contraction. The mass thereafter diminishes at shorter distances due to the reduced number of shells.

The external electromagnetic force acting on an electron shell is due to the radial equilibrium, which must be realized for all charges involved. This leads to an interaction between charges (eq. (10.3)) producing a deformation leading to a force equilibrium between the involved charges.

$$\vec{F} = \frac{m_d c^2}{r^3_{d_{fd}}} \frac{3}{\sqrt{8}} \frac{q_i}{e} r^2_{e_i} \int_0^{\pi} \int_0^{2\pi} O_T \cos\phi \cos\theta \sin\theta \, d\psi \, d\theta \quad (10.3)$$

$$O_T = \frac{|T|}{1+|T|} \qquad \vec{T} = \Sigma_{j \neq i} \frac{q_j}{e} \frac{r^2_{e_j} \vec{r}_j}{r^3_j}$$

m_d is the mass corresponding to a daon and $r_{d_{fd}}$ is the size of the surrounding free daons. r_e is the radius of reference (as defined in Electricity), which at these distances is smaller than r_{e_∞}. $\vec{T}$ is the sum of the action from the **external** charges acting on the examined shell surface. You can consider $\vec{O_T}$ as the external E-field. ϕ is the angle between $\vec{T}$ and $\vec{r}$, whereas θ is the angle relative to the center of the examined electron/positron.

Notice that the *Contraction* has no influence on the electromagnetic force since this only depends on the radial equilibrium relative to the external free daons. The reduced daon size due to the Contraction is compensated by a reduction of the order (O).

The values of the force are reduced compared to the classical values at shorter distances. This is due to the reduced reference radius (r_e) closing in on the center (see Electricity).

10.2.2 electron-positron

The next logical step is the interaction between an electron and a positron as presented in figure 10.5.

The mass follows rather well the classical value until at shorter distances the deformation is sufficiently strong so that the contraction in the internal parts reduces the size of the daons and their order (O), increasing the number of daons, and therefore the mass.

As you can see in figure 10.6, the mass is growing to very high values at around 1 fm. The mass is reduced at shorter

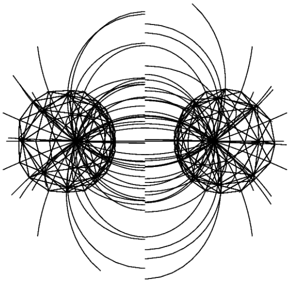

Figure 10.5: Part of the mesh at the interaction between an electron and a positron

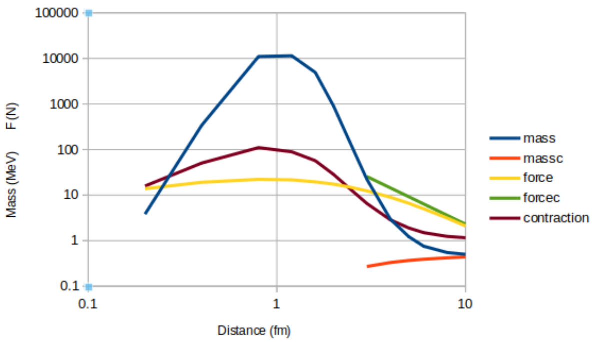

Figure 10.6: Mass and force variations relative to the distance between an electron and a positron

distances because of the fewer number of shells at disposition and that the order (O) must be smaller than 1.

The contraction starts to become important at some fermi distance between the participants; it's there after growing with the accumulation of contraction in each shell, leading to an important increase of the number of daons in each shell, leading to an increase of mass.

We have now found the reason for the much bigger mass of composite particles compared to the electron mass since the contraction gives a strong increase of the electron/positron mass. This is due to the accumulation of daons in a high number of shells giving a strong contraction (high number of daons) at the center of the electron/positron.

The mass of the individual electron/positron can be calculated as follows:

$$M = \frac{q_i}{e} c^2 \frac{m_d}{\sqrt{128}\, r_{d_{fd}}^3} \int_0^{\infty} r_{e_j}^2 C_j^3 \int_0^{\pi} \int_0^{2\pi} O_T \sin\theta \; d\psi \; d\theta \; dr \tag{10.4}$$

C_j is the Contraction of each daon within the spherical surface j.

$$\vec{T} = \Sigma_j \; \frac{q_j}{e} \; \frac{r_{e_j}^2 \vec{r}_j}{r_j^3}$$

$$O_T = \frac{|T|}{1 + |T|}$$

$\vec{T}$ corresponds to the sum of all electrical fields whereas O_T is the daons Order in a given point.

10.3 Annihilation

When an electron comes sufficiently close to a positron, there is an interaction where the electron/positron change into two photons. This is called annihilation. Note that the electron is rotating in the left-handed sense whereas the positron rotates in the right-handed sense so in a head-on collision, they'll rotate in the same sense!

After such a reaction, you will have a geometry where the daons are separated into three regions: the two external ones will be similar in number of daons and have their daons pointing in the same direction whereas the central one will have two times more daons with its daons pointing in the opposite direction as presented in figure 10.7. This, as we have learned previously, means three quasi-photons where two have the same size and direction and a third smaller and heavier one in between having the opposite direction.

This will result in two photons since when the quasi-photons start to move, the two external photons will be at-

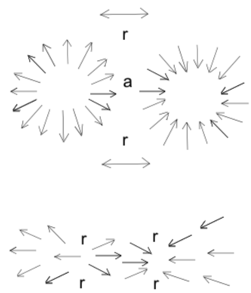

Figure 10.7: Scenario of annihilation: a = region of attraction, r = region of repulsion

tracted to each other and combine into one. The two resulting photons will have approximately the same mass (number of daons) but accelerating away in opposite directions and rotating with opposite handedness. This is exactly what you'll find in a dedicated experiment.

10.4 The Muon

The constituents of the lighter particles should be visible in their decay modes. The muon decays directly into electron, positron, photon and neutrinos, which demonstrate the simple construction of this particle. The most probable process looks like an annihilation between an electron and a positron. The neutrinos cannot be detected, meaning that the decays below are an interpretation from theoretical considerations and experimental data of the electron distribution.

$$\mu^- \rightarrow e^- \nu_e \bar{\nu}_\mu \quad ; \quad e^- \nu_e \bar{\nu}_\mu \gamma \quad ; \quad e^- \nu_e \bar{\nu}_\mu e^+ e^-$$

This means that the μ^- should be constituted by the most simple structure, i.e., two electrons plus one positron. They must for reasons of the electrostatic interaction be aligned with each other, as can be seen in figure 10.8. We can then try to give an interpretation of the muon decay.

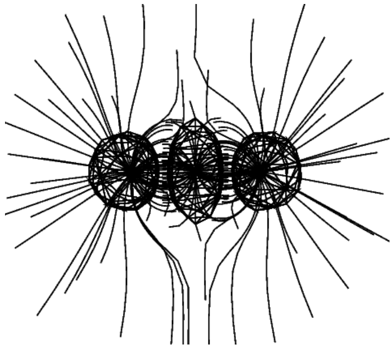

Figure 10.8: The muon geometry.

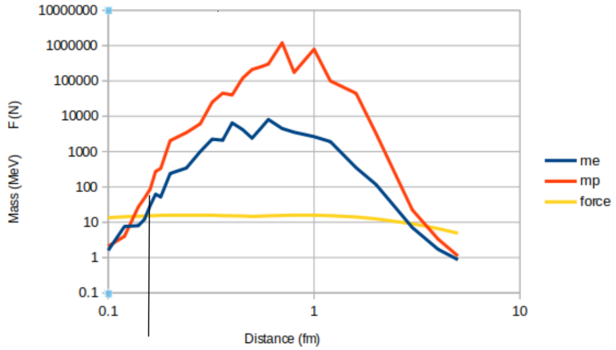

Figure 10.9: Mass and force variations of the muon relative to the distance between constituents

As was already discussed above, the annihilation gives as result three quasi-photons lined up, with in this case, the electron at one end. The quasi-photon closest to the electron will be absorbed by the electron while the central quasi-photon will be pushed against the external quasi-photon. This means that the two remaining quasi-photons will be side by side but in opposite directions, which is an invitation to produce a neutrino (see Photon and Neutrino).

It should be said that the graphs of force and mass are static, i.e., this is not the real appearance from a scenario of particle creation. The creation is a dynamical process where the mass and force can vary over a wide range. The main interest of these graphs is to identify the position of maximum stability for the particles and the characteristics around these points.

We have chosen to exclude the *Contraction* from the graph to simplify the understanding; the contraction just follows the mass variation.

At the position of the correct muon mass (indicated in figure 10.9), you have that the positron is about 3 times heavier than the electron and that the distance between an electron and the positron is 0.16 fm.

The μ^- has a simple effective symmetry. The two external electrons are repelling each other so that they cannot come close together. If the central positron approaches one of the electrons, the other one will follow, attracted by the positron. This makes the internal forces relatively low. This plus the linearity of the geometry do not assure the stability but give a relatively long lifetime to this particle.

The errors in the presented graphs are due essentially to the basic mesh, which is too sparse in the azimuthal sense. The error for the mass is around 20 percent and maybe 2 percent for the electromagnetic force.

The charge of any particle comes from the resulting number of radial equilibrium, i.e., the difference between the number of positrons (having their daons pointing inwards) minus the number of electrons (having their daons pointing outwards). The charge of a particle is well defined once the distance is much bigger than the reference radius of the particle ($r >> \sqrt{Z} r_{e_\infty}$).

10.5 The strong force

The muon is the simplest of all composite particles; we'll therefore use it as an example to explain the strong force. All composite particles behave in the same manner.

If we put electrons and positrons close together, we obtain only annihilation. To create a particle, we need constituents which have sufficiently high mass so that the sum of their masses is higher than the final particle's mass. This can be obtained by a high energy collision or decay from a heavier particle. This is a static approach, so we haven't taken into account the relative velocity between the constituents.

Let us imagine that the μ^- at the moment of creation (normally a π^- decay) has its constituents "far apart" corresponding to the part of the graph (fig. 10.9) where the mass is reduced with the distance between them. If an electron/positron has too little mass relative to the value indicated in the graph, it would try to increase its number of daons (mass) by attracting the surrounding daons. This will lead to an attractive force independent from the charge, which will bring the electron/positron closer together.

But this would further reduce its mass relative to the graph. If it has too much mass, then the electron/positron would try to get rid of its daons, leading to a repulsion independent from charge, which will result in a separation between the constituents, which will further increase its mass relative to the graph. We have therefore at this part of the graph a saddle point which is highly unstable.

If the distances are such that the constituents are on the side of the graph where the mass is growing with the distance between the constituents, then if the electron/positron has too little mass, it will get an attraction, i.e., a reduction of the distances giving a better match for the masses. If you have too much mass, then it gets a repulsion, increasing the distance between the constituents, which again gives a better adaption for the mass. This leads to a "potential well", i.e., a stable area!

If the mass gradient is changing relative to the distance between charges, then the electron/positron will move until a point is reached where the mass gradient is constant (inflection point), i.e., where the second derivative of mass relative to the distances is zero (eq. (10.5)). This is due to the difference in force over the electron/positron shells, i.e., it must feel the same but opposite force on the two sides relative to the barycenter of the particle.

We have therefore that the constituents will use some time to equilibrate their masses and relative positions during which their excess energy/mass will evaporate away as photons and/or neutrinos.

$$\frac{\delta^2 m}{\delta^2 s} = 0 \tag{10.5}$$

The strong force keeping the constituents in their position is simply

$$F_s = \frac{\delta m}{\delta s} c^2 \tag{10.6}$$

If you examine the graph in figure 10.9, you'll find that this force is around 1000 $\frac{N}{fm}$! This is the strong force!

10.6 The pi0

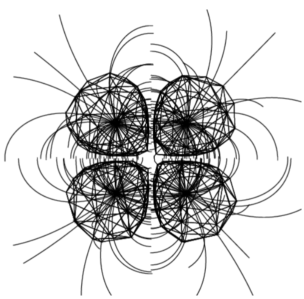

Figure 10.10: The π^0 geometry

We will again start with the decay modes to get a better understanding:

$$\pi^0 \rightarrow 2\gamma \quad ; \quad e^- e^+ \gamma \quad ; \quad e^+ e^- e^+ e^-$$

The very unstable π^0 decays after one or two annihilations into gammas and/or electrons/positrons and should therefore be constituted by two electrons and two positrons, which must for reasons of electromagnetic symmetry be positioned in a square as can be seen in figure 10.10.

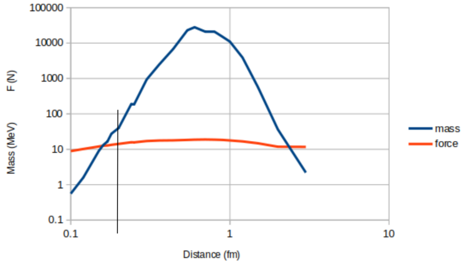

Figure 10.11: Individual mass and EM-force between the constituents of π^0 relative to the distance from the symmetry center.

At the moment of creation, you have the usual re-equilibrium of the masses leading to some stability, but the constituents are strongly attracted to the opposite charge partners, so that annihilations are fast. There's no equilibrium to delay the decay.

The correct mass is obtained when the constituents are at a distance of around 0.2 fm from the center of symmetry as can be seen in figure 10.11. The strong force is here around 10000 $\frac{N}{fm}$.

10.7 The pi-

The π^- which preferably decays into a muon should be constituted by three electrons and two positrons.

$$\pi^- \rightarrow \mu^- \nu_\mu \quad ; \quad \mu^- \nu_\mu \gamma \quad ; \quad e^- \nu_e$$

The e^- should be positioned in a regular triangle while the e^+ should, for reasons of electromagnetic symmetry, be positioned face to face on a line passing through the barycenter and perpendicular to the plane of the triangle as shown in figure 10.12.

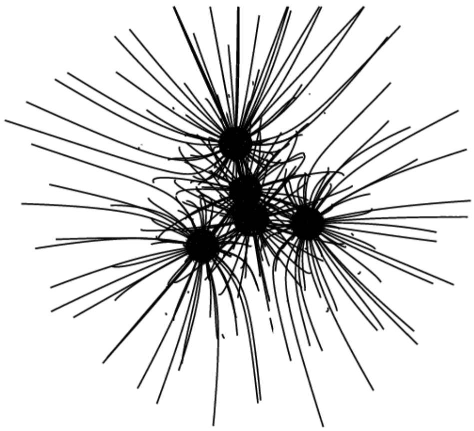

Figure 10.12: parts of the π^- mesh showing the geometry of the constituents.

At the point of stability, the electrons are positioned at 0.25 fermi from the center of symmetry with a mass of 14 MeV whereas the positrons are positioned at 0.147 fermi with a mass of 50 MeV. The strong force is around 10000 $\frac{N}{fm}$ for the electrons and about 3 times stronger for the positrons.

In a scenario of creation or decay of particles, the mass of the particles is not well defined; the mass of a created particle can very well be much lower or much higher than the value indicated in the graph. If a particle obtains a too high mass, it will emit daons (mass) closing in on its final mass. It can happen that the particle has obtained a too low mass. It will then absorb mass (daons) from the surrounding fields or particles until it has reached its final mass (it can of course during this period also become unstable and decay). This is a force of attraction if it needs more daons and a force of repulsion if it has too many.

The electrons are maintained in a triangular position due

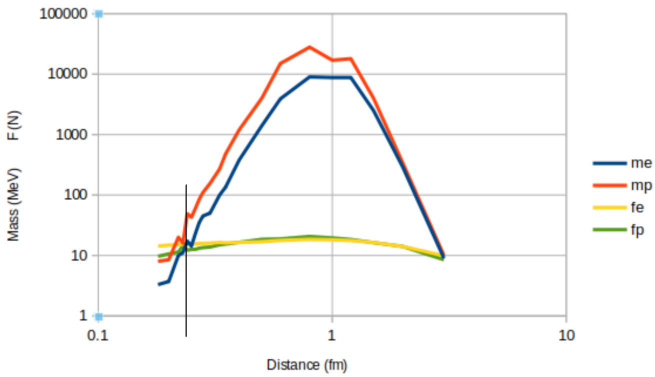

Figure 10.13: Mass and force between the constituents of π^- relative to the distance from an *electron* to the center of symmetry.

to their repulsion from each other while the positrons are repelled from each other through the center of the triangle. Now, if a positron closes in on an electron, also this particle has no regulatory force to maintain it, i.e., the other positron will be repelled into the opposite direction, i.e., it will close in on the other electrons. This particle has a more complex geometry but is still quite unstable. As for the π^0, there's nothing to stop the annihilation between the constituents, which is the reason that the π^- decays easily into μ^-.

The heavier mesons like $\eta, K, \rho, \omega \ldots$ using the same reasoning seem to be constituted by three or more pions! If this is so, then it would explain their short life times since in this case they must behave like π^0 and/or π^-. They should therefore be rather unstable, quickly decaying with one or more annihilations.

10.8 The Proton

The baryons must necessarily be constituted by electrons and positrons, which gives the explanation for the very precise charge unity of the proton in the same way as the lighter particles. So why the strong difference in stability?

The only possible answer is that the proton has a special symmetry. The proton is also quite heavy compared to the leptons and mesons. The number of constituents must also be higher, so we are looking after a structure of perfect symmetry with a relatively high number of participants where half of them have a positive charge and the other half have the same but negative charge. This reasoning makes us think of a crystal of ions with similar characteristics like CsCl for example. So from physical chemistry, we obtain that similar sized charged ions order themselves into cubes placed parallel to each other where the cube with - charges is displaced relative to the one with + charges so that the corner of a cube of - charges is placed in the center of the cube of + charges.

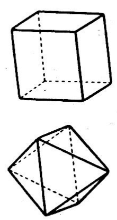

Figure 10.14: The geometry of the proton.

If we now apply this knowledge to the proton, we obtain that the necessary stability can only be obtained with the most simple structure which is a complete cube of positrons with an electron in its center and six other electrons placed outside the center of the cube's faces.

Such a symmetry has the electrons as well as the positrons in perfect symmetry between themselves since the electrons form an octahedron as proposed in figure 10.14.

The central electron is placed perfectly symmetric relative to the surrounding constituents which produce similar sized daons within its shells. The result is that this electron obtains a very low mass relative to the surrounding constituents. The other electrons/positrons become similar in their mass and

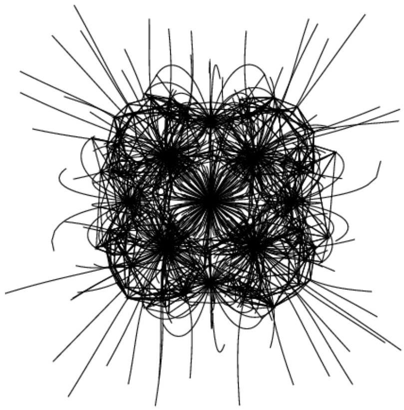

Figure 10.15: Part of the proton mesh.

force.

The position of stability is when the positrons are situated at a distance of 0.33 fermi from the central electron and the other electrons at a distance of 0.325 fermi so almost the same. Their masses are around 55 MeV for the positrons and 80 MeV for the electrons whereas the central electron's mass is only around 0.5 MeV. The proton is the most symmetric structure of all and therefore the most stable one. The proton is the most important particle for all construction of matter; it therefore deserves a special attention.

The constituents are placed on the positive slope of the force-mass graph as can be seen in figure 10.16. The slope is extremely strong around $10^5 \frac{N}{fm}$ which means that if a positron moves towards a smaller radius a strong reduction of the attraction towards the central electron will result as also an even stronger increase of the attraction towards the external electrons. The central electron can therefore not approach a positron because this would immediately be pulled away by the external electrons. In the case of an external electron moving to smaller radius, we have also a strong reduction of the attraction towards the positrons but also an increase of the repulsion from the central electron pushing it back. This can very well explain the absolute stability of the proton.

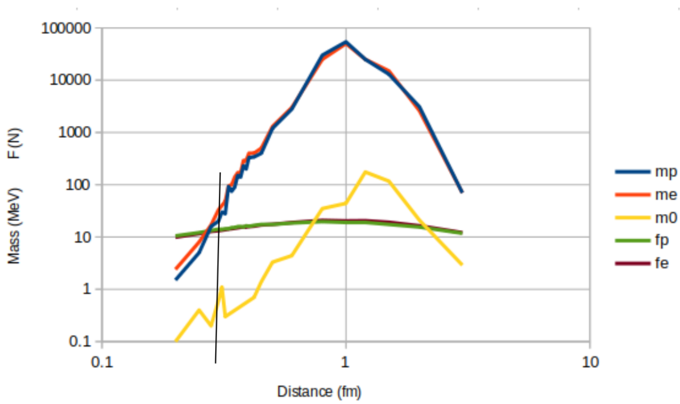

Figure 10.16: Mass and force variations of the proton constituents relative to the distance between a positron and the central electron.

Notice that the proton has *three different types* of electron/positron whereas the examined mesons have *two different types* of electron/positron, i.e., the number of types corresponds to the number of quarks proposed in the "Standard Model".

10.9 The Neutron

We obtain the neutron by simply adding an electron. This causes some considerations:

- At this very short distance, the electron can't have any associated wave since the wavelength would be much too long, i.e., the action from the proton on the electron is much stronger than the action producing the associated wave. This is the essential difference between a Hydrogen atom and the neutron.

- There is no place for the extra electron within the pro-

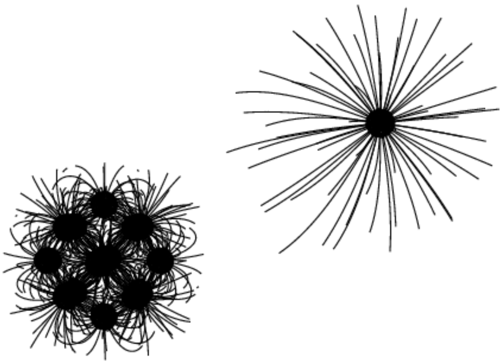

Figure 10.17: The geometry of the neutron.

ton which means that the electron has to be placed outside.

- The mass of the neutron is slightly higher than the proton which means that the electron must be placed rather close to the proton since the "normal classical" decrease of potential would give a reduction of the mass for both the electron and the proton. The electron must therefore be placed sufficiently close to the proton so that the increase of mass due to the deformation of the shells will start to act, i.e., at the beginning of the barrier of growing mass which means around 8 fm distance away from the protons' center.

We place an electron outside a proton just in front of a positron and examine the variation of mass and force relative to the distance between them as presented in figure 10.18. The electron mass is not included since its variation is negligible.

If we start from "far away," we have the classical reduction of mass due to the electromagnetic potential. When the electron comes closer, the proton mass starts to increase due to

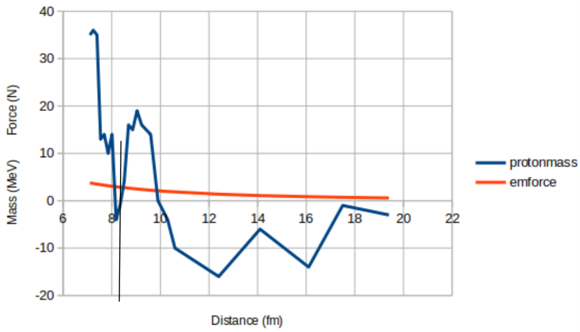

Figure 10.18: Mass of the proton and the EM-force variation between the electron and the proton relative to the distance between them.

the contraction of its constituents. Suddenly at around 9 fm, the proton mass goes down which creates a "potential well" which explains the stability of the Neutron! The EM-force from the electron seems to rearrange slightly the proton's constituents which reduce the mass. A detailed analysis is difficult at this stage; a more precise mesh would be needed.

The electron will move around the proton in a rather erratic motion since the electro-magnetic interaction + a slight touch of strong force depends on the relative position of the electron. It is difficult in a static approach to give details on the trajectory since the electron will feel a stronger local force variation due to the variation of the distance from the constituents of the proton.

This quasi-stable particle must have a unique way to decay. The most probable such mode is when the electron in its erratic motion reaches close to the azimuthal position of an electron which would give a sufficiently strong repulsion to expel the electron.

The heavier baryons using the same reasoning as above seem to be constituted by a basic proton with leptons and/or mesons attached in a similar way as the above electron!

10.9.1 The nuclear force

We have seen that all particles have a very strong growth of their mass at a distance between their constituents of around 1 fm. Imagine now a particle closing in at this distance; such a particle must deform so that its daons adapt their sizes to the surrounding daon size gradient. It will need more mass/energy. It will therefore be attracted to the daons of the other particle. This corresponds then to a "field" acting on any particle independent of its charge. Such a field does not exist for the photon and the neutrino since these can adapt their daons to any situation.

When two protons are close enough together, they will start to feel the interaction between the individual constituents; this will produce a certain geometrical interface where attraction and repulsion will be in equilibrium between the electromagnetic repulsion and the attractive energy-mass field (strong force). The electrons should have their trajectories concentrated at the strongest points of attraction which should be around the points of the proton interfaces since there they are attracted by several protons at the same time.

10.9.2 The weak force

From the above it becomes evident that the "weak force" is just an annihilation between electrons and positrons and other interactions where the strong force can be excluded.

The heavier bosons (W, Z and Higgs') have in the daon theory no specific role to play. Their characteristics indicate in any case some specific symmetries for these particles. **Quarks and gluons don't exist!**

Chapter 11

Gravity and Dark Matter

To comprehend the phenomena of gravity and dark matter, it is essential to first understand the fundamental structure of our Universe and the pivotal role played by free daons. Free daons are the building blocks of the cosmos, permeating the Universe and influencing its dynamics.

The mean radius of a free daon is approximately 10^{-18} meters. This allows us to estimate the density of free daons as follows:

$$D_d = \frac{1}{r^3_{d_{fd}}} \simeq 10^{54}\ m^{-3}$$

This value is staggering when compared to the Universe's mass density, which is approximately one neutron per cubic meter. The corresponding number of daons associated with mass is:

$$D_m = \frac{m_n}{m_d} \simeq 10^{14}\ m^{-3}$$

From this comparison, it is evident that the Universe is overwhelmingly dominated by free daons.

All free daons within our Universe tend to achieve a uniform size. This uniformity arises because the action of a daon is inversely proportional to its radius—smaller daons exert a stronger action than larger ones. In a Universe filled with free daons, interactions between daons of varying sizes drive smaller daons to expand and larger daons to contract, ultimately leading to a state of uniformity.

11.1 Dark Energy

Hypothesis I: The Universe is enveloped by an empty void, or more precisely, a void that does not interact with the daons within our Universe.

In a Universe filled with free daons of uniform size, the mean value of attraction-repulsion and contraction-expansion is zero. Consequently, the only possible interactions must occur at the surface of the Universe, where anisotropy exists. A daon that lacks contact with its neighbors expands rapidly. In a static situation, interactions with neighboring daons maintain a daon at a constant radius. This characteristic of daons explains the expansion of the Universe, as surface daons are in contact with their neighbors inside the Universe but lack an interacting zone outside it.

To provide a more detailed understanding of the interaction between free daons, we can separate the zones of expansion from the zones of interaction:

$$a_{d_{\parallel}} = a_d(12\langle\cos\theta\rangle - 12\langle\cos\eta\rangle) = 0$$

Here, a_d represents the action at one point of contact. The angle θ corresponds to the surface angle of the zone of contraction for free daons, whereas the angle η represents the surface angle of the zone of expansion. The surface angle $\frac{\pi}{6}$ corresponds to the mean size of the 12 zones of interaction (12 neighboring daons), which should be equivalent to the zone of expansion.

The angles θ and η are, on average, identical because daons quickly adapt to any change in interaction, bringing surrounding actions to equilibrium. For a surface daon, three zones of attraction transform into three zones of expansion toward the surrounding void. The radial action from a daon at the surface of the Universe is therefore:

$$a_u = 6a_d \cos\phi = 6\sqrt{\frac{2}{3}} \cdot \frac{3}{2}\frac{c^2}{r_{d_{fd}}} \tag{11.1}$$

This equation represents six zones of expansion multiplied by the mean radial direction $\cos\phi = \sqrt{\frac{2}{3}}$, and the action of a free daon $a_d = \frac{3}{2}\frac{c^2}{r_{d_{fd}}}$.

This leads surface daons to expand, pushing their neighboring daons and causing them to expand as well. Consequently, the Universe experiences an action of expansion. The force of expansion is directed perpendicular to the surface of the Universe, implying that the Universe must be spherical with identically sized surface daons.

Hypothesis II: The number of daons within our Universe is constant.

We can estimate the total number of daons in the Universe (N_{du}) as follows:

$$N_{du} = \frac{R_u^3}{r_{d_{fd}}^3} \cdot \frac{\pi}{3\sqrt{2}} \tag{11.2}$$

Here, R_u is the radius of the Universe, and the last term is the filling factor for closely packed identical spheres in a volume.

The number of free daons at the border of the Universe is:

$$N_{db} = \frac{4\pi R_u^2}{\pi r_{d_{fd}}^2} \cdot \frac{\pi}{2\sqrt{3}} \tag{11.3}$$

The last term is the filling factor for closely packed identical spheres on a plane surface.

The radial action of free daons at the border of the Universe results in an accelerated expansion of the Universe.

Combining equations (11.1)-(11.3), we obtain the acceleration to first order:

$$a_U \simeq \frac{N_{db} \cdot a_u}{N_{du}} \simeq 36 \frac{c^2}{R_u} \qquad (11.4)$$

Here, we neglect the delayed interaction, which causes variations in daon size relative to the radius of the Universe. **This is the accelerated expansion of the Universe, which accounts for the "dark energy" phenomenon**.

11.2 The Hubble Parameter

The Hubble parameter, in an isotropic universe, is defined as the velocity of expansion v of a sphere divided by its radius r. Although the Hubble parameter is not constant in time, it must be close to constant throughout the Universe (H_0), at this moment:

$$H_0 = \frac{v}{r} \qquad (11.5)$$

The velocity of expansion at the border of the Universe, relative to its center, can exceed the speed of light, since the limit c is a local limit, giving the maximum relative velocity between an object and its surrounding free daons.

Assuming that the number of daons within the Universe (N_{du}) is constant and applying this to the expansion of the Universe, we realize that the size of free daons is growing with time and must be directly proportional to the size of the Universe. We can then express the velocity of expansion for a free daon v_{fd_e} as:

$$v_{fd_e} = \frac{v}{r} r_{d_{fd}} = H r_{d_{fd}} \qquad (11.6)$$

11.2.1 Mass

The discussion above leads us to the following question: what is the correlation between a particle's mass and the size of free daons? This question was examined using the particle simulation programs EP and PART. First, we need to understand which mass we are considering. The mass of an electron is obtained as follows:

$$\begin{aligned} m &= m_d \sum_i \frac{4\pi r_i^2}{\pi r_{d_i}^2} \cdot \frac{\pi}{2\sqrt{3}} \cdot O^2 \cdot \frac{\Delta r}{\sqrt{\frac{8}{3}} r_{d_i}} \\ &= \frac{m_d}{1.144} \cdot \frac{\pi}{\sqrt{2}} \cdot \frac{r_{e\infty}^3}{r_{d_{fd}}^3} \end{aligned} \tag{11.7}$$

This is the sum of the number of daons in a shell, multiplied by the order O (the strength of interaction $< \cos\psi >$). This must be multiplied by the order again, which gives the sliding motion between shells of daons and the particle in motion. In this way, we obtain the part of the ordered daons that follow the particle, giving it its mass. $\sqrt{\frac{8}{3}} r_d$ is the distance between two neighboring shells.

The analysis gives the following law for the rest mass of any particle:

$$m = K_p r_{d_{fd}} \tag{11.8}$$

Here, K_p is the total effective action of contraction, a constant but different for each type of particle.

This means that the mass of all particles is directly proportional to the size of free daons (approximately to the size of the Universe):

$$M = M_0 \frac{r_{d_{fd}}}{r_{d_{fd0}}} \simeq M_0 \frac{R_U}{R_{U_0}} \tag{11.9}$$

Here, R_U is the radius of the Universe at any given moment, and the index 0 indicates the current value.

11.2.2 The Free Daon Flux

As indicated above, there is another mass around each particle since the ordered daons that are not following a particle also represent a mass, and a very large one. The total mass associated with an electron is:

$$\begin{aligned} m_{et} &= m_d \int_0^R 4\pi r^2 \frac{O}{\pi r_d^2} \cdot \frac{\pi}{2\sqrt{3}} \cdot \frac{dr}{\sqrt{\frac{8}{3}} r_d} \\ &= m_d \frac{\pi}{\sqrt{2}} \cdot \frac{r_{e\infty}^2}{r_{d_{fd}}^3} R \end{aligned} \tag{11.10}$$

We have neglected the small mass variation close to the center of the electron.

This means that every particle is associated with an almost infinite mass! It simply demonstrates that a radial equilibrium is maintained at any distance. The electric field is responsible for the equilibrium until an opposite charge reduces the field to zero. The electric field is then replaced by a corresponding deficit in daon size, maintaining the equilibrium around any particle.

This means that the expansion of the Universe creates a flux of free daons toward all masses. The increase in mass over time gives rise to a flux of free daons. We can express the number of free daons passing through a spherical shell with radius R around a mass M as:

$$N_{fd} = \frac{v_{fd} \cdot 4\pi R^2}{\frac{4\pi}{3} r_{d_{fd}}^3} \cdot \frac{\pi}{3\sqrt{2}} \tag{11.11}$$

We can also write, for any particle, that the number of daons needed for radial equilibrium, passing through radius R, is:

$$N_{fd} = \frac{M}{m_e} \frac{\delta}{\delta t} \frac{m_{et}}{m_d} \tag{11.12}$$

The ratio $\frac{M}{m_e}$ is constant, independent of the Universe's expansion. The daon flux must pass along the flux lines associated with the charge. Using equations (11.6)-(11.9), we obtain:

$$r_{e\infty} \simeq r_{e\infty 0} \left(\frac{r_{d_{fd}}}{r_{d_{fd0}}} \right)^{\frac{4}{3}} \tag{11.13}$$

This gives the variation of mass over time as:

$$\frac{\delta}{\delta t}\frac{m_{et}}{m_d} = \frac{\pi}{\sqrt{2}} \cdot \frac{r_{e\infty}^2}{r_{d_{fd}}^3} \cdot \frac{HR}{3} \tag{11.14}$$

We can now combine equations (11.10) and (11.14), giving the velocity of the free daon flux as:

$$v_{fd} \simeq \frac{M}{m_e} H \frac{r_{e\infty}^2}{3R} \tag{11.15}$$

Note the $\frac{1}{R}$ dependence, which means that such a daon flux is felt at large distances! At the surface of the Earth, the radial velocity of free daons is approximately 1.35 $\frac{m}{s}$.

11.3 Explanation of Newtonian Gravitation

A free daon flux around a particle results in an additional inclination of its ordered daons, perfectly matching the particle's rotation, velocity, and radial equilibrium, as if the particle obtained an added velocity. This situation was already examined when we studied magnetism, where we found that this situation does not produce any additional action (inertial system). So, where does the gravitational force come from?

If the gravitational action were due to the speed of free daons, this would mean an inversion of the effect if the velocity of a particle were higher than the velocity of the surrounding free daon flux. Calculating the velocity of the free daon flux shows that it is very low, meaning the velocity of the free daon flux itself gives no action. However, there is a secondary action due to the geometry of the source of the free daon flux.

Using a spherical mass M as the source, the concentric geometry gives a compression due to the radial velocity of free daons. This compression leads to a reduced size of the daons.

We start by calculating how much a daon is compressed outside a sphere of mass M. The azimuthal compression is:

$$\begin{aligned} r_{d_{az}} &= r_d \left(1 - \frac{v_{fd}}{c} \cdot \frac{1}{4\pi} \int_0^{\pi} \int_0^{2\pi} \sin^3\theta \; d\phi \; d\theta \right) \\ &= r_d \left(1 - \frac{2}{3}\frac{v_{fd}}{c}\right) \end{aligned} \tag{11.16}$$

The corresponding radial compression is:

$$\begin{aligned} r_{d_r} &= r_d \left(1 - \frac{v_{fd}}{c} \cdot \frac{1}{4\pi} \int_0^{\pi} \int_0^{2\pi} \cos^2\theta \sin\theta \; d\phi \; d\theta \right) \\ &= r_d \left(1 - \frac{1}{3}\frac{v_{fd}}{c}\right) \end{aligned} \tag{11.17}$$

The azimuthal compression is stronger than the radial one. The difference between these two actions therefore gives a radial expansion! The total compression is then, to first order, using equation (11.15):

$$\begin{aligned} r_{d_c} &= \sqrt{r_{d_{az}} r_{d_r}} = r_d \left(1 - \frac{1}{6}\frac{v_{fd}}{c}\right) \\ &= r_d \left(1 - \frac{H}{18c}\frac{M}{m_e}\frac{r_{e\infty}^2}{R}\right) \end{aligned} \tag{11.18}$$

We can now express the gravitational force as the sum of the action between daons within the mass m due to the variation of the daon flux and the radius of curvature created by the source mass M at distance R. We start by calculating the action on a shell of daons surrounding a mass m, using equation (11.15):

$$f_s \simeq m_d \frac{r_{e\infty}^2}{r_{d_{fd}}^3} \sqrt{2} \cdot 2\pi \; r \; O \frac{Hc}{9}\frac{M}{m_e}\frac{r_{e\infty}^2}{R^2} \tag{11.19}$$

Integrating this throughout the electron and using the electron mass in equation (11.7), we get:

$$F_G \simeq \frac{1.144}{18} r_{e\infty}^2 \frac{Hc}{m_e}\frac{Mm}{R^2} \tag{11.20}$$

Comparing this with Isaac Newton's classical formula:

$$F = G\frac{mM}{R^2}$$

We obtain:

$$G = \frac{1.144}{18}\ r_{e\infty}^2\ \frac{Hc}{m_e} = 6.67 \times 10^{-11}\ \frac{m^3}{s^2}kg \qquad (11.21)$$

Here, H is the Hubble parameter, c is the speed of light, $r_{e\infty}$ is the electron's reference radius, and m_e is the electron mass. The following value of the Hubble constant was used:

$$H = 2.37 \times 10^{-18}\ s^{-1} \qquad (72.2\ \frac{km}{sec\ Mpc})$$

This is the explanation of Newtonian gravitation.

We use the value of G to calculate the Hubble constant H_0, since Newton's constant G is better known than H_0. The Hubble "constant" is not actually constant as its value varies with the Universe's expansion. Thus, we obtain the "local Hubble constant" at this moment in time!

11.3.1 The Photon and the Neutrino

Photons and neutrinos have no mass accumulation and thus no associated free daon flux, meaning that they are not sources of gravitation. However, since they have a radial equilibrium, they do experience gravitational attraction. The specific characteristics of these two objects mean that they have no centrifugal force as they simply follow the free daon flux. When deviated by a gravitational field, they have no inherent force perpendicular to the velocity vector resisting the deviation, resulting in twice the deviation of a "normal" particle.

Note that the force of gravitation is different on a neutrino due to its specific geometry (a dedicated computer code can provide a precise value).

11.4 Black Hole

We can now examine what happens when the mass of a star becomes larger and larger. First, note that the size of free daons (equation 11.18) is limited by the azimuthal velocity of compression, which cannot exceed the maximum speed c. Thus, the minim size of a compressed daon is:

$$r_{d_{fd}} = r_{d_{fd0}} \left(1 - \frac{1}{6}\frac{v_{fd}}{c}\right) = \frac{5}{6} r_{d_{fd0}} \tag{11.22}$$

$r_{d_{fd0}}$ is the radius of a free daon "far away" from the source.

When the gravitational and kinetic energy of an atom exceeds the binding energy of its electrons, atoms break down into a compressed plasma-like state (neutron stars). The density can vary depending on the gravitational force but cannot exceed $10^{18}\ \frac{kg}{m^3}$ (the density of a proton). This density limit keeps the enclosed matter at a constant density value, attracted particles accumulate outside this limit, causing this central dens sphere to grow.

Let's examine equation (11.15) more closely, where we set the velocity of the free daon flux to c i.e., this means a Black Hole since nothing can move radially outwards.

$$c = \frac{M}{m_e} H \frac{r_{e\infty}^2}{3R} \left(\frac{r_{d_{fd}}}{r_{d_{fd0}}}\right)^{\frac{8}{3}} \Rightarrow \frac{M}{R} = \frac{3m_e c}{H r_{e\infty}^2} \left(\frac{6}{5}\right)^{\frac{5}{3}} \tag{11.23}$$

$r_{d_{fd}}$ is here the compressed size of the free daons, at the surface of the BH.

Thus, the mass M of a black hole is directly proportional to its radius R. Examining the gravitational force at the surface of a black hole using equations (11.21) and (11.23), we find

$$F_G = G\frac{Mm}{R^2} = 3.6 \times 10^{26} G \frac{m}{R} \tag{11.24}$$

i.e., a Black Hole's gravitation becomes weaker with the inverse of its radius!

We can now calculate the minimum radius and mass necessary for the creation of a black hole using equation (11.15). We assume that the radial velocity of free daons equals the signal velocity c at the surface of a black hole. From equation (11.23), the density inside a black hole is:

$$\frac{M}{R} = \frac{4\pi}{3} R^2 D \simeq 3.6 \times 10^{26} \Rightarrow D \simeq \frac{0.9 \times 10^{26}}{R^2} \frac{kg}{m^3} \quad (11.25)$$

A small black hole must be very similar to a large neutron star. Scaling down the densities using equation (11.25) shows that a large black hole has a much lower density than a smaller one.

Using the proton density as a limit, we obtain:

$$R \simeq 10\ km$$

This gives the upper limit for the mass of a neutron star and the lower limit for a black hole to

$$M \simeq 4 \times 10^{30}\ kg \simeq 2 \text{ solar masses}$$

11.4.1 Radial Frame Dragging

The radial free daon flux means that the local frame of reference (free daons) is absorbed by the source, resulting in radial frame dragging.

11.4.2 Azimuthal Frame Dragging

If a neutron star or black hole's accretion disk is rotating, then the speed of an individual particle can reach the speed of light. This pushes the surrounding free daons, causing them to follow the rotation of the disk. The local frame of reference thus follows the rotation of the accretion disk around its host.

11.4.3 Black Hole Jets

When a black hole absorbs too much mass in a short period, it's unable to reorder its internal equilibrium quickly enough.

The absorbed mass therefore moves along the surface of the star from the accretion disk (at the equator) toward the poles. When the mass from all directions meets at the poles, it creates a radial push, leading to jets of matter directed radially outward from the poles. Each particle in these jets is reduced in mass and energy by a factor of $\frac{5}{6}$ compared to normal matter, giving the impression of being far away, due to the corresponding added redshift.

11.5 Dark Matter

The phenomenon of dark matter arises from measurements of the rotational velocity of disk galaxies, showing that their velocity is constant even at great distances. Classical gravity does not explain this phenomenon.

Let's examine a disk galaxy with a radius of approximately 40,000 light-years. At the edge of the disk, the rotational velocity is around 250 km/s, but this is the same velocity observed at a radius of 100,000 light-years. Using classical gravity, the mass of the galaxy at its border should be around 4×10^{40} kg. However, applying the same equation at a radius of 100,000 light-years yields 10^{41} kg. Thus, "dark matter" may exist around the galaxy to explain this discrepancy.

We examine the free daons surrounding a mass M. The electromagnetic force is zero outside such a mass, so we focus on the size of the free daons, which are squeezed together. The fact that free daons have different size depending on their distance to the source mass must lead to a force attracting free daons toward the mass M. These free daons follow the mass in its movement with a speed proportional to the attraction due to the difference in size (Order) of the daons surrounding the mass. The attraction of a free daon is directly proportional to the relative radial velocity $\frac{v_{fd}}{c}$. We can express this force as:

$$
\begin{aligned}
f_M &= m_d \frac{4\pi r_s^2}{\pi r_{d_r}^2} \cdot \frac{\pi}{2\sqrt{3}} O_s \frac{v_{fd}^2}{c^2} \cdot 3\sqrt{\frac{2}{3}} \cdot \frac{3}{2} \frac{c^2}{r_{d_r}} \\
&= \frac{m_d}{r_{d_r}^3} \cdot 3\sqrt{2} \cdot \pi r_s^2 O_s v_{fd}^2 \qquad (11.26)
\end{aligned}
$$

m_d is the mass of a daon multiplied by the number of daons within a shell, at the level of the surface (r_s), surrounding the mass M. r_{d_r} is the reduced size of the free daon due to compression. $\frac{v_{fd}}{c}$ is the relative velocity replacing the order O in the equation for electrostatic force, as explained in the context of magnetism. The following term is the force applied by a single daon. The term $O_s = \frac{r_{e\infty}^2}{r_D^2}$, represents the order around an electron near the surface of the source where the free daon flux reaches its maximum value, and r_D corresponds to the Debye length.

The total force between different shells surrounding the mass M must be identical to maintain the radial equilibrium. Thus, we use the characteristics of the surface of the source to calculate the radial force equilibrium, which gives the mass corresponding to the potential energy around the source M. We obtain:

$$
\begin{aligned}
M_D &= \int_{r_s}^{R} \frac{f_M}{c^2} dr \\
&= \frac{m_d}{r_{d_r}^3} \cdot 3\sqrt{2} \cdot \pi r_s^2 O_s \frac{v_{fd}^2}{c^2} (R - r_s) \qquad (11.27)
\end{aligned}
$$

Note that this added mass is proportional to the radius around the source. We can now calculate the dark matter (M_D,) surrounding each mass, by inserting numerical values into equation (11.27). The value of O_s is quite uncertain as surface conditions for most star types are not well known. We have:

$$\frac{m_d}{r_{d_r}^3} \simeq 10^{14}$$

Source	r_s (m)	$\frac{v_{fd}}{c}$	O_s	R (m)	M_D (kg)
Sun	7×10^8	4×10^{-5}	10^{-12}	10^{16}	10^{26}
W D	5×10^6	0.01	10^{-10}	10^{16}	10^{29}
B N S	10^4	1	10^{-6}	10^{16}	10^{32}
S BH	10^4	1	10^{-6}	10^{16}	10^{32}
MW BH	5×10^{10}	1	10^{-17}	10^{22}	10^{40}
B BH	10^{14}	1	10^{-23}	10^{22}	10^{41}

Table 11.1: Values for the Sun, With Dwarf, Big Neutron Star, Small BH, the Milky Way BH and a big Central BH.

The radius R indicates the surface where other masses become dominant, meaning free daons start to follow other masses and do not contribute to the mass of the examined source. Thus, R indicates a "density limit" for masses, similar to the Debye length (charge limit) for individual charges.

From this analysis, we conclude that the added mass from normal stars can be neglected, while very dense stars (white dwarfs, neutron stars, and black holes) contribute significantly to the "dark mass." To determine the total mass of a galaxy, it is necessary to sum the contributions from all these different sources.

The complete force, felt by any mass, surrounding a mass M becomes:

$$F \simeq G\frac{(M + M_D)}{r^2}$$

We conclude that the number and size of high-density stars within a galaxy give rise to the "dark matter" phenomenon. In particular, the size of the central black hole of a galaxy is crucial since it can contribute more mass than the total apparent mass of the galaxy. We also observe that at some distance from a galaxy, the force depends only on the "dark matter" phenomenon as the force becomes proportional to $\frac{1}{r}$ instead of $\frac{1}{r^2}$.

Chapter 12

The Characteristics of Our Universe

The Universe is a dynamic and evolving entity, characterized by a complex interplay of fundamental constants, physical laws, and cosmic phenomena. In this chapter, we delve into the variation of some of these basic constants relative to the Universe's size and its velocity of expansion. We distinguish between *real physical constants*—those that remain invariant—and *parameters* that evolve with the Universe's expansion. This exploration will shed light on the nature of time, the behavior of gravitational forces, the phenomenon of redshift, and the intriguing possibility of twin universes.

12.1 Real Physical Constants

At the heart of our theoretical framework are the *real physical constants*, which remain unchanged regardless of the Universe's expansion. These constants form the bedrock upon which the dynamics of the Universe are built.

- **The daon mass** (m_d): Defining the mass of a daon is inherently challenging due to its unique interaction properties. Unlike conventional particles, daons interact without undergoing acceleration. The "normal" mass that we observe in particles is a result of the collective interaction between daons within those particles.

- **The charge**: Charge is a fundamental property that arises from the radial equilibrium of daons. In an electron, the daons' axes are directed radially outward, while in a positron, the charge is identical but the rotational axis of the daons is inverted. The net charge of a particle is essentially the sum of its negative and positive charges, reflecting the radial equilibrium state.

- **The number of daons within the Universe**: This is a fixed quantity, representing the total number of daons that exist across the cosmos.

- **The fine structure constant (α)**:

$$\alpha = \left(\frac{v_\perp}{v_\parallel}\right)^2$$

  The fine structure constant is defined as the square of the ratio of the transverse velocity ($v_\perp$) to the longitudinal velocity ($v_\parallel$) of an electron moving at a constant velocity. This constant plays a pivotal role in describing the electromagnetic interactions within the Universe.

- **The speed of light (c)**: The speed of light is the maximum radial velocity at which a daon can contract or expand, as well as its maximum rotational velocity. It serves as a universal speed limit for all physical processes.

- **The velocity in general**: Velocity is always defined within a local reference frame, providing a context for the motion of objects within the Universe.

- **The internal action of any stable particle (K_i)**:

$$K_i = \frac{m_i}{r_{d_{fd}}}$$

The internal action, denoted by K_i, is a constant that varies for each type of particle. It is defined as the ratio of the particle's mass (m_i) to the radius of a free daon ($r_{d_{fd}}$).

12.2 Constants Which Are Parameters

In contrast to the real physical constants, there exist *parameters* that vary with the expansion of the Universe. These parameters are not fixed but evolve in response to the changing size and dynamics of the cosmos. We introduce a parameter P, which quantifies the expansion of local free daons relative to the Universe's expansion:

$$P = \frac{r_{d_{fd}}}{r_{d_{fd_0}}} \approx \frac{R_U}{R_{U_0}}$$

Here, the subscript 0 denotes the current values of these parameters, while R_U represents the radius of the Universe at any given moment. It is important to note that the ratio of the Universe's radii is not exactly equal to the free daons size ratio. This is due to the absorption of mass during the Universe's expansion and the wave-like radial variations in the size of daons, which arise from the delay between the forces of expansion and contraction.

The following "constants" are observed to vary with the size of the Universe (R_U):

- **The mass of particles (m):**

  $$m = m_0 P$$

  The mass of particles increases proportionally with the parameter P, reflecting the expansion of the Universe.

- **The radius of a free daon ($r_{d_{fd}}$):**

  $$r_{d_{fd}} \approx r_{d_{fd_0}} P$$

The radius of a free daon also scales with the parameter P, indicating that daons themselves expand as the Universe grows.

- **The electron's reference radius** (r_{e_∞}): Using the electron's mass and the equations for particle mass and daon radius, we derive:

$$m_e \approx m_d \frac{\pi}{1.144\sqrt{2}} \frac{r_{e_\infty}^3}{r_{d_{fd}}^3} \Rightarrow r_{e_\infty} = r_{e_{\infty_0}} P^{4/3}$$

  This equation shows that the electron's reference radius increases with the Universe's expansion, following a $P^{4/3}$ relationship.

- **The Coulomb constant** (C): Combining the equations for particle mass and the electron's reference radius, we find:

$$C = \frac{1}{4\pi\epsilon_0} = \sqrt{2}\frac{m_d}{e^2}\pi\frac{r_{e_\infty}^4}{r_{d_{fd}}^3}c^2 = C_0 P^{7/3}$$

  The Coulomb constant, which governs the strength of electrostatic interactions, varies with the Universe's expansion according to $P^{7/3}$.

- **The Planck constant** (h): Using the expression for the Coulomb constant, we derive the Planck constant as:

$$h = \frac{e^2}{4\pi\epsilon_0 v_0} = h_0 P^{7/3}$$

  The Planck constant, fundamental to quantum mechanics, also scales with $P^{7/3}$.

- **The wavelength of the associated wave** (λ): The wavelength of a particle's associated wave is given by:

$$\lambda = \frac{h}{mv} = \lambda_0 P^{4/3}$$

  This relationship indicates that the wavelength of particles increases with the Universe's expansion.

- **The size of atoms, molecules, and all matter (s)**: The size of all matter, from atoms to molecules, follows the same scaling law:

  $$s = s_0 P^{4/3}$$

  This implies that the size of all matter is increasing faster than the Universe itself!

- **The Hubble parameter (H)**: The Hubble parameter, which describes the rate of the Universe's expansion, is given by:

  $$H = H_0 \frac{V_U}{V_{U_0} P}$$

  This parameter is crucial for understanding the dynamics of the Universe's expansion.

- **The gravitational constant (G)**: Using the equations for particle mass, the electron's reference radius, and the Hubble parameter, we derive the gravitational constant as:

  $$G \approx 1.144 \frac{Hc}{18 m_e} r_{e\infty}^2 = G_0 \frac{V_U}{V_{U_0}} P^{2/3}$$

  The gravitational constant, which governs the strength of gravitational interactions, varies with the Universe's expansion according to $P^{2/3}$.

12.3 What Is Time?

Time is a fundamental yet elusive concept. We propose that time is intrinsically linked to biological processes and the perception of the human brain. Specifically, time can be defined as the duration of an electron's complete oscillation of its associated wave. Using the equation for the wavelength of the associated wave, we find:

$$t = \frac{\lambda}{v} \sim t_0 P^{4/3} \tag{12.1}$$

t_0 represents our current perception of time. *This relationship suggests that time is slowing down as the Universe expands.*

An intriguing consequence of this theory is that, as all matter—atoms, molecules, and larger structures—grows with the Universe, velocities remain independent of the Universe's expansion. This means that, despite the Universe's growth, the relative speeds of objects within it are not directly affected by this expansion.

12.4 The Variation of the Force of Gravity

Gravity is the dominant force in the Universe, shaping its structure and dynamics. To understand how the gravitational force is modified by the Universe's expansion, we consider the equilibrium of the gravitational force between two stars of masses m and M, separated by a distance r. Using the equations for particle mass and the Hubble parameter, we derive:

$$
\begin{aligned}
F_g &= G_0 P^{2/3} \frac{V}{V_U} \frac{mMP^2}{r^2} = \frac{mPv^2}{r} \\
&\Rightarrow r = r_0 P^{5/3} \frac{V_U}{V} \qquad (12.2)
\end{aligned}
$$

r_0 is the initial distance between the two masses. *This result indicates that the distance between stars—and by extension, the size of galaxies and solar systems—grows faster than the Universe itself!*

This growth is not limited to the distances between stars but also affects the size of individual stars and other forms of matter. When we consider the influence of dark matter, the scenario becomes even more complex. The action between galaxies increases, leading to stronger accelerations and higher velocities. This suggests that the growth of cosmic structures is a dynamic and ongoing process, driven by the interplay of gravity and dark energy.

But, this means that the relative size of the Universe is minimal when its absolute size is maximal, and vice versa. Therefore, it is more accurate to consider the size and time of our Universe relative to our own scale and perception of time. From this perspective, the Universe appears to be getting smaller with time, as we—and all matter within the Universe—are expanding faster than the Universe itself. Our perception of time is also slowing down as the Universe expands.

12.5 Redshift

Redshift is a phenomenon characterized by the reduced energy of photons originating from distant cosmic sources. Despite the vast distances these photons travel, we can observe sharp line spectra from extremely distant galaxies, indicating that the photons have not undergone diffusion or interaction during their journey. However, their wavelengths are shifted toward the red end of the spectrum.

The conventional explanation for redshift is that the expansion of the Universe increases the wavelength of photons' associated waves. However, the daon theory cannot accept this explanation, as it only applies to electromagnetic waves, which are distinct from photons. Moreover, photons are stable energy packets, and their energy should not change due to variations in the surrounding free daons.

According to our theory, the mass of all particles (except photons and neutrinos) increases with the Universe's expansion. Using the equations for particle mass, the Planck constant, and the wavelength of the associated wave, we find that the energy of a photon emitted by an atom during a transition between energy levels is:

$$\Delta E = h\nu = \Delta E_0 P \tag{12.3}$$

This means that the energy of a photon emitted by an atom is directly proportional to the mass of the electron (and the atom), which increases with the Universe's expansion.

Consider a photon emitted by an atom in a distant galaxy. The energy of this photon can be expressed as:

$$\Delta E = h\nu = h\frac{c}{\lambda} \tag{12.4}$$

Since the photon's energy must remain constant, we have:

$$E = h_0 P^{7/3} \frac{c}{\lambda_0 P^{4/3}} = h_0 P \frac{v}{\lambda_0} = Const. \tag{12.5}$$

The resulting wavelength of the photon is:

$$P = \frac{\lambda}{\lambda_0} \Rightarrow P = 1 + z \tag{12.6}$$

This relationship allows us to use redshift as a direct indicator of distance, or more precisely, the size of the emitter's surrounding free daons.

12.6 The Cosmic Microwave Background Radiation

The Cosmic Microwave Background (CMB) radiation provides a snapshot of the early Universe. This energy corresponds to a temperature of about 2.5 Kelvin (K).

During the initial phases of the Universe's expansion, the atoms mass was much smaller, which means that the energy of the electrons within these atoms were very low. The emission of low-energy photons was abundant during this period, as ionization was extremely easy. This process occurred at the very beginning of the Universe's expansion.

12.7 The Radial Oscillation of the Universe

As we look further into the cosmos, we are effectively looking back in time. During these earlier epochs, galaxies were smaller, with relatively more space between them. The activity within these galaxies was more intense, as time ran faster in the past. Conversely, in the distant future, an intelligent observer might perceive the Universe as smaller than it is today.

The Universe underwent a rapid expansion shortly after reaching its minimum size since, then the "dark energy" had its strongest action and the gravitation its weakest. Looking forward, the increasing gravitational force and the diminishing influence of the dark energy will lead to a deceleration of the Universe's expansion, eventually bringing it to a halt. The vast distances between cosmic structures will amplify the delayed effects of gravitational interactions from distant regions. As a result, the increase in gravitational forces will persist long after the Universe's expansion has ceased.

When the Universe close in on its maximal size, the "local" gravitational force starts to weaken, causing stars to expand. When the Universe stops its expansion, the *local* gravitation becomes zero, the stars radial equilibrium becomes impossible all stars will lose all their mass, producing spherical expanding spheres of plasma.

During the contraction of the universe there is no life possible, everything will become plasma!

A simple one-dimensional program, named COSMOS, was developed to simulate the characteristics of a "free daon Universe" over time. We examined the period from minimum to the actual size (the maximum extension would be interesting but then it will be necessary to include the delayed actions which becomes dominating at those enormous distances).

We have some precise limits and a parameter to take into account:

- The Hubble parameter must be used as starting point.

- The minimum size of the Universe must be smaller or equal to the limit where Cosmic Microwave Background Radiation will appear.

- The minimum size of the Universe must be bigger than the limit where the electron's mass becomes smaller than about 30 daons, where the electron will disappear.

These limits are stringent i.e. we can be reasonably sure that the results are close to correct.

If we start from the minimum size of the Universe, we find a radius of 180 million lightyears (180 My) and the acceleration (from essentially the "dark energy") around 2.5 $10^{-6}\frac{m}{s}$. During the phase of contraction the force of gravitation is inverted so that the interaction between neutral masses is repulsive. The gravitation is inverted at the minimum size i.e. its very small compared to the "dark energy" force of expansion. These characteristic give a strong acceleration, so that the velocity, at the border of the Universe quickly reach 20c!

After around 12.3 Billion years, the acceleration becomes negative, so that the velocity of expansion starts to slow down! This is due to the increase of the force of gravitation as well as the reduced force of the "dark energy". We reach or actual time after 14.0 billion years where the radius of the Universe border is 400 billion lightyears (Gy) whereas the velocity of expansion (at the Unverse border relative to its center) is around 22.4c! Notice that we are already in a phase of deceleration i.e. the velocity of expansion is slowing down.

While we can make reasonable calculations during periods of nearly constant expansion velocity and at smaller distances, the dynamics become significantly more complex at the maximum size of the Universe. This complexity arises from the strong variations in acceleration and the delayed interactions across vast cosmic distances. To fully understand the radial oscillations of the Universe, a more sophisticated computational model is needed—one that accounts for the strongly delayed signals due to the enormous distances involved.

This radial oscillation must lead to waves of variations in the free daon size i.e., it might be possible to detect such variations and calculate our radial position within our Universe!

It appears that we are currently within one of an infinite number of oscillations of the Universe. If we attempt to estimate the duration of a complete oscillation, we arrive at a timescale of approximately 50 billion years (Gy).

An intriguing aspect of the Universe's boundary is its behavior as a perfect mirror. Daons expand at the speed of light (c), so if an object attempts to cross the Universe's boundary, the daons will follow it, creating an extrusion with a larger surface area facing the surrounding void. This extrusion causes the daons to expand further, weakening their mutual interactions. As a result, the daons within the extrusion become larger and weaker, leading to a deceleration to zero followed by an acceleration back toward the Universe's boundary. *This implies that nothing—not even a photon or a neutrino—can escape from the Universe.*

12.8 Supervoids

During the Universe's expansion phase, black holes continue to grow, becoming colossal predators that consume surrounding mass, including stars, planets, and gas. When the expansion eventually halts, the Hubble constant becomes negative. This reversal transforms then the enormous Black Holes into "White Holes," which expel the mass they had previously consumed.

The ejected mass forms expanding spheres around each white hole. These spheres do not cease their expansion even after the white holes disappear but continue until they encounter other expanding spheres. The result is a cosmic landscape dominated by enormous voids, interspersed with intricate geometric patterns of mass.

12.9 The Perceived Size of a Distant Galaxy

To understand the perceived size of a distant galaxy, we consider the Universe's expansion velocity at the galaxy's location. Using the photons emitted by the galaxy, we can calculate its velocity relative to us due to the Universe's expansion:

$$\frac{(c-v)t}{ct} = \frac{\lambda_0}{\lambda} = \frac{1}{1+z} \Rightarrow v = c\frac{z}{1+z} \tag{12.7}$$

The size of the galaxy, at the moment of emission, is smaller by a factor of $P^{5/3}$. However, during the time between the emission and detection of the photons, the Universe's expansion increases the distance between the photons, causing the galaxy's image to appear larger by a factor of P. Therefore, the galaxy's actual size was:

$$s = s_p P^{2/3}$$

where s_p is the perceived size of the galaxy's image as observed through a telescope.

The time in the distant galaxy was running faster by a factor of:

$$t = t_0 P^{4/3}$$

12.10 The Local Reference Frame

All movements within the Universe require a local reference frame to define velocity and acceleration. The local reference frame is the surrounding free daons. We can calculate the velocity of the free daon flux around all masses by generalizing equation (11.15), we obtain:

$$v_{fd} = \sum_i \vec{v}_{fd_i} = H\frac{r_{e\infty}^2}{3m_e}\sum_i m_i \frac{\vec{r}_i}{r_i^2} \tag{12.8}$$

The local reference frame is thus defined by the surrounding free daons, including their size and velocity. This frame provides the context for understanding the motion and interactions of all objects within the Universe.

12.11 Stellar Aberration

Stellar aberration is the apparent shift in the position of a star due to the Earth's orbital motion. When observed through a telescope, a star's position swings by about 20.5 arc seconds every six months—an amount that corresponds to the Earth's orbital velocity. This phenomenon confirms that light from stars travels in straight lines.

The angle of stellar aberration, α, is given by:

$$\tan \alpha = \frac{v}{c}$$

where v is the Earth's orbital velocity (approximately 30 km/s), and c is the speed of light. This yields an aberration angle of 20.5 arc seconds, which matches observational data.

The concept of a local reference frame around each mass implies that the Earth exists within a "bubble" that is nested inside the Sun's "bubble," which in turn is part of the galaxy's "bubble," and so on. However, a challenge arises when a photon transitions from one "bubble" to another. At the interface between these bubbles, the photon's velocity would theoretically exceed the speed limit c, as it would include both the speed of light and the relative velocity between the bubbles. To resolve this, the photon must adapt to maintain a constant local velocity of c. This adaptation is achieved through an acceleration directed opposite to the photon's velocity relative to the surrounding free daons, ensuring that its trajectory remains straight and its speed constant.

From the Earth's reference frame, the photon appears to arrive at an angle corresponding to the stellar aberration. However, from the perspective of the galaxy's "bubble," the photon continues on a straight path, unaffected by the local reference frames it traverses.

12.12 The Pound-Rebka Experiment

The Pound-Rebka experiment aimed to demonstrate that photons gain energy as they descend a gravitational potential and lose energy as they ascend. The experiment was conducted in a tower with a height difference of 22.5 meters between the photon source and the receiver. The source emitted a photon from a specific atomic decay, while the receiver used the same atomic level but with an added velocity parallel to the photon's velocity, corresponding to the difference in photon energy.

The source was placed on an oscillating device, providing a variable velocity that introduced a frequency shift:

$$f_r = \sqrt{\frac{1 - \frac{v}{c}}{1 + \frac{v}{c}}} f_e$$

According to the General Theory of Relativity, the gravitational effect on the photon's frequency is given by:

$$f_r = \sqrt{\frac{1 - \frac{2GM}{(R+h)c^2}}{1 - \frac{2GM}{Rc^2}}} f_e$$

The oscillation of the emitter was adjusted until the two effects—Doppler shift and gravitational redshift—perfectly compensated each other. The experiment yielded a frequency difference of:

$$\frac{\Delta f}{f_e} = (2.56 \pm 0.25) \times 10^{-15}$$

In the context of the daon theory, a photon's energy or frequency cannot change once it is created. Consider a photon emitted from an atom on the Earth's surface with frequency f_e. When this photon reaches a receiver located 22.5 meters above the ground, its energy appears too low. This discrepancy arises because the gravitational field produce a difference in size of the daons, proportional to the radius of the Earth. The daons surrounding the receiver is therefore slightly larger than those around the emitter. Using equation (11.18) for the size of the compressed daons, we find:

$$r_d = r_{d_0}\left(1 - \frac{G}{c^2}\frac{M}{R}\right)$$

The ratio between the frequencies becomes:

$$\frac{r_d}{r_{d_0}} = \frac{f_r}{f_e} = 1 + \frac{G}{c^2}\frac{M}{R}\frac{22.5}{R} \Rightarrow \frac{\Delta f}{f} = 2.45 \times 10^{-15}$$

Which is in excellent agreement with the experimental findings.

12.12.1 Time in GPS Satellites

The Global Positioning System (GPS) relies on atomic clocks orbiting the Earth, each continuously transmitting time and position data. A GPS receiver uses trilateration to determine its location on the Earth's surface. The atomic clocks on the satellites experience time dilation due to their high orbital velocity of 3.9 km/s, resulting in a time dilation of 7 microseconds per day. Additionally, according to General Relativity, the clocks run faster due to the weaker gravitational field at their orbital altitude, adding an extra 45.8 microseconds per day relative to an atomic clock on Earth.

Our theory suggests that time dilation is a consequence of mass increase, which aligns with the Special Theory of Relativity when the local reference frame coincides with Einstein's inertial reference frame. Here, we focus on the *frequency* difference between the satellite clock and the Earth's reference time. Using the equations for the Planck constant and the daon radius, we derive a frequency difference of:

$$\frac{\Delta f}{f} = \left(\frac{\lambda_r}{\lambda_s}\right) - 1 = -\frac{H}{18c}\frac{M}{m_e}r_{e\infty}^2\left(\frac{1}{R} - \frac{1}{4.12R}\right)\frac{3}{8} = 5 \times 10^{-10}$$

This corresponds to a time difference of 45.8 microseconds per day, in perfect agreement with observational data.

12.13 SI Units

The variation of the values of the "constants," as described above, leads to corresponding variations in the SI units. However, these units are measured using instruments and parameters that also change over time. Despite this, high-precision measurements could potentially reveal the proposed variations in the tenth decimal place from year to year.

12.14 Different types of energy

We'll here define three types of energy:

- Energy associated with mass; can be understood as the number of "effective" daons, multiplied by c^2, associated with an object or exchanged in an interaction.
- Energy of movement; number of effective daons rotating, vibrating or being displaced.
- Energy from a gravitational potential; this is proportional to the variation of the free daon size, surrounding a mass.

12.15 Twin Universes?

The number of protons in the Universe must remain constant throughout its oscillation period. Otherwise, the total mass of the Universe would diminish with each oscillation. This implies that black holes cannot destroy protons. Additionally, there is no known process for proton production without its antiparticle. From this, we can conclude that the matter-antimatter asymmetry is a permanent feature of the Universe.

Given nature's propensity for symmetry, we propose the existence of an antimatter Universe with identical physical laws to our own, except for an inversion of charges. These two universes should move away from each other, maintaining a cosmic balance between matter and antimatter.

While this framework resolves many of the Universe's mysteries, profound questions about the nature of infinity in space and time remain unanswered. Similarly, metaphysical questions—such as "How?" and "Why?"—continue to elude our understanding, inviting further exploration and contemplation.

Acknowledgments

Special thanks to my family for their patience and support.

Bibliography

[1] Gustafsson J.E.S., "Evidence that a Reference System is Surrounding the Earth as Well as any Other Mass", International Journal of Science and Research (IJSR), Volume 9 Issue 10, October 2020, 1629 - 1630

[2] A. Einstein "On the Electrodynamics of Moving Bodies". Translation by George Barker Jeffery and Wilfrid Perrett in The Principle of Relativity, London: Methuen and Company, Ltd.

[3] W. H. Bragg; W. L. Bragg (1913). The Reflexion of X-rays by Crystals. Proc. R. Soc. Lond. A. 88 (605): 428–38. Bibcode:1913RSPSA..88..428B. doi:10.1098/rspa.1913.0040.

[4] M.A. Van Hove, W.H. Weinberg, C. M. Chan, Low-Energy Electron Diffraction, Springer-Verlag, Berlin Heidelberg New York, 1986, 1–27, 46–89, 92–124, 145–172

[5] W. E. Lamb; R. C. Retherford (1948). "Fine Structure of the Hydrogen Atom by a Microwave Method". Physical Review. 82 (3): 241–243. Bibcode:1948PhRv...82..241L. doi:10.1103/PhysRev.82.241.

[6] Pound, R. V.; Rebka Jr. G. A. (November 1, 1959). "Gravitational Red-Shift in Nuclear Resonance". Physical Review Letters. 3 (9): 439–441. Bibcode:1959PhRvL...3..439P. doi:10.1103/PhysRevLett.3.439.

[7] P. Debye Zur Theorie der spezifischen Waerm, Annalen der Physik (Leipzig) 39 (4)