Models for Quarks and Elementary Particles — Part II: What is Mass?

Ulrich K. W. Neumann

Tschidererstr. 3, D-86609 Donauwörth, Germany

E-mail: Marianne-Dru.Neumann@t-online.de

It is extremely productive to give the resultant vector (**EV**) from the outer vector product (Part I of this article series) a physical significance. The **EV** is assumed as electric flux ∉ with the dimensions [Vm]. Based on Maxwell's laws this develops into the idea of the magnetic monopole (MMP) in each quark. The MMP can be brought in relation with the Dirac monopole. The massless MMP is a productive and important idea on the one hand to recognise what mass is and on the other hand to develop the quark structure of massless photon (-likes) from the quark composition of the electron. Based on the experiments by Shapiro it is recognised that the sinusoidal oscillations of the quark can be spiralled in the photons. In an extreme case the spiralling of such a sinusoidal arc produces the geometric locus loop of a quark in a mass-loaded particle.

1 Introduction

Based on some characteristics of the photon mentioned in Part I [1], vectors are introduced to describe the quarks. The formal structures of the quarks (of the first generation) are presented with outer vector product, its angular movements and the corresponding space types. A first order of the elementary particles follows [2].

2 The magnetic monopole (MMP)

It is highly productive to give the vectors from the outer vector product (Part I of this series of papers) a physical meaning. Initially, the **EV** is assumed as electric flux ∉ with the dimensions [Vm].

A very good model for further considerations is given in [3] (see Fig. 7.128, p.398 therein), in which a changing electric field with an enclosing magnetic field is shown. For the present models this should be formulated as follows: a vector pair (**VP**) generates the **EV** issuing from the origin of a coordinate system, which **EV** is now identified with an electric flux ∉. When this flux is created, almost the entire electric flux ∉ based on Maxwell's laws creates the magnetic flux Φ located ring-shaped about the ∉-flux. With this linkage, the models are put on the basis of the QED mentioned in Part I. Feynman [4] calls the QED-theory the best available theory in natural sciences.

The electric source flux ∉ in turn comprises the toroidal magnetic flux Φ, (like the water of a fountain overflowing on all sides), whose maximum radius is designated MAGINPAR, which is illustrated with Fig. 1.

The ∉-**EV** with toroidal magnetic flux Φ is a substantial part of the description of a quark. With the coverage of the toroidal magnetic flux Φ through the electric source flux ∉ it is also an obvious explanation for the magnetic flux Φ not appearing outside the confinement under normal circumstances. The ∉-**EV** shown in Fig. 1 does not correspond to a dipole.

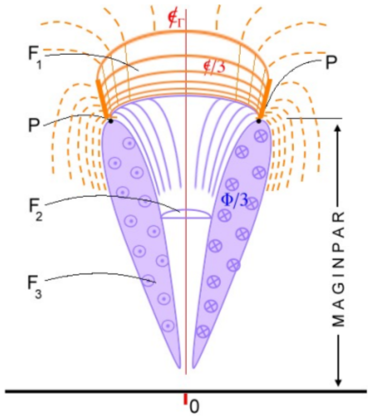

Fig. 1: Schematic section through the Φ- and ∉-fields of a (d-)quark. In the Φ-tube or funnel the ∉-field lines created in orange are not indicated. P designates the outer apex line of the Φ-flux which determines the MAGINPAR at the same time. Graphically, the configuration is also called "fountain". The symbolic $∉_\Gamma$-field line lies on the funnel longitudinal axis and is discussed in Part III.

With the latter, the fields shown would be simultaneously visible on two sides of the coordinate origin, while an ∉-flux trough would also have to appear opposite to a source flux ∉.

A **Zk** (see Part I) comprises two such ∉-source fluxes offset by 180° relative to each other which are merely like a dipole. A three-quark particle according to Table 1 (see Part I) comprises three ∉-source fluxes.

Dirac has stated the charge of the magnetic monopole according to Jackson ([3], p.319), as follows:

$$g^2 = \frac{1}{{}^e\alpha} \times \frac{n^2}{4} \times 4\pi\mu_0\hbar c \;\left[\mathrm{V}^2\mathrm{s}^2\right] \quad \text{or} \quad g = \frac{n}{2} \times \sqrt{\frac{4\pi\mu_0\hbar c}{{}^e\alpha}}\,,$$

$$g = 4.1357\times10^{-15} \;[\mathrm{V\,s}] \quad \text{with} \quad n = 1\,.$$

If this value is multiplied with double the value of the fine structure constant $2\,{}^e\alpha = 1/68.518$, it is identical to the value of the magnetic flux $\Phi = 6.03593\times10^{-17}$[Vs] of the present models. The dimension of g is likewise identical to the magnetic flux ϕ of the present models, (see [2] Chapter 8.1).

The electron or the electric unit charge of $q = 1.60219\times10^{-19}$ [As] according to [1] Table 1 and according to [2] (Chapter 7 therein), consists of three d-quarks. Consequently the natural constant Φ does not stand for a quark either but for a "3QT", i.e. according to a first assumption for the three d-quarks of the electron. Imagining the electric flux $\notin$ and the toroidal magnetic flux Φ of a quark according to Fig. 1 the magnetic fluxes of a d-quark or of a u-quark amount to:

$$\Phi_d = \frac{\Phi}{3} = \frac{6.03593\times10^{-17}}{3} = 2.01198\times10^{-17}\ [\mathrm{Vs}]\,,$$

$$\Phi_u = \frac{2\Phi}{3} = 4.02396\times10^{-17}\ [\mathrm{Vs}]\,.$$

According to the present models these magnetic fluxes are the values of the magnetic monopoles (MMPs).

Obviously this means that we, and our entire world, also consist of the much sought-after MMPs.

The intensity of the interaction of the Dirac monopole is estimated extremely high. Since the MMP according to the present models is approximately $2\,{}^e\alpha$ smaller, the intensity of the interaction of the MMPs is substantially smaller as well. The force between two charged particles corresponds to the product of both charges:

$$\frac{g^2}{\Phi^2} = \frac{\left(4.1356\times10^{-15}\right)^2}{\left(6.03593\times10^{-17}\right)^2} = \frac{\left(68.518\times6.03593\times10^{-17}\right)^2}{\left(6.03593\times10^{-17}\right)^2} = \frac{68.518^2}{1} = \frac{4695}{1}\,.$$

The charge quantity g determined by Dirac thus results in 4695 times greater a force between the charges g than between the fluxes Φ. A further reduction of the interaction obviously results through the $\frac{\Phi}{3}$ and $\frac{2\Phi}{3}$ fragments of the d- or u-quarks. These reduction factors are not the sole cause for the quite obviously much lower intensity of the interaction of the MMPs than assumed by Dirac. The probably decisive reduction factor is the construction of the quark sketched in Fig. 1, where the magnetic flux Φ of a quark is shielded to the outside by the electric flux $\notin$.

The literature sketches an MMP as follows:

- A constant magnetic field oriented to the outside on all sides (hedgehog) not allowing an approximation of additional MMPs;
- If two or more (anti-) MMPs attract one another, they are unable to assume a defined position relative to one another because of their point-symmetrical structure;
- The "literature MMP" is the logical continuation of the current world view of the "spheres" which is moderated through probability densities. Atoms are relatively "large spheres", nucleons are "very small spheres" therein, and the quarks would consequently be "even smaller spheres" in the nucleons and the electrons are allegedly point-like. The interactions between the "spheres" are secured by the bosons as photons or gluons.

The aspects of these models are:

- The idea of the "sphere chain" is exploded in these models since the swivelling and simultaneously pulsating MMPs act in all particles. Particles can be seen highly simplified as different constellations of MMPs;
- The idea of the "fountain" according to Fig. 1 contains the toroidal magnetic flux Φ as MMP;
- The structures brought about by the MMP are temporally, spatially and electromagnetically highly anisotropic and asymmetrical. Without this structure our world would not be possible. From this it can be concluded that the highly symmetrical "literature MMP" sketched above must not be seen as an elementary part of our world.

3 Some enigmas of the photon

(a) Why the photon has the electric and magnetic vectors positioned vertically to the direction of flight and vertically to each other is not answered in Part I;

(b) If the photon is created through "annihilation" of electron and positron as is well known and if the electron according to Table 1, Part I, has the quark structure $\underline{dd}\,{}_{\perp}d$, the question arises if the characterisation of the photon with the simple letter γ according to the standard model is correct;

(c) If electron and positron have a basic mass $m = 0.511$ MeV/c^2 why does the photon have the mass zero?

(d) Why does the wavelength of the light observed by us not fit to the Compton wavelength of the electrons emitting the light?

To solve the enigma, some courageous jumps have to be performed:

First jump: The photon consists of the same quark type as the electron, namely d according to Table 1 (of Part I);

Second jump: The photon contains its own anti-particle, i.e. consists of the quark types d and $\bar{d}$ according to the models;

Third jump: Both quark groups (3 d and 3 $\bar{d}$) oscillate by themselves with very similar basic frequencies. This is explained as follows:

The Compton wavelength of the electron (3 d) or that of the positron (3 $\bar{d}$) in each case results in a basic frequency of approximately 10^{20}Hz. Thus the photon has two very similar basic frequencies. The beat resulting from both frequencies has a wavelength or frequency which is greater and lower respectively by the factor 10^5 and with just under 10^{15}Hz is also in the visible range. The beat is the answer to Question (d) concerning the photon.

Some consequences of the courageous jumps:

(1) The photon must be seen as a composite **yet uniform** particle;

(2) Two frequencies in this uniform medium create a **beat**;

(3) According to Table 1 of Part I, Line B, there are three additional leptons in addition to the electron (or its anti-particle positron). It can be expected that from these leptons and each of their anti-particles composite **yet uniform** particles can be formed according to the same pattern as with the photon. These particles are called "photon-like" in the models.

In Table 1, the quark structure of the electron is introduced with $\underline{dd}_{\perp}d$. Using the anti-d-quark the positron has the same structure. If both elementary particles in the photon are connected it should be unsurprisingly expected that both structures can be found again in the photon. In addition to this it should be expected that both particles are closely connected with each other. This is expressed in that the two singular quarks of electron and positron in turn assume a close bond. In the models this is called "bond coordination" or "Bk" in brief and in the case of the photon $\underline{\underline{d\bar{d}}}$ as structural element. Consequently the overall structure of the photon appears as $\underline{dd}_{\perp}\underline{\underline{d\bar{d}}}_{\perp}\underline{\bar{d}\bar{d}}$. The overall photon-like structure of the neutrinos would be $\underline{dd}_{\perp}\underline{\underline{u\bar{u}}}_{\perp}\underline{\bar{d}\bar{d}}$, etc.

In contrast with the three-quark particles of Table 1 the photon-likes are six-quark particles. It is clear that the six-quark structure of the photon-likes has substantial consequences on the reaction equations of the weak interaction. This is reported in Part IV. The quark structure of the photon is the answer to Question (b) concerning the photon.

4 The "pioneering" experiments of Shapiro

Years after the discovery of the quark structure of the photons and long after the insight, as to what mass actually is, was gained, the experiments by Shapiro [5] were brought into relation with both. Here, the experiments by Shapiro are dealt with first in order to facilitate introduction to the subjects.

Towards the end of the nineteen-sixties, Shapiro observed a reduced speed of light c_M near the Sun. The cause is the "refractive index of the vacuum". Deviating from the interpretation through the standard model of physics and utilising new insights through these models the following is determined in a first jump:

Under the effect of directed electric fields the flat sinusoidal oscillation of the photon becomes helical (see [2], pages 167 and 179). This results in that at constant frequency the penetration points of the sine curve through the "x-axis" are situated closer together and the speed of the photon in direction of flight is no longer c but c_M.

Following this thought pattern it can be determined in a second jump: Under the effect of extremely strong highly directional electric fields the initially flat sinusoidal oscillation of the photon is spiralled to such an extent that the geometrical locus loops used for "stationary" particles appear (see [2], page 165ff and Fig. 2 and 3).

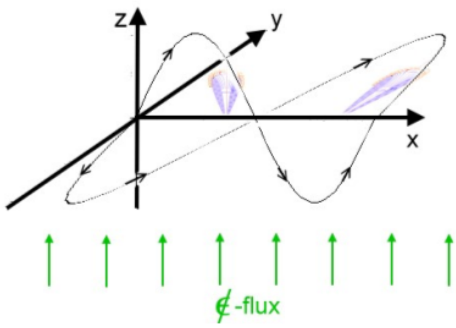

Fig. 2: A photon with initially flat sinusoidal arcs and with schematically sketched "fountain" runs vertically to the direction of an electric field while the arrows on the sinusoidal arcs indicate the sequence of the amplitude.

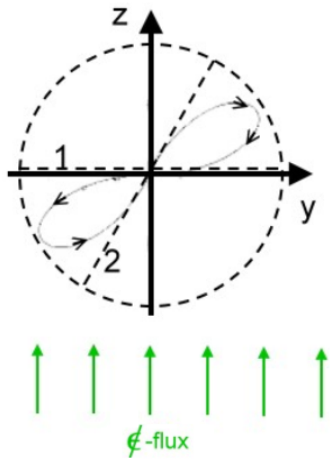

Fig. 3: Projection of the helically deformed initially horizontal and flat sinusoidal arcs of a photon according to Fig. 2 in the $y-z$ plane.

Looking at the helical sinusoidal oscillation in the direction of the x-axis a sinusoidal arc presents itself as a narrower or wider loop. If the loop is very narrow the progressive speed c_M of the photon is only a little smaller than c [5]. However if the loop is very wide the photon is practically unable to move. This means that the photon is then captured in an electron.

The extremely strong directional electric fields can be found in the source fields of the "fountain", Fig. 1, of the electron quarks. This means that an electron with suitable MAG-INPAR is able to spiral the lateral sinusoidal oscillation of an approaching photon to such an extent that the lateral sinusoidal oscillation becomes a central-symmetrical sinusoidal oscillation. If the amplitudes or MAGINPAR of both particles fit to each other the photon is stored in the electron. This also means that an electron charged in this way — and that is every electron from our environment — has central-symmetrical sinusoidal oscillations of 3 d-quarks as well as stored 3 d- and 3 $\bar{d}$-groups of the photons.

It is now evident: the flat oscillation of the photon is converted to the radial oscillation in the electron or in the fermion through the extremely strong directional electric quark source fields. The geometrical locus loops developed from formal aspects which are shown in Part I for instance with Fig. 3 are sine curves or sinusoidal oscillations which are presented in polar coordinates for a centre each.

5 What is mass?

In Table 1 the neutron and the neutrino are positioned below each other. Both have the same types and quantities of quarks, however with different structural signs! The mass of the neutron almost amounts to 940 MeV, the mass of the neutrino according to the standard model below one eV. The electron and the positron each have a basic mass of 0.511 MeV, while the photon consisting of the same quarks has no mass at all.

Quite obviously, "mass" is not a characteristic of a quark. Mass is a characteristic which arises from the constellation of several quarks. Only certain elementary particles have mass! These include those where the MMPs perform central-symmetrical sinusoidal oscillations, e.g. the three-quark particles of Table 1. The amplitude of the central-symmetrical sinusoidal oscillations is practically identical with the MAGINPAR R. The magnitude of the MAGINPAR R is determined by the frequency ν via $\nu = \frac{c}{\lambda} = \frac{c}{X\pi R}$.

In [2] (page 164), mass is defined as follows:

$$m = \frac{h}{c^2}\,\nu = \\ = \frac{\Phi q}{2\,{}^{e}\alpha c^2}\,\nu = 7.3726\times10^{-51}\left[\frac{\mathrm{V\,A\,s^4}}{\mathrm{m^2}}\right]\times\nu\left[\frac{1}{\mathrm{s}}\right]. \tag{1}$$

Conclusion: Mass is nothing other than the very, very frequent occurrence of the MMPs Φ at the coordinate centre of the particle in accordance with the frequency ν multiplied by the electric charge q divided by c^2 and also $2\,{}^{e}\alpha$. The constants jointly have the value 7.3726×10^{-51} [$\mathrm{V A s^4/m^2}$]. These statements satisfy a desire of physics that has remained unanswered for a very long time. The masses of the mass-loaded elementary particles known to us that could only be experimentally measured in the past can be calculated from elementary quantities.

With a photon, the six quarks or MMPs involved describe a lateral movement along a line. The sinusoidal oscillations of the MMPs are not central-symmetrical. According to the definition such particles have no mass. The lateral movement is the answer to Question (c) regarding the photon.

The well-known relation of mass m [$\mathrm{V A s^3/m^2}$] and inertia ${}^{N}\Theta$ [$\mathrm{V A s^3/m}$] becomes visible by introducing the equations $h = {}^{N}h/2\,{}^{e}\alpha$ and ${}^{N}h = {}^{N}\Theta \times c$. (See [2], Fig. 8.3a of Chapter 8.2.1 therein.) By this equation, equation (1) transforms to

$$m = \frac{{}^{N}\Theta\,\nu}{2\,{}^{e}\alpha c} \quad \text{or} \quad m = \frac{{}^{N}\Theta}{2\,{}^{e}\alpha X\pi R},$$

which is the short version of equation (8-II) on page 156 of [2].

Submitted on December 26, 2007
Accepted on January 28, 2008

References

1. Neumann U.K.W. Models for quarks and elementary particles — Part I: What is a quark? *Progress in Physics*, 2008, v. 2, 71–74.
2. There in the internet http://www.universum-un.de a book entitled "Models for quarks and elementary particles" will be displayed having a volume of approximately 250 DIN A4 pages.
3. Jackson J. D. Klassische Elektrodynamik. 3rd edition, Walter de Gruyter, Berlin — New York, 2002.
4. Feynman R. P. QED Die seltsame Theorie des Lichtes und der Materie Piper. München-Zürich, 1988.
5. Bergmann-Schaefer. Lehrbuch der Experimentalphysik, Volume 3, Optik, 10. Edition Walter de Gruyter, Berlin — New York, 2004, 1365 and 1369.