Emission and Regeneration Unified Field Theory (“E & R” UFT). “Focal Point” representation of Subatomic Particles.

Osvaldo Domann

odomann@yahoo.com

Abstract – Our standard model is based on the representation of a particle as an isolated differential volume in space, where the whole rest energy of the particle is concentrated. This representation requires the introduction of exchange particles (carriers) to explain interactions between the isolated volumes. The result is the definition of independent carriers for each of the four types of forces (interaction), namely, the photon for the electromagnetic interaction, the gluon for the strong interaction, the W and Z bosons for the weak interaction and the graviton for the gravitation. The representation of particles as isolated entities in space is common to all theories, namely the ether, the string and the standard models. The present work is based on findings of a model where subatomic particles are represented as focal points of rays of Fundamental Particles (FPs) that move from infinite to infinite. FPs are emitted by the focal point and at the same time regenerate it. Each subatomic particle extends over the whole space and interactions between subatomic particles are the product of the interactions of the angular momenta of their FPs. No carriers are required.

Motivation and Methodology . – As a logical theory, physics should have a pyramidal shape, where few postulates at the top allow the deduction of all known laws from top to bottom. Each law in the theoretical building, expressed as an equation, is deduced from equations that are placed at a higher level.

Figure 1 shows a schematic comparison between the methodology used in mainstream physics (Standard Model) and the proposed approach. The standard theory starts formulating mathematically the basic laws for individual particles, namely, Coulomb, Ampere, Lorentz, Maxwell, Gravitation, etc., by matching experimentally obtained curves with mathematical equations. At a second level thermodynamic laws are introduced to describe assemblies of particles with state variables. Then the particle's wave is postulated (de Broglie) to explain the analogy between diffraction patterns obtained with electromagnetic rays and rays of particles. The particle's wave allows the definition of differential equations of the wave function to describe mathematically the quantized behaviour of particles in nature (Schroedinger). Up to this point of the theory, no explanation is given about the origin of the forces and momenta obtained by measurements between particles. Efforts made to find explanations are:

- of experimental nature, scattering particles in particle accelerators and
- of theoretical nature, trying to infer interactions between fundamental particles postulating the invariance of wave equations under gauge transformations.

The proposed approach intends to explain what happens in the space between two charged particles or two masses, that generates the forces we measure at the particles. The methodology followed starts postulating fundamental particles (FPs) based on the idea, that the energy of a subatomic particle, like the electron, is not concentrated at a point but distributed in space and, that the energy is stored in FPs that are emitted continuously from a focal point in space and to which regenerating FPs continuously return. FPs store the energy as rotations which are independent of coordinate systems and which define longitudinal and transversal angular momenta (field). In a second step the interactions between FPs are postulated as interactions between their angular momenta, which mathematically is expressed as scalar and vector products. Finally, the interaction laws between FPs are determined in a recursive process so that the fundamental laws of physics, namely, Coulomb, Ampere, Lorentz, Maxwell, Gravitation, etc. can be derived. The methodology makes sure, that the approach is in accordance with experimental data.

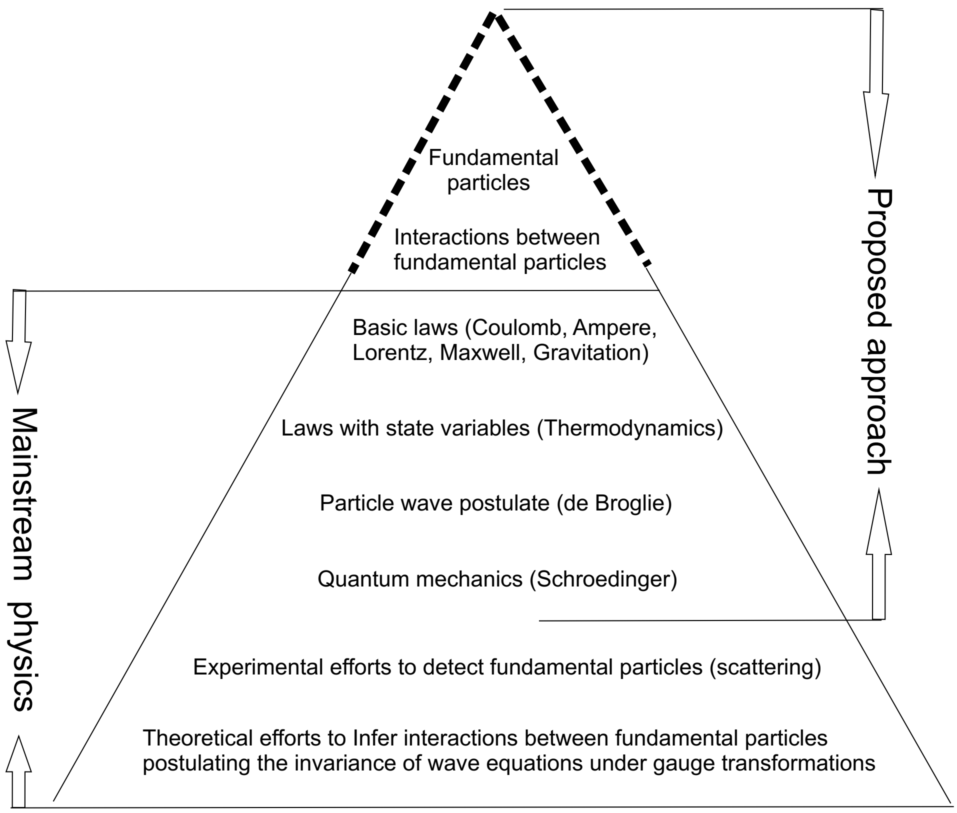

Fig. 1: Methodology followed by the proposed approach

Introduction . – Subatomic particles (SPs) are represented as focal points of rays of Fundamental Particles (FPs). FPs are emitted by the focal point and at the same time regenerate it and are defined as follows.

The total energy of a SP with constant $v \neq c$ is

$$E = \sqrt{E_o^2 + E_p^2} \qquad E_o = m\,c^2 \qquad E_p = p\,c \tag{1}$$

$$with \qquad p = \frac{m\,v}{\sqrt{1-\frac{v^2}{c^2}}}$$

The total energy $E = E_e$ is split in

$$E_e = E_s + E_n \tag{2}$$

$$with \quad E_s = \frac{E_o^2}{\sqrt{E_o^2 + E_p^2}} \quad and \quad E_n = \frac{E_p^2}{\sqrt{E_o^2 + E_p^2}}$$

With the help of a distribution equation

$$d\kappa = \frac{1}{2}\,\frac{r_o}{r^2}\,dr\,\sin\varphi\,d\varphi\,\frac{d\gamma}{2\pi} \tag{3}$$

differential emitted dE_e, regenerating dE_s and dE_n energies are defined

$$dE_e = E_e\,d\kappa = \nu\,J_e \qquad dE_s = E_s\,d\kappa = \nu\,J_s \tag{4}$$

$$and \qquad dE_n = E_n\,d\kappa = \nu\,J_n$$

The distribution equation $d\kappa$ gives the part of the total energy of a SP moving with $v \neq c$ contained in the differential volume $dV = dr\;rd\varphi\;r\sin\varphi\;d\gamma$.

The concept is shown in Fig. 2 where BSP means Basic Subatomic Particles and are electrons and positrons.

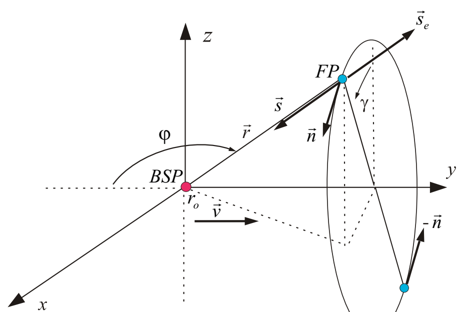

Fig. 2: Unit vector $\bar{s}_e$ for an emitted FP, and unit vectors $\bar{s}$ and $\bar{n}$ for the longitudinal and transversal components of a regenerating FP, of a BSP moving with $v \neq c$

The part E_s of the total relativistic energy tends to zero for the speed v tending to c, and defines the longitudinal angular moment J_s of the regenerating FPs (4).

The part E_n of the total relativistic energy is zero for

$v = 0$ and tends to infinity for the speed v tending to c, and defines the transversal angular moment J_n of the regenerating FPs (4). The direction of $\bar{J}_n$ is defined by the right screw in the direction of the speed $\bar{v}$ and is independent of the charge of the BSP.

The energy of opposed transversal angular momenta J_n of two regenerating FPs (two blue points at Fig. 2) that arrive at the focal point is transformed into linear momenta as shown in Fig. 3.

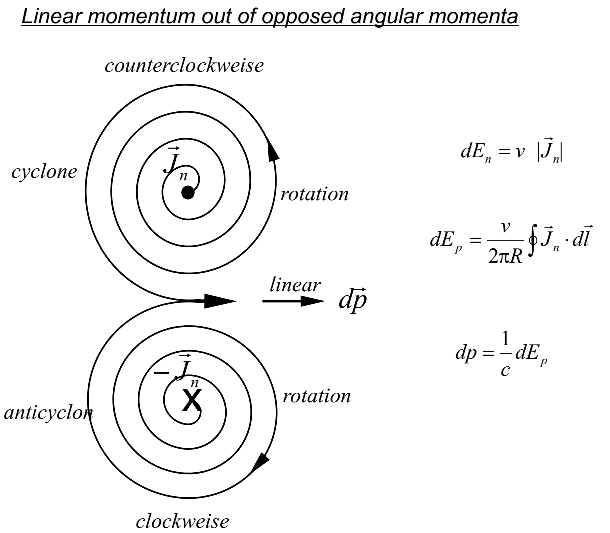

Fig. 3: Generation of linear momentum out of opposed angular momenta

The interaction between an electron and positron is the product of the interactions of the angular momenta of their Fundamental Particles (FPs).

Fig. 4 shows the linear momentum p_{stat} between an electron and positron as a function of the distance d. The force is

$$F_{stat} = \frac{\Delta p}{\Delta t} = \frac{p_{stat} - p_2}{\Delta t} = \frac{p_{stat}}{\Delta t} \tag{5}$$

$p_2 = 0 \quad and \quad \Delta t = 5.42713 \cdot 10^{-28}\ s$

Five regions can be identified along the distance $d/r_o = \gamma$, where $r_o = 1.0 \cdot 10^{-16}\ m$ is the radius of the electron or positron.

1. From $0 \ll \gamma \ll 0.1$ where $p_{stat} = 0$
2. From $0.1 \ll \gamma \ll 1.8$ where $p_{stat} \propto d^{\,2}$
3. From $1.8 \ll \gamma \ll 2.1$ where $p_{stat} \approx constant$
4. From $2.1 \ll \gamma \ll 518$ where $p_{stat} \propto \frac{1}{d}$
5. From $518 \ll \gamma \ll \infty$ where $p_{stat} \propto \frac{1}{d^{\,2}}$ (Coulomb)

The curve was calculated for $r_o = 1.0 \cdot 10^{-16}\ m$ and with $K = 5.42713 \cdot 10^4\ s/m^2$ we get $\Delta t = K\ r_o^2 = 5.42713 \cdot 10^{-28}\ s$ constant for all distances d.

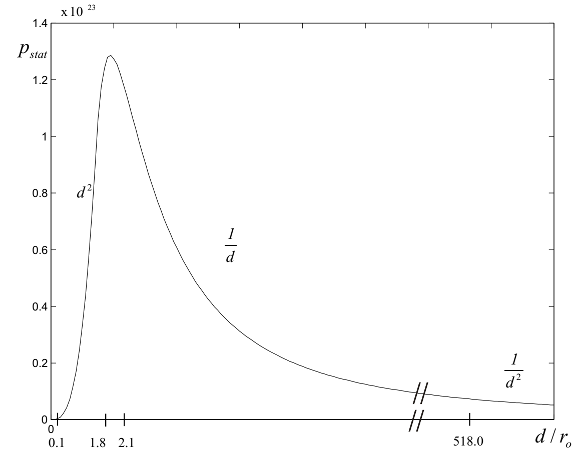

Fig. 4: Linear momentum p_{stat} as function of $\gamma = d/r_o$ between an electron and positron with maximum at $\gamma = 2$

Fig. 5 shows a cut trough an atom identifying the five zones.

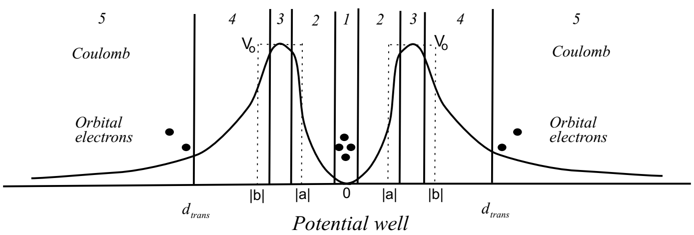

Fig. 5: Potential well between charged particles

1. Zone 1 represents the core of an atomic nucleus where electrons and positrons neither attract nor repel each other. They build a swarm of electrons and positrons.
2. Zone 2 is the zone from where electrons and positrons that have migrated out of zone 1 are reintegrated to zone 1 or expelled out of the atom.
3. Zone 3 shows the high of the momentum wall p_{stat} through which the expelled electrons and positrons tunnel.
4. Zone 4 is a transition zone to the Coulomb zone.
5. Zone 5 is the Coulomb zone that extends up to infinity.

Note: A very important finding of the approach is that electrons and positrons neither attract nor repel each other when the distance between them tends to zero.

Fig. 6 shows fermions (electrons/positrons), photons and neutrinos. Fermions are rays of FPs that form a focal point. Photons are independent rays of FPs with alternating opposed transversal angular momenta, which generate alternating opposed longitudinal momenta when interacting with a target (see Fig. 3). Neutrinos are pairs of FPs with opposed transversal angular momenta, which generate a longitudinal moment when interacting with a target.

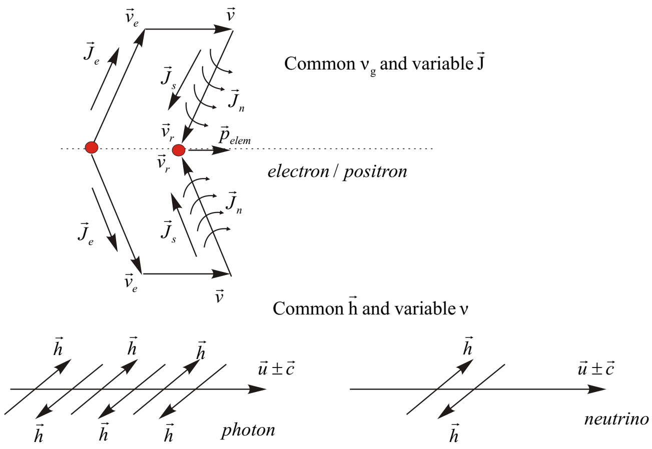

Fig. 6: Fermions, photons and neutrinos

Difference between the Standard and the E & R Models.. – An important difference between the two models we have in particle physics. The concept is shown in Fig.7

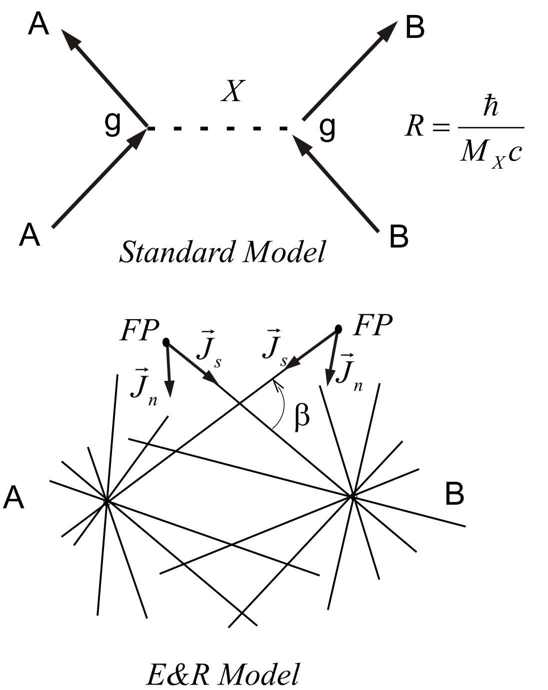

Fig. 7: Differences between the Standard and the E & R Models

The SM defines carrier particles X for the interaction between particles A and B and leads to energy violation during the time $\hbar/\Delta E$. The range R of these carrier particles defines the distance over which the interaction can take place and is given by

$$R = \frac{\hbar}{M_X\ c} \tag{6}$$

where M_X is the mass of the carrier particle with the coupling strength g to the particles A and B. For electromagnetic interactions the carrier particles are the photons with $M_X = 0$, the range is $R = \infty$. For the weak interactions the carrier particles are the W and Z bosons with masses in the order of $80 - 90\ GeV/c^2$ corresponding to a range of $2 \cdot 10^{-3}\ fm$. For the strong interactions the carrier particles are the gluons and for the gravitation the gravitons.

The E & R model has no carrier. The particles A and B are formed by rays of FPs that go from ∞ to ∞ through a point in space which is called "Focal Point". FPs are continously emited from the Focal Point and FPs continously regenerate the Focal Point. The regenerating FPs are the FPs emited by other Focal Points in space. The particles A and B are continously interacting through their FPs, independent of the distance between them. FPs are the constituents of subatomic particles.

FPs have no rest mass and are emitted with the speed c or ∞ relative to the Focal Point. They have longitudinal and transversal angular momenta and their interaction is given by the cross product of their angular momenta, cross product which is proportional to $\sin\beta$. To get the total force between the particles A and B, the integration over the whole space of all the interactions of their FPs is required.

All interactions are **electromagnetic interactions** and are generated out of the combinations of the interactions of the longitudinal and transversal angular momenta of the FPs.

The **strong interaction** is explained with the zero electromagnetic force between electrons and positrons, which are the constituents of nucleons, for the distance between A and B tending to zero. No force is required to hold nucleons together.

The **Weak interaction** is an electromagnetic repulsive interaction between migrated electrons or positrons that interact with the remaining electrons and positrons of the nuclei core. The small electromagnetic force is explained with the small distances between A and B, force which is proportional to the cross product which is proportional to $\sin\beta$. See Fig. 7.

The **Gravitational interactions** are the result of electromagnetic attractive interactions between electrons and positrons that have migrated slowly out of their nuclei core and are then reintegrated with high speed. The so generated momenta are passed inductively to other nuclei and are very small because the distance between the interacting electrons and positrons is very small.

Mass and charge in the E & R Model. – The SM defines mass and charge as different physical characteristics, although it cannot explain what charge is. It defines particles like the neutrons having mass but no charge.

The E & R Model defines mass and charge as physical characteristics that are intrinsic to particles and cannot be separated. The charge of an electron and positron is defined by the sign of the longitudinal angular momentum of emited FPs. Positive rotation in moving direction corresponds to a positive charge and negative rotation to a negative charge. Neutrons are composed of equal numbers of electrons and positrons so that their longitudinal angular momenta of emited FPs compensate, resulting an effective zero charge.

A mass unit is associated with a charge unit. To the rest mass $9.1094 \cdot 10^{-31}\ kg$ of a positron or electron corresponds a charge of $\pm\ 1.6022 \cdot 10^{-19}\ C$.

For complex particles, that are formed by more than one electron or positron, we have for example for the Coulomb force

$$F = 2.307078 \cdot 10^{-28}\ \frac{\Delta n_1\ \cdot \Delta n_2}{d^2}\ N \tag{7}$$

The charge Q of the Coulomb law is replaced by the expression $\Delta n = n^+ - n^-$ which gives the difference between the **constituent** numbers of positive and negative particles (positrons and electrons) that form the complex particle. As the n_i are integer numbers, the Coulomb force is quantified.

The expression $\Delta n = n^+ - n^-$ corresponds to the nuclear charge number or atomic number Z.

$$\Delta n = n^+ - n^- \ = \ Z \tag{8}$$

As examples we have for the proton $n^+ = 919$ and $n^- = 918$ with a binding Energy of $E_{B_{prot}} = -6.9489 \cdot 10^{-14}\ J = -0.43371\ MeV$, and for the neutron $n^+ = 919$ and $n^- = 919$ with a binding Energy of $E_{B_{neutr}} = 5.59743 \cdot 10^{-14}\ J = 0.34936\ MeV$.

Quarks composed of electrons and positrons.. – The existence of Quarks were first infered from the study of hadron spectroscopy. Infered means that they were reconstructed from the final measured products obtained after collisions of particles. The final products are neutrons, protons, pions, muons, electrons, positrons, photons, and neutrinos. As neutrons, protons, pions and muons are composed of electrons and positrons according the $E\&R$ model, the real final products are electrons, positrons, photons and neutrinos. And as also according to the $E\&R$ model the photon is a sequence of neutrinos, the final products are reduced to electrons, positrons and neutrinos.

To explain the interpretation given by the model $E\&R$ UFT we calculate an example with the proton, which is a baryon and has three quarks, namely A, B and C. The concept is shown in Fig: 8

Example: The proton has a mass of $938.2723\ MeV/c^2$. With the mass of an electron or positron of $0.511\ MeV/c^2$ we get ≈ 1837.00 electrons and positrons from which $n^+ = 919$ are positrons and $n^- = 918$ electrons. The mass of

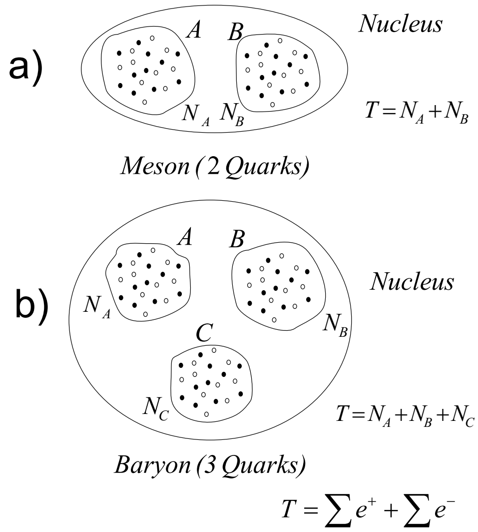

Fig. 8: Nucleus composed of quarks.

the proton m_p is equal 1837 times the mass of an electron plus the binding energy.

$$1837\ m_e + m_{binding} = m_p \tag{9}$$

The total number of electrons and positrons at the proton are

$$T = N_A + N_B + N_C = n^+ + n^- = 1837 \tag{10}$$

where N_i is the total namber of electrons and positrons at Quark i.

As the proton is a baryon it has three quarks with the electric charge uud. With the SM we get the charge of the proton adding the fractional charges

$$u\ +\ u\ -\ d = \frac{2}{3} + \frac{2}{3} - \frac{1}{3} = 1 \tag{11}$$

Charges that are a fraction of the charge of an electron or positron violate the charge conservation principle.

The finding of the "$E\&R''$ model that electrons and positrons neither attract nor repell each other when the distance between them tend to zero, allows to interpret the charge numbers Q of quarks as a relative charge

$$u = \left| \frac{N_i^+ - N_i^-}{N_i} \right| \qquad and \qquad d = -\left| \frac{N_i^+ - N_i^-}{N_i} \right| \tag{12}$$

where N_i^+ and N_i^- are the number of positrons and electrons at the quark i and $N_i = N_i^+ + N_i^-$ and $\Delta N_i = N_i^+ - N_i^-$.

As the sum of the differences between electrons and positrons at each quark must give the charge of the proton we write

$$u\ N_A + u\ N_B + d\ N_C = \frac{2}{3} N_A + \frac{2}{3} N_B - \frac{1}{3} N_C = 1 \tag{13}$$

With equations (10) and (13) and the condition that the result must give positive integer numbers of N_A, N_B and N_C, we can fix arbitrarily one of them and calculate the others. As there are many possibilities, we conclude that the distribution of electrons and positrons on the three quarks of baryons is not constant and may vary from case to case. For mesons the distribution is well defined because they have only two quarks.

If we fix for the moment arbitrarily $N_A = 499$ we get

$$N_A = 499 \qquad N_B = 114.33 \qquad N_C = 1223.66 \qquad (14)$$

We should get integer numbers, but this is irrelevant for the moment to understand the new interpretation and continue with the obtained results and get

$$\Delta N_A = \frac{2}{3} N_A = 332.66 \qquad \Delta N_B = \frac{2}{3} N_B = 76.22 \qquad (15)$$

and $\quad \Delta N_C = -\frac{1}{3} N_C = -407.886$

or

$$\Delta N_A + \Delta N_B + \Delta N_C = 332.66 + 76.22 - 407.886 = 1 \qquad (16)$$

The **rest masses** of the quarks are, with m_e the mass of the electron

- $m_A = N_A\ m_e = 4.54558 \cdot 10^{-28}\ kg$
- $m_B = N_B\ m_e = 1.03847 \cdot 10^{-28}\ kg$
- $m_C = N_C\ m_e = 1.11498 \cdot 10^{-27}\ kg$

Note: The rest masses m_A and m_B which belong to the same type u of quarks of the proton are not equal.

As chemical elements are composed of protons and neutrons, the atomic number Z of an element can be expressed as the sum of the ΔN of its quark constituents.

$$Z = \sum_i \Delta N_i \qquad (17)$$

Note: All hadrons have a total charge equal -1, 0 or 1 while chemical elements have charges $Z \geq 1$. Quarks play a similar function at hadrons as protons and neutrons play at chemical elements.

Now we come back to the fractional numbers of N and ΔN. If we round the fractional numbers slightly to get integer numbers as follows

$$N_A = 499 \quad N_B = 114 \quad N_C = 1224 \qquad (18)$$

to get $T = 1837$, and

$$\Delta N_A = 333, \quad \Delta N_B = 76, \quad \Delta N_C = 408, \qquad (19)$$

to get $\sum \Delta N = 1$,

we get for the relative charge of the quarks

- $u_A = \frac{\Delta N_A}{N_A} = 0,6673 \approx \frac{2}{3}$
- $u_B = \frac{\Delta N_B}{N_B} = 0.6666 \approx \frac{2}{3}$
- $d_C = \frac{\Delta N_C}{N_C} = 0.33333 \approx \frac{1}{3}$

More examples:

For the π^+ **particle** we have that $n^+ = 137$ and $n^- = 136$ and that it is an $u\bar{d}$ particle.

$$T = N_A + N_B = n^+ + n^- = 273 \qquad (20)$$

$$u\ -\ \bar{d} = \frac{2}{3} + \frac{1}{3} = 1 \qquad (21)$$

With the equations

$$\frac{2}{3}\ N_A - \frac{1}{3}\ N_B = 1 \qquad and \qquad N_A + N_B = 273 \qquad (22)$$

we get

$$N_A = 92 \qquad \Delta N_A = u\ N_A = 61.333 \qquad (23)$$

$$N_B = 181 \qquad \Delta N_B = d\ N_B = -60.333 \qquad (24)$$

$$\Delta N_A + \Delta N_B = 61.333 - 60.333 = 1 \qquad (25)$$

The **rest masses** of the quarks are

- $m_A = N_A\ m_e = 8.3806 \cdot 10^{-29}\ kg$
- $m_B = N_B\ m_e = 1.6488 \cdot 10^{-28}\ kg$

For the **neutron** we have that $n^+ = 919$ and $n^- = 919$ and that it is a udd particle. We get

$$T = N_A + N_B + N_C = n^+ + n^- = 1838 \qquad (26)$$

$$u\ -\ d\ -\ d = \frac{2}{3} - \frac{1}{3} - \frac{1}{3} = 0 \qquad (27)$$

For the Σ^+ **particle** we have that $n^+ = 1164$ and $n^- = 1163$ and that it is an uus particle.

$$T = N_A + N_B + N_C = n^+ + n^- = 2327 \qquad (28)$$

$$u\ +\ u\ +\ s = \frac{2}{3} + \frac{2}{3} - \frac{1}{3} = 1 \qquad (29)$$

The distribution of electrons and positrons on the different quarks must not be necessarily static.

Conclusion: The Q values for the electric charge at quarks refere to the relative charge of the quarks. There is no need to introduce fractional charges which were never directly measured. All charges are integer multiples of the charge of an electron, which constitutes the unit of the charge.

Note: No strong forces or gluons are necessary to hold quarks together, because for the distance tending to zero electrons and positrons neither attract nor repel each other. The distribution of electrons and positrons on the quarks is not a constant. The numbers N_i of the u quarks of one hadron may be different because u gives only the relative charge of a quark.

General Conclusion.. – The present work is based on findings of the model “Emission & Regeneration” Unified Field Theory. The model represents subatomic particles as focal points of rays of Fundamental Particles (FPs) that move from infinite to infinite. FPs are emitted by the focal point and at the same time regenerate it. Regenerating FPs are FPs that are emitted by other focal points. Interactions between subatomic particles are the product of the interactions of the angular momenta of their FPs.

The interaction between two charged subatomic particles tends to zero for the distance between them tending to zero, allowing to place the zero of the potential energy at the distance zero between the particles. Atomic nuclei can thus be represented as swarms of electrons and positrons that neither attract nor repel each other.

As atomic nuclei are composed of nucleons which are composed of quarks, the quarks can also be seen as swarms of electrons and positrons. This allows a completely new interpretation of the interactions between quarks and the corresponding energy states. No strong forces or gluons are necessary to hold quarks together, because, for the distance tending to zero, electrons and positrons neither attract nor repel each other.

Fermions are rays of FPs that form a focal point. Photons are independent rays of FPs with alternating opposed transversal angular momenta, which generate alternating opposed longitudinal momenta when interacting with a target. Neutrinos are pairs of FPs with opposed transversal angular momenta, which generate a longitudinal moment when interacting with a target. See Fig. 3.

The Q values for the electric charge at quarks refer to the relative charge of the quarks. There is no need to introduce fractional charges which were never directly measured. All charges are integer multiples of the charge of an electron, which constitutes the unit of the charge.

The “Emission & Regeneration” Unified Field Theory has only one field from which the whole theory is deduced, namely the field of the angular momenta of the FPs.

Note: Measurements, to indirectly detect assumed or fictitious particles or interaction laws will always give a positive result, because the indirect measurements will always be based on the theoretical model where the assumed particles or laws were previously introduced and made consistent with the model. That is why the affirmation, that the existence of an assumed particle or law was experimentally confirmed is a fallacy. The carrier particles X of Fig. 7 of the standard model are examples of assumed or fictitious particles.

To decide between two theoretical models that explain the same number of physical interactions, the one with the lowest number of assumed or fictitious particles and interaction laws should become the preference.

Note:. – Because of the completely different representation of particles as “focal-points” used in the proposed approach to derive the basic laws of physics, compared with all past and present models which are based on particles moving in fictitious substances like ether, on particles as oscillating strings, on point-like or wave-packet particles moving in the empty space, no direkt reference works exist.

The present paper is an extract from the complete work available at www.odomann.com. An audio introduction can be found at www.odomann.com under DPG Tagung Jena 2021 with the title “Focal-Point representation of Subatomic Particles.pptx “

REFERENCES

[1] Particle Physics, *Second Edition*, edited by B.R. Martin & G. Shaw (John Wiley & Sons, Chichester) 2003

[2] Quantentheorie, *Grundlagen und Anwendungen*, edited by Max Schubert/Gerhard Weber (Spektrum Akademischer Verlag: Heidelberg) 1993

[3] Elektromagnetische Feldtheorie, *Grundlagen und Anwendungen*, edited by Harald Klingbiel (Vieweg + Teubner Verlag, Wiesbaden) 2011