THE REINTERPRETATION OF THE ATOM

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ABSTRACT

This publication contains a mathematical-physical approach for a new interpretation of the atom and its structure. The basis for this is, on the one hand, the unipolar induction according to Michael Faraday (1791-1867), which has proven itself in practice, and, on the other hand, the various experiments in classical physics that led to the concept of the atom. Further basis for this elaboration are the essays: "The reinterpretation of the 'Maxwell equations'[1]", "The reinterpretation of the Einstein de Haas experiment[2]" and "The reinterpretation of the Stern Gerlach experiment[3]". These fundamentals, in combination with the calculation rules of vector analysis, differential calculus and analysis, show a new interpretation of the atom. The unipolar induction according to Michael Faraday (1791-1867) results in a generally valid calculation approach for the structure and functioning of an atom.

An alternative approach to calculating the weak and strong nuclear force is also shown, which provides a common mathematical-physical basis for bringing together all nuclear forces. This also makes it possible to see how the atomic nucleus experiences stabilization. Another innovation is the combination of waves and particles through the presented model.

This all points to an interpretation of the atom as a vortex structure within a medium. This paper also shows approaches to calculating these vortex structures.

This elaboration has no claim to accuracy. Logical connections are created based on mathematical and physical principles, which lead to the conclusions in this essay. These conclusions are fundamentally based on classical physics.

1. INTRODUCTION

The concept of the atom has a long history, and there are several scientists and philosophers from different eras who have made significant contributions to our understanding of the atom. The following scientists and philosophers are just a few examples of those who developed ideas to describe the atom.

The early philosophers Democritus and Leucippus (ca. 460-370 BC) developed the idea that matter must consist of indivisible units, the so-called "Atomos". This idea was based not on trials or experiments but rather on observations and logical reasoning.

In the “Scientific Revolution” (from the mid-16th century to the end of the 17th century), John Dalton (1766-1844) developed his modern atomic theory. In the early 1800s he came up with a scientifically based theory based on experiments and data obtained from them. His theory described that matter must be made up of atoms that have specific masses and are combined in specific ratios to form chemical compounds.

The discovery of the atomic structure was made by several scientists, each of whom developed their own theory, but all found a similar structure of the atoms. J.J. Thomson (1856–1940) discovered the electron in 1897, which indicated that atoms are made up of smaller particles and therefore are not indivisible. He developed the "plum pudding model" of the atom, in which the electrons are embedded in a "soup" of positive charge.

Ernest Rutherford (1871–1937) conducted the famous gold foil experiment in 1909, which led to the discovery of the atomic nucleus. He showed that most of an atom's mass is concentrated in a tiny, positively charged nucleus while electrons orbit that nucleus.

Niels Bohr (1885–1962) then developed the Bohr model of the atom in 1913, in which the electrons revolve around the nucleus in specific, quantized orbits. This model helped explain the stability of atoms and the emission spectra of hydrogen.

This work is intended to continue these considerations by applying mathematical methods that were not yet available at the time. It is assumed that the particles belonging to the atom consist of rotating structures within a medium. The resulting logic, in combination with the stated discoveries, is manifested in this elaboration.

In the two elaborations "The reinterpretation of the Einstein de Haas effect[2]" and "The reinterpretation of the Stern Gerlach experiment[3]", explanations have already been made about the two experiments presented there and also calculation errors that occur due to the incomplete "Maxwell equations", which were reformulated and improved in the elaboration "The reinterpretation of Maxwell's equations[1]", were corrected. In order to create a consistent overall picture of these new interpretations, the atom is explained in a new way in this work using existing information.

2. IDEAS AND METHODS

2.1 IDEAS FOR REINTERPRETING THE ATOM

The idea for the "reinterpretation of the atom" is based on the facts presented in the three elaborations "The reinterpretation of the 'Maxwell equations'[1]", "The reinterpretation of the Einstein de Haas experiment[2]" and "The reinterpretation of the Stern Gerlach experiment[3]" were presented. The three elaborations deal with mechanisms that govern the behavior of the atom. The resulting conclusions in combination with the development of the atomic model presented in the introduction can be summarized and result in an overall model that also allows for new theories on the topic. These ideas are based on logical conclusions and are also described mathematically below. First, however, the mathematical basics must be clarified.

2.2 MATHEMATICAL PRINCIPLES AND FORMULATIONS

The basic mathematical descriptions used in this work are listed below.

Mathematical basics:

$\vec{a}\,;\vec{b}\,;\vec{c}$ = Metavectors
$\hat{a}$ = Unit vector
$|\vec{a}|$ = Magnitude of a vector
$\times$ = Cross product
δ = Delta
rot = Rotation operator
div = Divergence
grad = Gradient
Σ = Sum
i = Run variable
(Sp) = Track

Mathematical equations:

Cross product:

$$\vec{c}=\vec{a}\times\vec{b}=\begin{pmatrix} a_y b_z - a_z b_y \\ a_z b_x - a_x b_z \\ a_x b_y - a_y b_x \end{pmatrix} \tag{2.2.1}$$

Rotation:

$$\operatorname{rot}\vec{c}=\operatorname{rot}(\vec{a}\times\vec{b})=(\operatorname{grad}\vec{a})\vec{b}-(\operatorname{grad}\vec{b})\vec{a}+\vec{a}\operatorname{div}\vec{b}-\vec{b}\operatorname{div}\vec{a} \tag{2.2.2}$$

Gradient:

$$(\operatorname{grad}\vec{a}) = \begin{pmatrix} \frac{\delta a_x}{\delta x} & \frac{\delta a_x}{\delta y} & \frac{\delta a_x}{\delta z} \\ \frac{\delta a_y}{\delta x} & \frac{\delta a_y}{\delta y} & \frac{\delta a_y}{\delta z} \\ \frac{\delta a_z}{\delta x} & \frac{\delta a_z}{\delta y} & \frac{\delta a_z}{\delta z} \end{pmatrix} \tag{2.2.3}$$

Gradient in multiplication by a vector:

$$(\operatorname{grad}\vec{a})\vec{b} = \begin{pmatrix} \frac{\delta a_x}{\delta x} & \frac{\delta a_x}{\delta y} & \frac{\delta a_x}{\delta z} \\ \frac{\delta a_y}{\delta x} & \frac{\delta a_y}{\delta y} & \frac{\delta a_y}{\delta z} \\ \frac{\delta a_z}{\delta x} & \frac{\delta a_z}{\delta y} & \frac{\delta a_z}{\delta z} \end{pmatrix}\begin{pmatrix} b_x \\ b_y \\ b_z \end{pmatrix} = \begin{pmatrix} b_x\frac{\delta a_x}{\delta x} + b_y\frac{\delta a_x}{\delta y} + b_z\frac{\delta a_x}{\delta z} \\ b_x\frac{\delta a_y}{\delta x} + b_y\frac{\delta a_y}{\delta y} + b_z\frac{\delta a_y}{\delta z} \\ b_x\frac{\delta a_z}{\delta x} + b_y\frac{\delta a_z}{\delta y} + b_z\frac{\delta a_z}{\delta z} \end{pmatrix} \tag{2.2.4}$$

Divergence:

$$\operatorname{div}\vec{a} = \left(\frac{\delta a_x}{\delta x} + \frac{\delta a_y}{\delta y} + \frac{\delta a_z}{\delta z}\right) \tag{2.2.5}$$

Divergence in multiplication by a vector:

$$\vec{a}\operatorname{div}\vec{b} = \begin{pmatrix} a_x\left(\frac{\delta b_x}{\delta x} + \frac{\delta b_y}{\delta y} + \frac{\delta b_z}{\delta z}\right) \\ a_y\left(\frac{\delta b_x}{\delta x} + \frac{\delta b_y}{\delta y} + \frac{\delta b_z}{\delta z}\right) \\ a_z\left(\frac{\delta b_x}{\delta x} + \frac{\delta b_y}{\delta y} + \frac{\delta b_z}{\delta z}\right) \end{pmatrix} \tag{2.2.6}$$

Hadamard-Product:

$$\vec{c}=\vec{a}\circ\vec{b}=\begin{pmatrix} a_x \cdot b_x \\ a_y \cdot b_y \\ a_z \cdot b_z \end{pmatrix} \qquad (2.2.7)$$

Relationship between divergence and gradient:

$$(Sp)(\operatorname{grad} a)=\operatorname{div} a \qquad (2.2.8)$$

Euler formula:

$$e^{(jx)} = \cos(x) + j\sin(x) \qquad (2.2.9)$$

2.3 PHYSICAL PRINCIPLES AND FORMULATIONS

The basic physical descriptions used in this work are listed below.

Physical principles and units:

$\vec{E}$ = electric field strength in $\frac{kg\ m}{A\ s^3}$

$\vec{v}$ = velocity in $\frac{m}{s}$

$\vec{B}$ = magnetic flux density in $\frac{kg}{A\ s^2}$

$\vec{H}$ = magnetic field strength in $\frac{A}{m}$

$\vec{D}$ = electrical flux density in $\frac{A\ s}{m^2}$

$\vec{L}$ = angular momentum in $\frac{kg\ m^2}{s}$

$\vec{r}$ = radius in m

$\hat{r}$ = radius as a unit vector in m

$\vec{p}$ = pulse in $\frac{kg\ m}{s}$

$\vec{R}$ = overall focus in m

m = mass in kg

$\vec{F}$ = force in $\frac{kg \cdot m}{s^2}$

G = Gravity constant in $\frac{m^3}{kg \ s^2}$

Φ = undefined field unit

k = Wave vector in $\frac{1}{m}$

μ = Permeabilität in $\frac{kg \cdot m}{A^2 \cdot s^2}$

ϵ = Permittivität in $\frac{(A^2 s^4)}{(kg\, m^3)}$

q = electrical charge in $A \cdot s$

$\vec{m}$ = magnetic moment in $A \cdot m^2$

Physical equations:

Unipolar induction according to Michael Farady:

$$\vec{E} = \vec{v} \times \vec{B} \tag{2.3.1}$$

Electric field equation:

$$\text{rot}\,\vec{E} = \text{rot}(\vec{v} \times \vec{B}) = (\text{grad}\,\vec{v})\,\vec{B} - (\text{grad}\,\vec{B})\,\vec{v} + \vec{v}\,\text{div}\,\vec{B} - \vec{B}\,\text{div}\,\vec{v} \tag{2.3.2}$$

Magnetic induction:

$$\vec{H} = -(\vec{v} \times \vec{D}) \tag{2.3.3}$$

Magnetic field equation:

$$\text{rot}\,\vec{H} = \text{rot}(\vec{v} \times \vec{D}) = -(\text{grad}\,\vec{v})\,\vec{D} + (\text{grad}\,\vec{D})\,\vec{v} - \vec{v}\,\text{div}\,\vec{D} + \vec{D}\,\text{div}\,\vec{v} \tag{2.3.4}$$

Angular momentum:

$$\vec{L} = \vec{r} \times \vec{p} \tag{2.3.5}$$

Total angular momentum:

$$\vec{L}_G = \Sigma_i(\vec{r}_i \times \vec{p}_i) \tag{2.3.6}$$

Overall focus:

$$\vec{R} = \frac{(m_1 \cdot |\vec{r}_1| + m_2 \cdot |\vec{r}_2|)}{(m_1 + m_2)} \cdot \hat{r} \tag{2.3.7}$$

Law of gravitation:

$$\vec{F}_G = G \cdot \frac{(m_1 \cdot m_2)}{|\vec{r}|^2} \cdot \hat{r} \tag{2.3.8}$$

Force equation:

$$\vec{F} = (\vec{k} \circ \vec{v}) \times \vec{p} = (\vec{k} \circ \vec{v}) \times m\vec{v} = m((\vec{k} \circ \vec{v}) \times \vec{v}) \tag{2.3.9}$$

Force field equation:

$$\operatorname{rot} \vec{F} = (\operatorname{grad}(m\vec{k} \circ \vec{v}))\vec{v} - (\operatorname{grad} \vec{v})(m\vec{k} \circ \vec{v}) + (m\vec{k} \circ \vec{v}) \operatorname{div} \vec{v} - \vec{v} \operatorname{div}(m\vec{k} \circ \vec{v}) \tag{2.3.10}$$

Impulse from quantum mechanics:

$$\vec{p} = \hbar \vec{k} \tag{2.3.11}$$

Relationship between electric field strength and electric flux density:

$$\vec{D} = \epsilon \vec{E} \tag{2.3.12}$$

Relationship between magnetic field strength and magnetic flux density:

$$\vec{B} = \mu \vec{H} \tag{2.3.13}$$

Magnetic moment:

$$\vec{m} = q\vec{r} \times \vec{v} \tag{2.3.14}$$

Coulomb force:

$$\vec{F}_C = \frac{1}{4\pi\epsilon_0} \cdot \frac{(q_1 \cdot q_2)}{|\vec{r}|^2} \cdot \hat{r} \tag{2.3.15}$$

Lorentz force:

$$\vec{F} = q(\vec{v} \times \vec{B}) \tag{2.3.16}$$

2.3 THE ATOMIC NUCLEUS AND THE PROTON

At the beginning, the atomic nucleus is described here, using the facts known from various experiments. The discovery and study of the atomic nucleus occurred primarily through particle scattering experiments. Ernest Rutherford (1871-1937), conducted the gold foil experiment in 1911, in which he concluded that an atomic nucleus must have a positive electrical charge. In an experiment, Rutherford (1871-1937) and his colleagues Hans Geiger (1882-1945) and Ernest Marsden (1889-1970) found this out by bombarding a thin gold foil with alpha particles. Alpha particles are helium nuclei (4He) that come from a radioactive source. They observed the scattering of alpha particles (4He) by the gold foil. Most alpha particles (4He) passed through the film almost unaffected. However, a small fraction of the alpha particles (4He) were scattered to large angles, and some were even backscattered. The conclusion that emerged was that the positive electric charge and almost all of the mass of an atom are concentrated in a tiny, dense nucleus.

In another experiment conducted by Ernest Rutherford (1871-1937), nitrogen (14N) was also bombarded with alpha particles (4He). Alpha particles (4He) consist of two protons and two neutrons. The reaction that Rutherford observed was that hydrogen (1H) and oxygen (17O) were formed.

The resulting conclusion was that the original nitrogen nucleus absorbs two protons and two neutrons from the alpha particle (4He), but loses one proton. This causes the nitrogen (14N) to become oxygen (17O). The proton knocked out corresponds to the hydrogen nucleus and was identified as hydrogen (1H). Ernest Rutherford (1871-1937) identified the resulting protons through various detection methods, such as the use of scintillation detectors and observation of particle tracks. These experiments confirmed that bombardment of nitrogen (14N) with alpha particles (4He) releases protons.

Since the proton has a charge, the resulting electric field can be described using equation 2.3.1.

$$\vec{E} = \vec{v} \times \vec{B} \tag{2.3.1}$$

In equation 2.3.1, $\vec{E}$ stands for the electric field strength, $\vec{v}$ for the velocity vector and $\vec{B}$ for the magnetic flux density. Equation 2.3.1 also describes the unipolar induction according to Michael Faraday (1791-1867), which has already been discussed in detail in the paper "The reinterpretation of the 'Maxwell equations'[1]".

Several conclusions emerge from Equation 2.3.1. First, it can be concluded that the proton has a magnetic flux density $\vec{B}$ that is oriented perpendicular to the positive electric field strength $\vec{E}$. The velocity vector $\vec{v}$ provides information that something is moving in the proton construct. Since the proton is a point-shaped structure, a further conclusion is that the velocity vector field $\vec{v}$ does not describe a rectilinear movement, but that it is a rotational movement. This means that a positive rotating electric charge creates a magnetic field and thus also a magnetic moment $\vec{m}$.

In addition to the positive electrical charge, the proton has a mass m. Since the conclusion has already been made that the proton rotates, it can be further concluded with respect to the mass m that the proton has an angular momentum $\vec{L}$ in addition to the magnetic moment $\vec{m}$. Equation 2.3.5 is the angular momentum equation. In Equation 2.3.5, $\vec{L}$ stands for the angular momentum, $\vec{r}$ for the distance vector to the center of the rotating structure and p for the momentum that combines the mass m with the rotation velocity $\vec{v}$.

$$\vec{L} = \vec{r} \times \vec{p} \quad (2.3.5)$$

Fig. 1 depicts both equation 2.3.1 and equation 2.3.5. A rotating structure is shown there that meets the requirements of both equations 2.3.1 and 2.3.5.

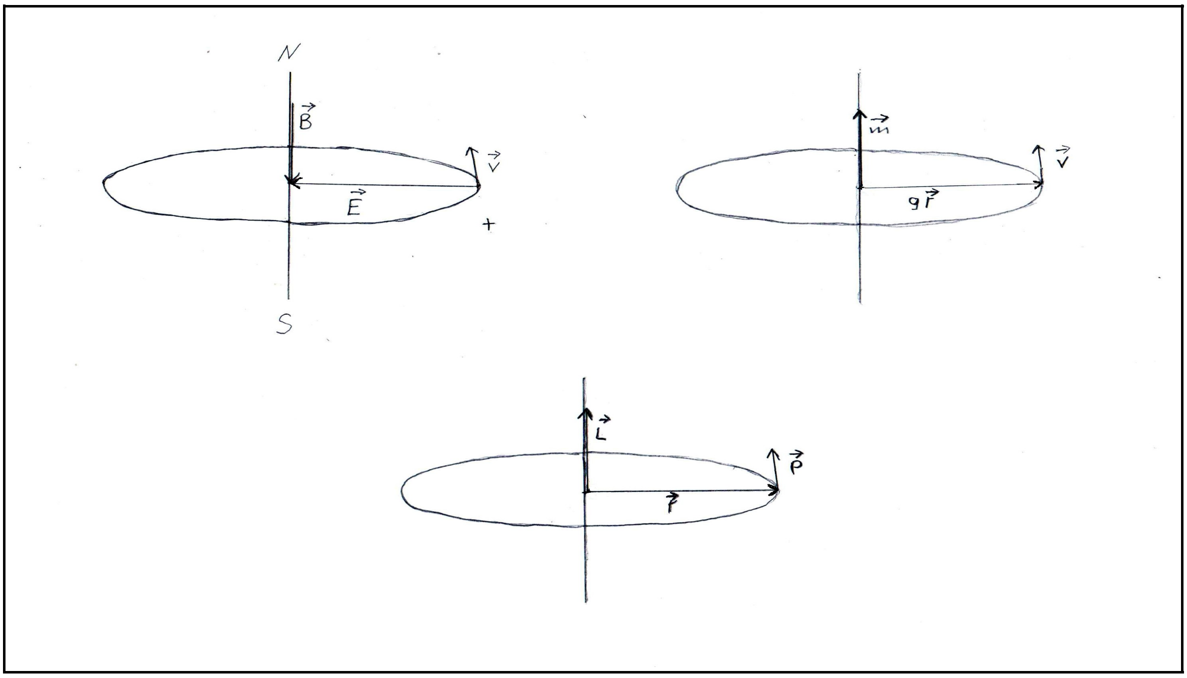


Fig. 1: The Proton; Source: Own representation

In addition to the proton, the atomic nucleus also consists of neutrons. These are discussed in the following chapter.

2.4 THE ATOMIC NUCLEUS AND THE NEUTRON

The neutron was discovered by James Chadwick (1891 - 1974) in 1932. Before the discovery of the neutron, it was known that the nucleus of an atom consisted only of protons, except that the mass of many nuclei was greater than could be explained by the pure number of protons. The conclusion was that there must be an additional component in the atomic nucleus that contributes to the mass but has no charge.
James Chadwick (1891 - 1974) worked at the Cavendish Laboratory at Cambridge University, where he conducted experiments to understand the nature of this additional nuclear component. He was inspired by the work of other scientists such as Irène (1897 - 1956) and Frédéric Joliot-Curie (1900 - 1958), who had observed that beryllium (9Be), when bombarded with alpha particles (4He), emits high-energy radiation . Chadwick then bombarded a beryllium foil with alpha particles (4He) that came from a radium source. He found that beryllium (9Be) emitted highly penetrating radiation under these conditions. To study the nature of this emitted radiation, James Chadwick (1891 - 1974) used a chamber filled with hydrogen and nitrogen gas. The radiation from the beryllium (9Be) struck these gases and produced recoil protons (in the case of hydrogen (1H)) and recoil nuclei (in the case of nitrogen (14N)). James Chadwick (1891 - 1974) measured the energy and range of recoil protons and nuclei. From this analysis of the recoil energy he concluded that the emitted radiation must consist of massive, electrically neutral particles. James Chadwick (1891 - 1974) calculated that these particles had a mass of approximately $1\mathrm{u}$ (atomic mass unit), but could not have an electrical charge. The conclusion was that these electrically neutral particles were actually the previously hypothesized neutrons. His results were presented in a publication in the "Proceedings of the Royal Society", where he confirmed the existence of the neutron.
The discovery of the neutron explained the missing mass m in the atomic nucleus and led to a better understanding of nuclear structure. It made it possible to explain isotopes that have different numbers of neutrons with the same number of protons. Neutrons also play a crucial role in nuclear reactions, including nuclear fission, which led to the development of various concepts related to nuclear energy.
Since an electric charge q has not yet been measured for the neutron, but a negative magnetic moment $\vec{m}$ was detected by Otto Stern (1888 - 1969) in 1933, the conclusion, based

on the proton, is that the neutron has an electric charge q, which is not visible to the outside and corresponds to the electrical charge q of the environment. Based further on the rotary structure (vortex) used in this work, it can be concluded that the proton has an electrical charge q in the center, which falls away towards the outside. Since the direction vector of the rotational velocity $\vec{v}$ of the vortex does not change, the vector of the electric field $\vec{E}$, the electric charge q or the position vector $\vec{r}$ must be negative. However, mathematically it cannot be ruled out that the velocity vector $\vec{v}$ also has a negative sign, which would mean that the neutron has an opposite direction of rotation compared to the proton. This results in a sign change for equation 2.3.14. This creates equation 2.4.1.

$$\vec{m} = q\vec{r} \times \vec{v} \tag{2.3.14}$$

$$-\vec{m} = -(q\vec{r} \times \vec{v}) \tag{2.4.1}$$

In Equations 2.3.14 and 2.4.1, $\vec{m}$ is the magnetic moment, q is the electric charge, $\vec{r}$ is the position vector, and $\vec{v}$ is the velocity. Fig. 2 shows the neutron taking the information mentioned into account.

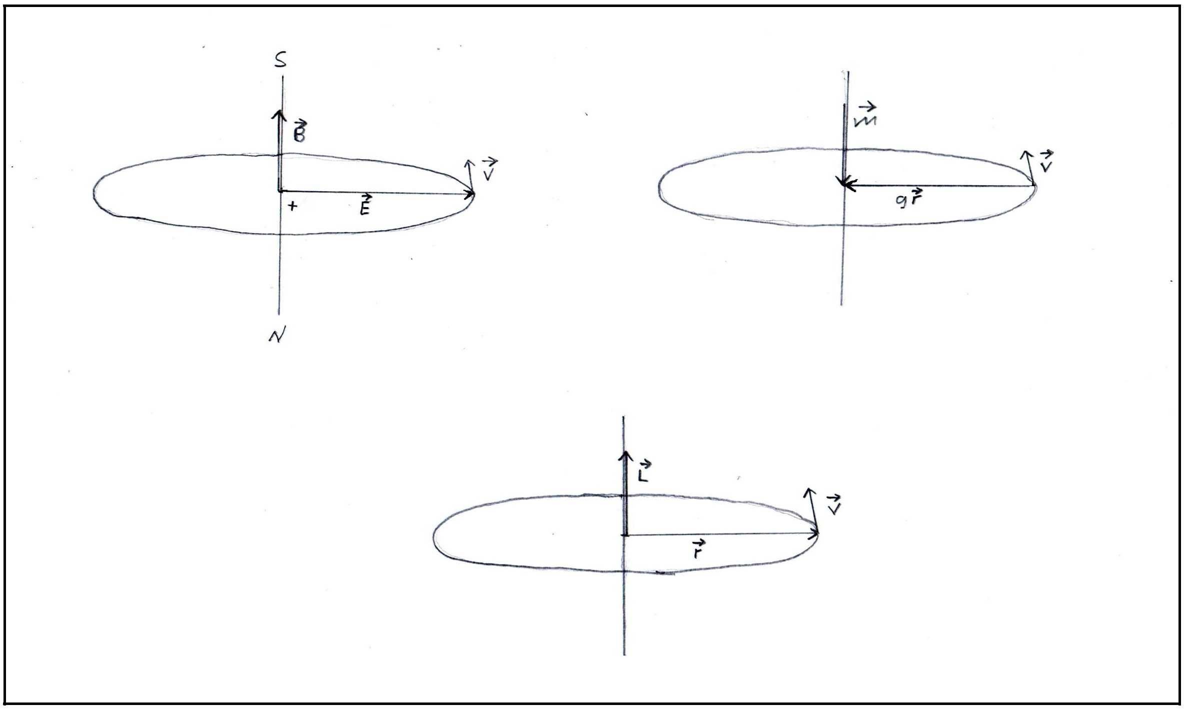


Fig. 2: The Neutron; Source: Own representation

The two equations 2.4.2 and 2.3.5 are also used to calculate the neutron.

$$-\vec{E} = -(\vec{v} \times \vec{B}) \tag{2.4.2}$$

In equation 2.4.2, $\vec{E}$ stands for the electric field strength, $\vec{v}$ for the velocity vector and $\vec{B}$ for the magnetic flux density.

$$\vec{L} = \vec{r} \times \vec{p} \tag{2.3.5}$$

In Equation 2.3.5, $\vec{L}$ stands for the angular momentum, $\vec{r}$ for the distance vector to the center of the rotating structure and $\vec{p}$ for the pulse.
The next chapter looks at the electron. Although this is not part of the atomic nucleus, it is similar to the proton and neutron due to its structure and functioning.

2.5 THE ELECTRON

The electron was discovered by the British physicist Joseph John Thomson (1856 - 1940). He carried out his experiments in 1897 at the Cavendish Laboratory of the University of Cambridge. J.J. Thomson (1856 - 1940) discovered the electron through experiments with cathode rays generated in evacuated glass tubes. These cathode ray tubes are better known as "Crookes tubes". J.J. Thomson (1856 - 1940) studied rays that emanate from the cathode when a high voltage is applied to the electrodes of a "Crookes tube". These rays were called cathode rays. J.J. Thomson (1856 - 1940) studied the deflection of these cathode rays by magnetic and electric fields. He found that the rays were deflected by the fields, which suggested that they consisted of charged particles. By measuring the deflection of the rays in the fields, J.J. Thomson (1856 - 1940) was able to determine the ratio of the electric charge q of the particles to their mass m . He found that this ratio was much larger for the particles in the cathode rays than for known ions, indicating that the particles were either very light or highly charged. Thomson concluded that the cathode rays were made up of tiny particles, which he originally called "corpuscles". These particles later became known as electrons. He found that these particles were much smaller than atoms, which meant that they must be constituents of atoms. The discovery of the electron was one of the most important discoveries in physics. It showed that atoms were not the indivisible building blocks of matter, as was believed at the time, but consisted of even smaller particles. This led to the development of the modern atomic model.

In classical physics, the electron is described as a point particle. Due to the size of the electron, its spatial extent is not measurable. Thomson developed the theory of a spherical structure for the electron. In the case of a spherical construct that has a negative electrical charge, the following description of the electron would be possible: The rotation of a charge in the electron does not take place around a central point but around an axis of rotation. However, the position vector $\vec{r}$ always has the same distance from the center of the axis of rotation. Fig. 3 shows this graphically. A charge can initially be derived from equation 2.3.1, as with the proton. Here, $\vec{E}$ is the electric field strength, $\vec{v}$ is the rotation velocity and $\vec{B}$ is the magnetic flux density.

$$\vec{E} = \vec{v} \times \vec{B} \tag{2.3.1}$$

Unlike the proton, the formulation of equation 2.3.1 must be given a negative sign on both sides of the equation because the charge of the electron is negative. The conclusion from this is that for the electron either the rotational velocity v is negative or the magnetic flux density B. This gives rise to equation 2.5.1 and Fig. 3.

$$-\vec{E} = -(\vec{v} \times \vec{B}) \tag{2.5.1}$$

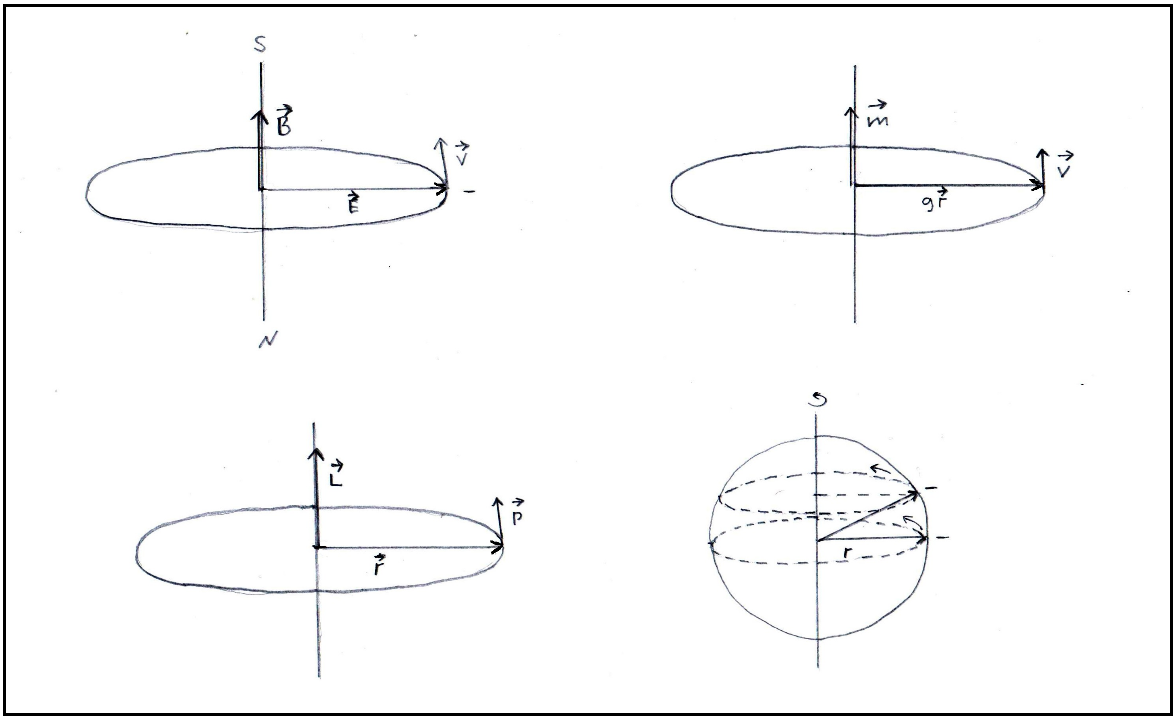


Fig. 3: The Electron; Source: Own representation

The rotation of the charge q with the distance $\vec{r}$ and the velocity $\vec{v}$ results in a magnetic moment $\vec{m}$ for the electron. This is expressed in equation 2.3.14.

$$\vec{m} = q\vec{r} \times \vec{v} \tag{2.3.14}$$

Since the electron also has a mass m, the rotation also creates an angular momentum $\vec{L}$. This is created from a rotating momentum $\vec{p}$ and a distance vector $\vec{r}$ to the center of rotation. The angular momentum $\vec{L}$ is formulated in equation 2.3.5 and shown in Fig. 3.

$$\vec{L} = \vec{r} \times \vec{p} \tag{2.3.5}$$

In the following chapter, the three parts of the atom are contrasted and compared.

2.6 ANALOGY OF PROTON, NEUTRON AND ELECTRON

Since the three atomic components proven by experiments have now been explained in this paper and have a common shape, they can also be compared with each other. All three components are obviously subject to a rotating motion, which, with an electric charge q, leads to a magnetic moment $\vec{m}$ and an electric field $\vec{E}$. Since all three components also have a mass m, the rotation also entails an angular momentum $\vec{L}$.
Ernest Rutherford (1871-1937) determined some basic properties of the atomic nucleus, such as size, mass and charge. Table 1 clearly shows the most important findings about these three components, but not all of this information comes from Ernest Rutherford (1871-1937).

	Proton	Neutron	Elektron
Masse:	1.6726219×10^{-27} kg	1.6749275×10^{-27} kg	9.10938356×10^{-31} kg
el. Ladung:	1.602×10^{-19} C	0 C	-1.602×10^{-19} C
Ausdehnung:	0.84×10^{-15} m	0.8×10^{-15} m	$<10^{-18}$ m
Energie:	938.272 MeV	939.565 MeV	0.511 MeV
magn. Moment:	1.410606×10^{-26} J/T	-9.662365×10^{-27} J/T	-9.284764×10^{-24} J/T

Tab. 1: Comparison of core components; Source: Own representation

2.7 THE CONVENTION OF ABOVE AND BOTTOM

Niels Bohr (1885 - 1962) extended the atomic model of Ernest Rutherford (1871 -1937) by introducing quantized electron orbits around the nucleus in 1913 to explain the stability of atoms and the emission spectra of hydrogen.

In summary, it can be assumed that the atomic nucleus has a mass m , a positive electrical charge q and is centered in the atom. It consists of protons and neutrons. Electrons orbit the nucleus. In the paper "The reinterpretation of the Stern Gerlach experiment[3]" it was described that the atom must have a convention as to where "up" and "down" are. Therefore, it is assumed at this point that the atomic nucleus must have a rotation of its own, which is due to the combined angular momentum $\vec{L}_G$ of the neutrons and protons. How this leads to a convention as to where "up" and "down" are and what causes the rotation of the nucleus is explained below.

Fig. 4 shows the atomic nucleus, according to the known information. The total angular momentum $\vec{L}_G$ of the atomic nucleus can be described mathematically and physically by equation 2.3.6. The equation shows the total angular momentum $\vec{L}_G$ which consists of the angular momenta of the protons and neutrons in the nucleus.

$$\vec{L}_G = \Sigma_i (r_i \times p_i) \qquad (2.3.6)$$

From the total angular momentum $\vec{L}_G$ in the atomic nucleus it follows that the atomic nucleus has its own rotation. The calculation of the angular momenta of the proton and neutron has already been done in chapters 2.3 and 2.4. The total angular momentum of the atomic nucleus $\vec{L}_G$ is then the logical consequence of the fact that almost the entire mass m of the atom is concentrated in the atomic nucleus. Because the proton and neutron have different masses, an overall center of gravity $\vec{R}$ results for the atomic nucleus, to which the total angular momentum $\vec{L}_G$ is aligned. The calculation of this overall center of gravity R is shown in equation 2.3.7.

$$\vec{R} = \frac{(m_1 \cdot |\vec{r}_1| + m_2 \cdot |\vec{r}_2|)}{(m_1 + m_2)} \cdot \hat{r} \qquad (2.3.7)$$

In equation 2.3.7, r_1 and r_2 are the positions of the two masses m_1 and m_2 . Both masses and positions refer to the nuclear elements (protons, neutrons). If the masses are equal, the overall center of gravity $\vec{R}$ is exactly in the middle of the two positions, otherwise the overall center of gravity $\vec{R}$ is on the line that connects both objects, closer to the heavier object. This gives the atomic nucleus its stability. The overall center of gravity $\vec{R}$ changes accordingly with the increase in additional protons and neutrons. These relationships are shown in Fig. 4.

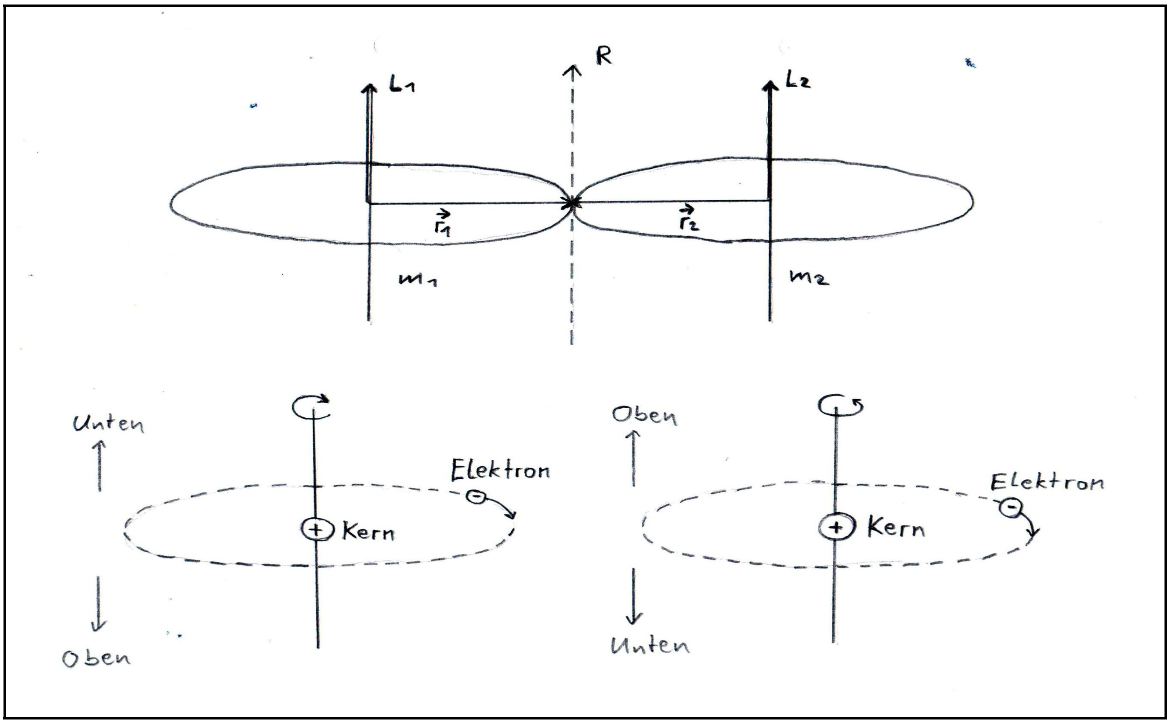


Fig.4: Top and bottom; Source: Own representation

In summary, a convention arises that the atom must have an "up" and a "down" from the direction of rotation of the atomic nucleus in combination with the direction of rotation of the electron around the atomic nucleus. If the atomic nucleus rotates in one direction and the electron rotates in the opposite direction around the atomic nucleus, the convention of up and down is different than if both the atomic nucleus and the electron rotate in the same direction. The rotation of the elements of the atomic nucleus results from its total angular momentum $\vec{L}_G$ and its total center of gravity $\vec{R}$.

2.8 NUCLEAR GRAVITATION

Since the atomic nucleus has a very high mass m compared to the electron, its rotation can be explained by the angular momentum $\vec{L}$. To explain the nuclear gravitational force $\vec{F}_K$, Newton's law of gravitation is used due to the mass at this point. The two objects with mass (proton / neutron) attract each other due to the gravitational force $\vec{F}_K$. The gravitational force between two masses m_1 and m_2 is given by equation 2.3.8.

$$\vec{F}_G = G \cdot \frac{(m_1 \cdot m_2)}{|\vec{r}|^2} \cdot \hat{r} \tag{2.3.8}$$

$$\hat{r} = \frac{\vec{r}}{|\vec{r}|} \tag{2.8.1}$$

Where G is the gravitational constant and $\vec{r}$ is the distance between centers of gravity of the two masses m_1 and m_2. Since both protons and neutrons have a mass m, Newton's law of gravity is also applicable here. At the beginning of this paper, it was mentioned that the particles of the atom are interpreted as vortex structures in a medium. This also means that there is the possibility that masses influence this medium, in the sense that masses create a potential difference in the medium. This potential difference is therefore responsible for the attraction between the masses. When combining the nuclear forces, the masses of the nuclear elements will play a role in the following chapters.

2.9 THE ELECTROMAGNETIC FORCE

The electromagnetic force, also known as the Coulomb force $\vec{F}_C$, is the force between electrically charged particles. In the atomic nucleus, the protons are positively charged, while neutrons are electrically neutral on the outside. Since protons are positively charged, they repel each other due to the Coulomb force $\vec{F}_C$. This repulsion decreases with the square of the distance between the protons. Analogous to the law of gravitation 2.3.8, the formulation from equation 2.3.15 applies to the Coulomb force $\vec{F}_C$.

$$\vec{F}_C = \frac{1}{4\pi\epsilon_0} \cdot \frac{(q_1 \cdot q_2)}{|\vec{r}|^2} \cdot \hat{r} \tag{2.3.15}$$

$$\hat{r} = \frac{\vec{r}}{|\vec{r}|} \qquad (2.8.1)$$

Where q_1 and q_2 are the charges of the two protons, r is the distance between the centers of gravity of these protons, and ϵ_0 describes the permittivity of the vacuum. The electromagnetic force F_C has an unlimited range, but decreases sharply with increasing distance to the outer boundary of the particle. Since the protons are very close to each other, the repulsive force between them is enormous. The repulsion of the protons is probably overcome by the strong nuclear force, or strong interaction. If the atomic nucleus becomes too large, the Coulomb force can outweigh the strong interaction, leading to instability and radioactive decay to achieve a more stable ratio of protons to neutrons.

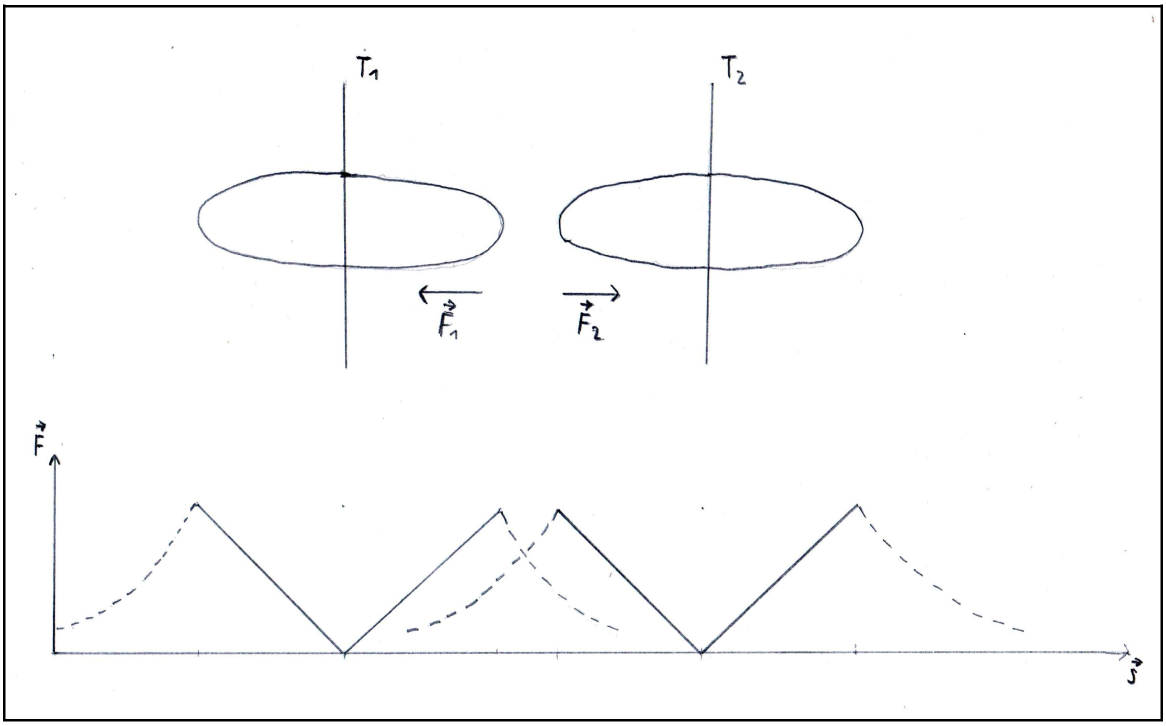
2.10 THE STRONG AND WEAK NUCLEAR FORCE

In a scenario where protons and neutrons are considered as vortex structures in a medium and this medium is influenced by mass potential differences, it can be assumed that these potential differences create an attractive force between the vortices.

In this model, which considers protons and neutrons as vortex structures in this medium, the concepts of the strong and weak nuclear forces could potentially be placed on a common basis. The strong nuclear force could be described by the direct attraction between vortices that occurs due to potential differences and the properties of the medium. This attraction would be extremely strong but limited to very short distances, similar to the real strong interaction. This interaction would be primarily responsible for holding the vortices (protons and neutrons) together in the nucleus.

The weak interaction could be described by additional but weaker modulations of the potential differences, possibly depending on the configuration of the vortices or the interplay of their flow fields. These modulations could cause the vortex structures to change slightly under certain conditions, which would correspond to a conversion between particles (similar to beta decay).

Both forces in this model could be based on the interaction of vortex structures influenced by potential differences in the medium. The potential differences in the medium could be caused by the mass m of the vortices (proton/neutron) themselves and their rotation. This would create a common physical basis for both forces based on the nature of the medium and the potential differences present in it. The strong interaction could be described by very intense, short-range potential differences, while the weak interaction could be caused by weaker and possibly longer-range potential differences or by additional effects (such as vortex transformations). The challenge is to design the model in such a way that it reconciles the extremely different strengths and ranges of the strong and weak interactions. This requires that the model operates differently on different scales or that additional mechanisms are introduced to explain the differences. This would mean that a single mechanism can explain both the strong binding effect of the strong nuclear force and the processes of the weak nuclear force. This can be achieved through the described complex interaction of the vortex structures and the potential differences. Fig. 5 shows the model in graphic form.



Fig, 5: Proton / Neutron in the medium; Source: Own representation

Calculating the hypothetical unification of strong and weak interactions under the assumption that protons and neutrons exist as vortex structures in a medium influenced by potential differences is a complex task, but several approaches exist.

First, an equation for a vortex structure in the medium is sought. Since this equation has already been established in the previous chapters for both the angular momentum $\vec{L}$ and the electric field $\vec{E}$, an equation can be formulated by analogy that is linked to an unknown physical quantity. First, a force $\vec{F}_M$ is sought in the medium that ensures that the vortex (proton / neutron) does not decay. What is also necessary for rotation is the velocity vector $\vec{v}$. What is sought is an unknown quantity ϕ that describes a vector that can be calculated with the velocity vector $\vec{v}$ in the cross product so that the force $\vec{F}_M$ is created. Equation 2.10.1 shows this connection.

$$\vec{F}_M = \phi \times \vec{v} \tag{2.10.1}$$

The unknown physical quantity ϕ results from the physical units for the force $\vec{F}_M$ and the velocity vector $\vec{v}$. The physical unit for the force $\vec{F}_M$ is $\frac{kg \cdot m}{s^2}$ and for the velocity $\vec{v}$ it is $\frac{m}{s}$. If these two physical quantities are calculated with one another, the physical unit $\frac{kg}{s}$ results for the physical quantity ϕ. Since this physical unit is dimensionless, but a vector is being sought, a physical unit that describes a vector quantity must be added. The simplest physical quantity that can be used to meet this requirement is the distance $\vec{s}$ with the physical unit m. If this physical unit is calculated with the physical unit of ϕ without changing the resulting equation, the physical expression $\frac{kg}{s} \cdot \frac{m}{m}$ is created. If this expression is reformulated, a new expression is created for ϕ, namely $\frac{kg \cdot m}{s} \cdot \frac{1}{m}$. The first part of this expression, i.e. $\frac{kg \cdot m}{s}$, corresponds to the physical quantity of the impulse $\vec{p}$. The second part of the expression, i.e. $\frac{1}{m}$, corresponds to the wave vector $\vec{k}$. This results in equation 2.10.2 and this relationship is illustrated in Fig. 6.

$$\vec{F}_M = \left(\vec{k} \circ \vec{p}\right) \times \vec{v} \tag{2.10.2}$$

If the wave vector $\vec{k}$ is defined as a vector, it can be calculated with the momentum $\vec{p}$ using the Hadamard product. The result is a common vector, the result of which is the multiplication of the directional components of the two vectors $\vec{k}$ and $\vec{p}$.

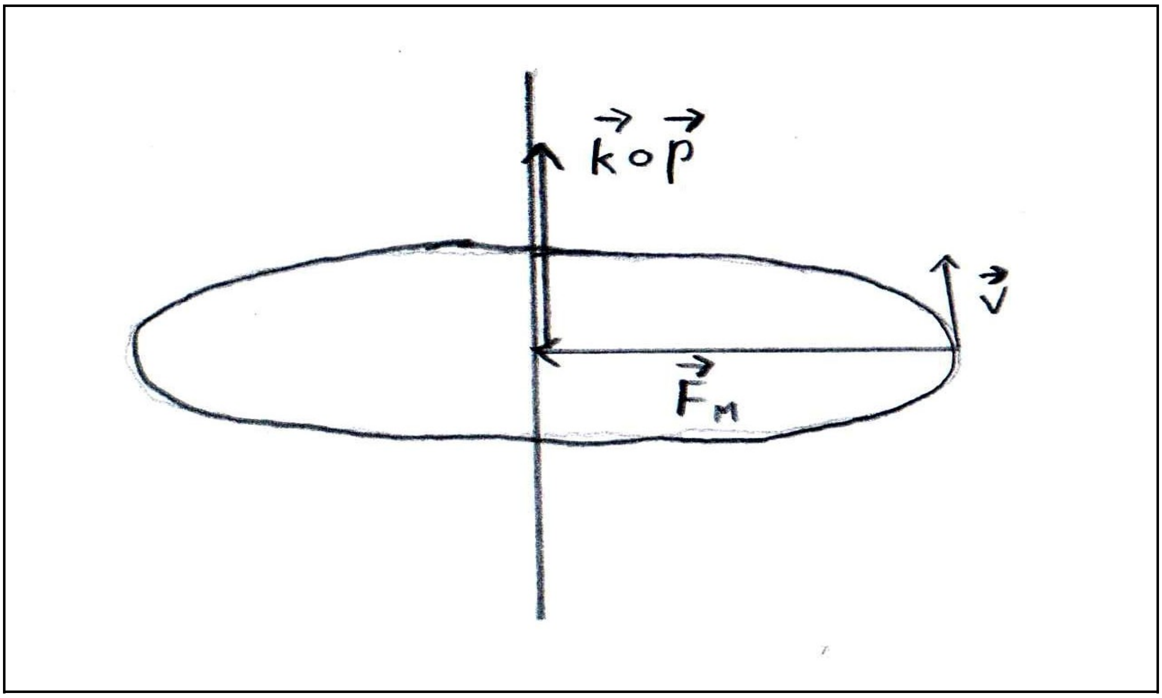


Fig. 6: Vortex / Force in the medium; Source: Own representation

The resulting force $\vec{F}_M$ is equivalent to the centripetal force and holds the atomic nucleus or the atomic nucleus elements together. This also results in an equally large counterforce $\vec{F}_\varphi$ that counteracts the force $\vec{F}_M$. This leads to the conclusion that this counterforce F_φ is realized by the medium. This counterforce can be the cause of the strong and weak nuclear force.

The wave vector $\vec{k}$ and its meaning are described in more detail in chapter 2.11. To investigate the rotational ability of the vortex structure in the medium, the rot -operator is now applied to equation 2.10.2. This results in equation 2.3.10. In this equation, the momentum $\vec{p}$ is divided again into the velocity vector $\vec{v}$ and the mass m. The expression $m\vec{k}\circ\vec{v}$ is therefore equivalent to the expression $\vec{k}\,\vec{p}$.

$$\mathrm{rot}\,\vec{F}_M=\left(\mathrm{grad}\left(m\vec{k}\circ\vec{v}\right)\right)\vec{v}-\left(\mathrm{grad}\,\vec{v}\right)\left(m\vec{k}\circ\vec{v}\right)+\left(m\vec{k}\circ\vec{v}\right)\mathrm{div}\,\vec{v}-\vec{v}\,\mathrm{div}\left(m\vec{k}\circ\vec{v}\right) \qquad (2.3.10)$$

Equation 2.3.10 results in five terms with which direct forces, shear forces, potential differences and all effects of the velocity vector field of the medium on the vortex structures can be calculated. The term $\mathrm{rot}\,\vec{F}_M$ indicates the extent to which the medium rotates, the velocity gradient $\mathrm{grad}\,\vec{v}$ is a measure of the deformation of the medium, the momentum gradient in combination with the wave vector $\mathrm{grad}\left(m\vec{k}\circ\vec{v}\right)$ indicates how the wave vector (and thus the wavelength, propagation direction and phase velocity) changes depending on the location, the velocity divergence $\operatorname{div}\vec{v}$ indicates how the volume of a medium element (e.g. a small liquid or gas mass) changes as it moves through a velocity field. The momentum divergence in combination with the wave vector $\operatorname{div}(m\vec{k}\circ\vec{v})$ describes the spatial variation of waves and the associated momentum flow.

In equation 2.3.10, two terms are mathematically connected to each other. The terms $(\operatorname{grad}(m\vec{k}\circ\vec{v}))\vec{v}$ and $\vec{v}\operatorname{div}(m\vec{k}\circ\vec{v})$ via equation 2.10.3 on the one hand and the terms $(\operatorname{grad}\vec{v})(m\vec{k}\circ\vec{v})$ and $(m\vec{k}\circ\vec{v})\operatorname{div}\vec{v}$ via equation 2.10.4 on the other.

$$(\mathrm{Sp})\operatorname{grad}(m\vec{k}\circ\vec{v}) = \operatorname{div}(m\vec{k}\circ\vec{v}) \tag{2.10.3}$$

$$(\mathrm{Sp})\operatorname{grad}(\vec{v}) = \operatorname{div}(\vec{v}) \tag{2.10.4}$$

According to the model used in this paper, these five terms could describe the strong and weak nuclear forces in combination. The mathematical calculation of the four related terms is given below in equations 2.10.5, 2.10.6, 2.10.7 and 2.10.8.

$$(\operatorname{grad}\vec{v})(m\vec{k}\circ\vec{v}) = \begin{pmatrix} \frac{\delta v_x}{\delta x} & \frac{\delta v_x}{\delta y} & \frac{\delta v_x}{\delta z} \\ \frac{\delta v_y}{\delta x} & \frac{\delta v_y}{\delta y} & \frac{\delta v_y}{\delta z} \\ \frac{\delta v_z}{\delta x} & \frac{\delta v_z}{\delta y} & \frac{\delta v_z}{\delta z} \end{pmatrix} \begin{pmatrix} m k_x \cdot v_x \\ m k_y \cdot v_y \\ m k_z \cdot v_z \end{pmatrix} = \begin{pmatrix} (m k_x v_x)\frac{\delta v_x}{\delta x} + (m k_y v_y)\frac{\delta v_x}{\delta y} + (m k_z v_z)\frac{\delta v_x}{\delta z} \\ (m k_x v_x)\frac{\delta v_y}{\delta x} + (m k_y v_y)\frac{\delta v_y}{\delta y} + (m k_z v_z)\frac{\delta v_y}{\delta z} \\ (m k_x v_x)\frac{\delta v_z}{\delta x} + (m k_y v_y)\frac{\delta v_z}{\delta y} + (m k_z v_z)\frac{\delta v_z}{\delta z} \end{pmatrix} \tag{2.10.5}$$

$$(m\vec{k}\circ\vec{v}) \operatorname{div} \vec{v} = \begin{pmatrix} (m k_x v_x)(\frac{\delta v_x}{\delta x} + \frac{\delta v_y}{\delta y} + \frac{\delta v_z}{\delta z}) \\ (m k_y v_y)(\frac{\delta v_x}{\delta x} + \frac{\delta v_y}{\delta y} + \frac{\delta v_z}{\delta z}) \\ (m k_z v_z)(\frac{\delta v_x}{\delta x} + \frac{\delta v_y}{\delta y} + \frac{\delta v_z}{\delta z}) \end{pmatrix} \tag{2.10.6}$$

$$\operatorname{grad}(m\vec{k}\circ\vec{v})\vec{v} = \begin{pmatrix} \frac{\delta(m k_x v_x)}{\delta x} & \frac{\delta(m k_x v_x)}{\delta y} & \frac{\delta(m k_x v_x)}{\delta z} \\ \frac{\delta(m k_y v_y)}{\delta x} & \frac{\delta(m k_y v_y)}{\delta y} & \frac{\delta(m k_y v_y)}{\delta z} \\ \frac{\delta(m k_z v_z)}{\delta x} & \frac{\delta(m k_z v_z)}{\delta y} & \frac{\delta(m k_z v_z)}{\delta z} \end{pmatrix} \begin{pmatrix} v_x \\ v_y \\ v_z \end{pmatrix} = \begin{pmatrix} v_x\frac{\delta(m k_x v_x)}{\delta x} + v_y\frac{\delta(m k_x v_x)}{\delta y} + v_z\frac{\delta(m k_x v_x)}{\delta z} \\ v_x\frac{\delta(m k_y v_y)}{\delta x} + v_y\frac{\delta(m k_y v_y)}{\delta y} + v_z\frac{\delta(m k_y v_y)}{\delta z} \\ v_x\frac{\delta(m k_z v_z)}{\delta x} + v_y\frac{\delta(m k_z v_z)}{\delta y} + v_z\frac{\delta(m k_z v_z)}{\delta z} \end{pmatrix} \tag{2.10.7}$$

$$\vec{v}\ \operatorname{div}\,(m\vec{k}\circ\vec{v}) = \begin{pmatrix} v_x(\frac{\delta(m k_x v_x)}{\delta x} + \frac{\delta(m k_y v_y)}{\delta y} + \frac{\delta(m k_z v_z)}{\delta z}) \\ v_y(\frac{\delta(m k_x v_x)}{\delta x} + \frac{\delta(m k_y v_y)}{\delta y} + \frac{\delta(m k_z v_z)}{\delta z}) \\ v_z(\frac{\delta(m k_x v_x)}{\delta x} + \frac{\delta(m k_y v_y)}{\delta y} + \frac{\delta(m k_z v_z)}{\delta z}) \end{pmatrix} \tag{2.10.8}$$

The resulting term, i.e. $\operatorname{rot}((m\vec{k}\circ\vec{v})\times\vec{v})$, consists of a vectorial addition of equations 2.10.5, 2.10.6, 2.10.7 and 2.10.8. At this point, it should be noted that this set of equations is to be viewed as analogous to the newly formulated "Maxwell equations" from the paper "The reinterpretation of the 'Maxwell equations'[1]". In addition, this set of equations is analogous to the Navier-Stokes equations. This connection is explained in the paper "Mathematical-Physical Approach to Prove that the Navier-Stokes Equations Provide a Correct Description of Fluid Dynamics[5]". It follows that equations 2.2.1 and 2.2.2 form the mathematical basis for the calculation of all media such as liquids, gases and/or fields.

$$\vec{c}=\vec{a}\times\vec{b}=\begin{pmatrix} a_y b_z - a_z b_y \\ a_z b_x - a_x b_z \\ a_x b_y - a_y b_x \end{pmatrix} \tag{2.2.1}$$

$$\operatorname{rot}\vec{c}=\operatorname{rot}(\vec{a}\times\vec{b})=(\operatorname{grad}\vec{a})\vec{b}-(\operatorname{grad}\vec{b})\vec{a}+\vec{a}\operatorname{div}\vec{b}-\vec{b}\operatorname{div}\vec{a} \tag{2.2.2}$$

In Chapter 2.11, according to the model used in this paper, the atomic nuclear forces are brought together taking into account equations 2.2.1 and 2.2.2.

2.11 SUMMARY OF ATOMIC NUCLEAR FORCES

For the proton and the neutron, a rotary structure within a medium is mathematically assumed in this paper, which has several physical consequences. First, an electric field $\vec{E}$ is generated from a magnetic flux density $\vec{B}$. This is shown in equation 2.3.1. This and the fact that both the proton and the neutron have a magnetic moment $\vec{m}$ leads to the conclusion that both the neutron and the proton have an electric charge q that is subject to rotation. This electric charge q establishes the relationship to the electromagnetic force, or Coulomb force $\vec{F}_C$. This relationship is formulated in equation 2.3.15. The assumed rotation also applies to the mass m . The mass m establishes the relationship to the law of gravitation. This is shown in equation 2.3.8.

Since in this work a rotating structure (vortex) is assumed for the proton and the neutron within a medium, equation 2.3.9 can be derived based on equation 2.3.1. Equation 2.3.9 initially only formulates the force that the rotating structure (vortex) creates. If the rot - operator is now applied to equation 2.3.9, equation 2.3.10 is created. Equation 2.3.10 can now be used to describe the force field that emanates from the proton and/or the neutron. The strong and weak nuclear forces can be derived from equation 2.3.10.

$$\vec{E} = \vec{v} \times \vec{B} \qquad (2.3.1)$$

$$\vec{F}_C = \frac{1}{4\pi\epsilon_0} \cdot \frac{(q_1 \cdot q_2)}{r^2} \qquad (2.3.15)$$

$$\vec{F}_G = G \cdot \frac{(m_1 \cdot m_2)}{r^2} \qquad (2.3.8)$$

:

$$\vec{F} = (\vec{k} \circ \vec{v}) \times \vec{p} \;\; (\vec{k} \circ \vec{v}) \times m\vec{v} = m(\vec{k} \circ \vec{v}) \times \vec{v} \qquad (2.3.9)$$

$$\mathrm{rot}\,\vec{F} = (\mathrm{grad}(m\vec{k} \circ \vec{v}))\vec{v} - (\mathrm{grad}\,\vec{v})(m\vec{k} \circ \vec{v}) + (m\vec{k} \circ \vec{v})\,\mathrm{div}\,\vec{v} - \vec{v}\,\mathrm{div}(m\vec{k} \circ \vec{v}) \qquad (2.3.10)$$

The rotation of mass m and electric charge q around a common axis of rotation within a medium brings together all known atomic nuclear forces. Fig. 7 shows this summary.

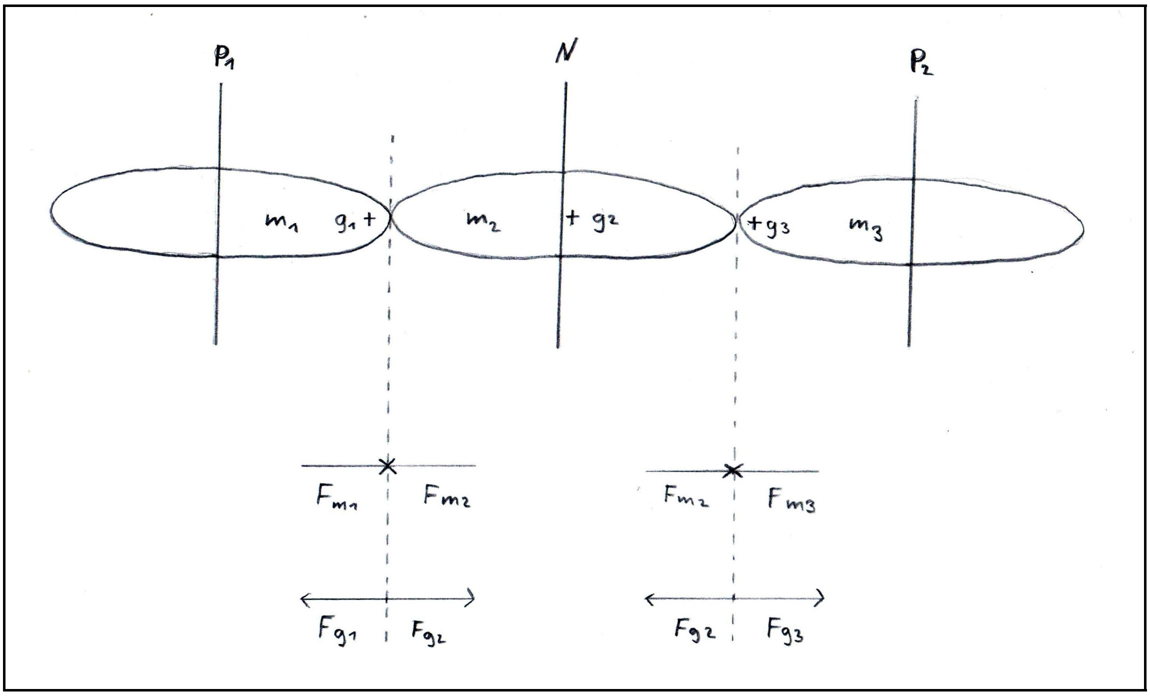


Fig. 7: Summary of nuclear forces; Source: Own representation

A mutual attraction of vortices in the medium takes place due to the flow fields that are located through the vortex, outside its rotation boundary. The dynamics that come with these flow fields in combination with density changes and deformations, as described by equation 2.3.10 and shown in Fig. 7, brings together the forces acting on the nucleus. This means that the nuclear forces must also be interpreted together.

Another fact can be derived from the rotating structure (vortex) within a medium, which also contributes to the stabilization of the forces in the atomic nucleus. If two protons or neutrons have the same rotation speed and energy, they can combine to form a ring vortex. The description of such ring vortexes can be found in Chapter 2.12. If such ring vortices form in the medium, they also contribute to the forces in the atomic nucleus.

2.12 THE RING VERTEBRA

Under the assumed conditions that protons and neutrons exist as vortex structures in a medium and are influenced by potential differences in the medium, ring vortices that form between these particles could play a potentially central role in the dynamics of the interactions. These ring vortices could serve as mediators of the interaction between protons, neutrons and electrons. They could connect the flow fields of the proton and neutron vortices and thus generate an additional force that binds the particles together. The ring vortex could enhance or modulate the interaction by distributing the energy or momentum between the vortex-like structures in the medium (protons and neutrons). These dynamics could lead to an effective force that keeps protons and neutrons in a stable configuration. The ring vortex connections could help stabilize the atomic nucleus by balancing and distributing the flow energy within the atomic nucleus. They could prevent the strong attractive forces of the protons and neutrons from causing collapse by forming a kind of "buffer" between them. Ring vortices could also play a role in dampening fluctuations in the vortex dynamics by allowing energy redistributions in the nucleus, thus ensuring a more homogeneous distribution of forces. If ring vortices act as a link between protons and neutrons, they could increase the range and effectiveness of the strong interaction by better coupling and focusing the flow fields of these particles. These ring vortices could also act as a kind of "catalyst" for conversion processes by creating short-term, locally concentrated flow fields that lead to changes in the vortices, similar to the weak interaction. They could serve as a mechanism for the exchange of energy between protons and neutrons. As a pair of particles approaches, the ring vortex could absorb energy and store it in the form of flow fluctuations, which is later released. During periods of unstable nuclear configurations, ring vortices could temporarily store energy and then release it to return the nucleus to a more stable state. In nuclear reactions such as fusion or beta decay, ring vortices could play a role by influencing or facilitating the necessary energy levels so that particles such as protons and neutrons react more efficiently with each other. Due to their dynamic nature, ring vortices could facilitate conversion processes within the nucleus by lowering the energy barriers for certain reactions. Ring vortices could provide a macroscopic analogy to the mediation processes described by exchange bosons in quantum mechanics. They could mediate the conversion of neutrons into protons (and vice versa) through short-term, dynamic effects, similar to the role of the W and Z bosons in the weak interaction. Ring vortices that form between protons and neutrons in a medium could play a key role in mediating and modulating forces within the atomic nucleus. They could act as a binding element, a stabilizing unit, a modulator of the strong and weak interactions, and as a mechanism for energy exchange and storage. These ring vortices could thus contribute to the stability and dynamics of atomic nuclei by influencing the interactions between protons and neutrons in a way that is analogous to the strong and weak nuclear forces.

The calculation of such a ring vortex, which connects particles with equal energy, could be done according to the generally valid mathematical formulation from equation 2.2.9.

$$e^{(jx)} = \cos(x) + j\sin(x) \qquad (2.2.9)$$

Um aus der Gleichung 2.2.9 die Berechnung eines Ringwirbels abzuleiten muss diese jedoch modifiziert werden. Die erste Modifikation bezieht sich auf den Radius der Wirbelstruktur. Dieser wird in die Gleichung 2.2.9 eingebunden und es entsteht die Gleichung 2.12.1.

$$r \cdot e^{(jx)} = a \cdot \cos(x) + jb \cdot \sin(x) \tag{2.12.1}$$

Where r is described by the expression $\sqrt{(a^2+b^2)}$. This is shown in equation 2.12.2.

$$r = \sqrt{(a^2+b^2)} \tag{2.12.2}$$

The components a and b from equation 2.12.1 refer to whether the ring vortex structure describes an ellipse or a circle in cross section. The second modification refers to the expression x in equation 2.12.1, which is replaced by an angle ϕ , which lies between 0° and 360° and a multiplier A , which modulates the wavelength. This modification serves to mathematically express the ring that the vortex describes. This results in equation 2.12.3.

$$r \cdot e^{(j\phi)} = a \cdot \cos(A \cdot \phi) - jb \cdot \sin(A \cdot \phi) \tag{2.12.3}$$

Equation 2.12.3 would be a simple mathematical description of a ring vortex structure. However, this cannot capture and describe points in space. Fig. 8 shows the formulation of equation 2.12.3 in pictorial form.

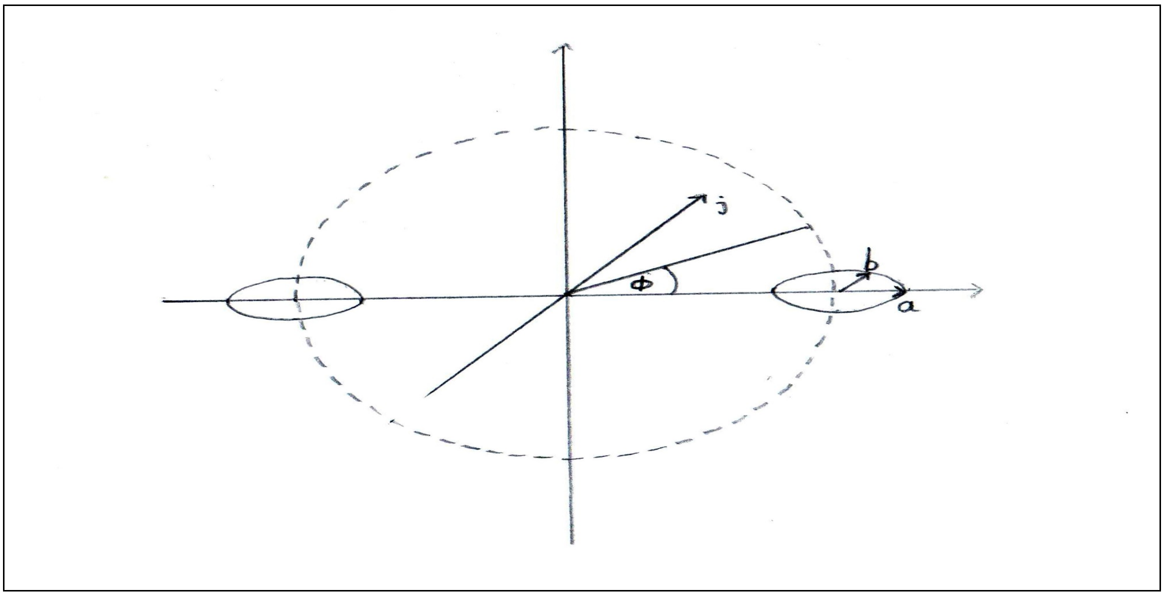


Fig.8: Ring vortex simple model; Source: Own representation

However, there are other approaches to modeling a ring vortex that can capture and describe spatial points. Since this paper generally refers to vector calculations, the following shows a mathematical approach to calculating a ring vortex that is based on vector calculations in the Cartesian coordinate system. To do this, it is first determined how points of the ring vortex structure can be captured and described in space. This is shown in equations 2.12.4, 2.12.5 and 2.12.6.

$$x = (R + r \cdot \cos(\theta))\cos(\phi) \tag{2.12.4}$$

$$y = (R + r \cdot \cos(\theta))\sin(\phi) \tag{2.12.5}$$

$$z = r \cdot \sin(\theta) \tag{2.12.6}$$

In order to fully describe the ring vortex (torus vortex) in a Cartesian coordinate system, both the circular movement in the xy -plane and the toroidal structure in the z -plane must be taken into account. R is the length of the radius of the torus ring, r is the length of the radius to be sought to the point to be sought within the cross section of the ring vortex, θ is the angle in the cross section of the torus and ϕ is the angle of the torus ring around the torus center. The position vector $\vec{r}$ follows from equations 2.12.4, 2.12.5 and 2.12.6. This can precisely define every point in space that belongs to the ring vortex through its description. This is shown in equation 2.12.7.

$$\vec{r} = \begin{pmatrix} (R + r\cos(\theta))\cos(\phi) \\ (R + r\cos(\theta))\sin(\phi) \\ r\sin(\theta) \end{pmatrix} \tag{2.12.7}$$

Equation 2.12.7 is illustrated in Fig. 9.

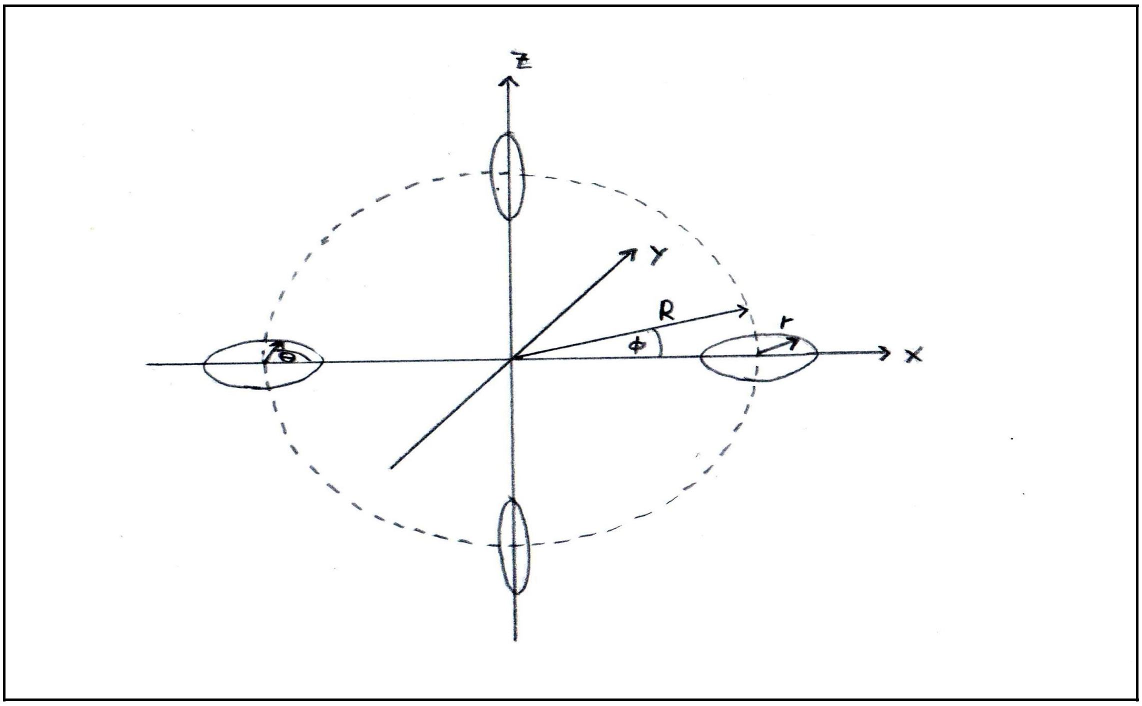


Fig.9: Ring vortex in the vector field; Source: Own representation

The position points inside a torus do not describe the velocity vector field of the torus. The velocity vector field that represents the flow inside the torus should take into account both the circular motion in the yz -plane and the motion of the torus in the xy -plane. Equation 2.12.8 shows this description.

$$\vec{v}(\theta,\phi) = \begin{pmatrix} -\sin(\phi)\cos(\theta) \\ -\sin(\phi)\sin(\theta) \\ \cos(\phi) \end{pmatrix} \cdot f(\theta,\phi) \qquad (2.12.8)$$

The x-component describes the movement in the x-direction, depending on the rotation of the torus in the xy -plane (θ) and the rotation in the cross-section (ϕ). The y -component describes the movement in the y -direction, which also depends on the rotation of the torus (θ) and the angle in the cross-section (ϕ). The z -component describes the movement in the z -direction, which is determined by the rotation of the cross-section of the torus (ϕ).
Das resultierende Vektorfeld erfasst die komplexe Strömungsdynamik eines Ringwirbels in dieser Konfiguration.
The function $f(\theta,\phi)$ in the vector field description of a ring vortex (torus vortex) describes the strength and distribution of the flow velocity in the torus. This function can be designed depending on various factors such as the position in the torus and the physical properties of the medium.

A general form of the function $f(\theta,\phi)$ could take into account the dependence of the velocity on the angles θ and ϕ, as well as on the position in the torus. A simple and physically plausible choice for the function $f(\theta,\phi)$ is formulated in equation 2.12.9.

$$f(\theta,\phi) = v_0 \cdot \sin(\theta) \cdot \sin(\phi) \cdot (1-\frac{r}{R+r\cos(\phi)}) \qquad (2.12.9)$$

Here v_0 is the magnitude of the maximum speed that the medium can reach in the torus. This value is determined by the physical properties of the medium and the external conditions. R is the value of the radius of the torus, r is the value of the radius of the cross section of the torus, ϕ is the angle in the cross section of the torus and θ is the angle describing the position along the torus.

The expression $\sin(\phi)$ ensures that the flow velocity $f(\theta,\phi)$ varies within the cross-section of the torus and is maximum in the center of the cross-section (at $\phi=\frac{\pi}{2}$), while it decreases at the edges of the cross-section (at $\phi=0$ and $\phi=\pi$).

The value provided by $\sin(\theta)$ models the variation of the velocity along the torus (rotation around the center).

The mathematical statement $(1-\frac{r}{R+r\cos(\phi)})$ ensures that the speed varies depending on the distance from the center of the torus. The further away a point is from the center of the torus, the greater the flow speed. This reflects the physical reality that the flow speed is greatest in the center of the torus and decreases towards the outside. Thus, equations 2.12.7, 2.12.8 and 2.12.9 are a sufficient description of a ring vortex structure, even in the velocity vector field.

The next chapter discusses the relationship between the rotational structures in the medium (protons, neutrons and electrons) and the waves they generate, which are described by the wave vector $\vec{k}$.

2.13 THE WAVE-PARTICLE DUALISM

In chapter 2.10, the wave vector $\vec{k}$ was already associated with the rotation of a particle (proton, neutron and electron). This occurs when a mass m rotates with a velocity $\vec{v}$. This is clear from equation 2.3.9.

$$\vec{F} = (\vec{k}\circ\vec{v}) \times \vec{p} = (\vec{k}\circ\vec{v}) \times m\vec{v} = m(\vec{k}\circ\vec{v}) \times \vec{v} \qquad (2.3.9)$$

Aus der Gleichung 2.3.9 kann ebenfalls geschlossen werden, dass der Wellenvektor $\vec{k}$ in Richtung parallel zur Rotationsachse zeigt. Der Wellenvektor $\vec{k}$ ist definiert durch die Gleichung 2.13.1.

$$\vec{k}=\left(\frac{2\pi}{\lambda}\right)\hat{k} \tag{2.13.1}$$

In equation 2.13.1, $\vec{k}$ is the wave vector, π is the number of circles, λ is the wavelength and $\hat{k}$ is the unit vector. This means that the particle describes a wave motion along the axis of rotation during rotation. In the case of an interaction with a medium, this means the generation of a wave in this medium. Since this paper assumes a medium in which particles exist as vortex structures, a vortex structure can be derived for a particle that generates a wave in this medium. This results in a wave-particle duality. Fig. 6 shows these relationships. In the paper "The reinterpretation of the electromagnetic wave equation[4]", the calculation of waves is referred to mathematically and physically.

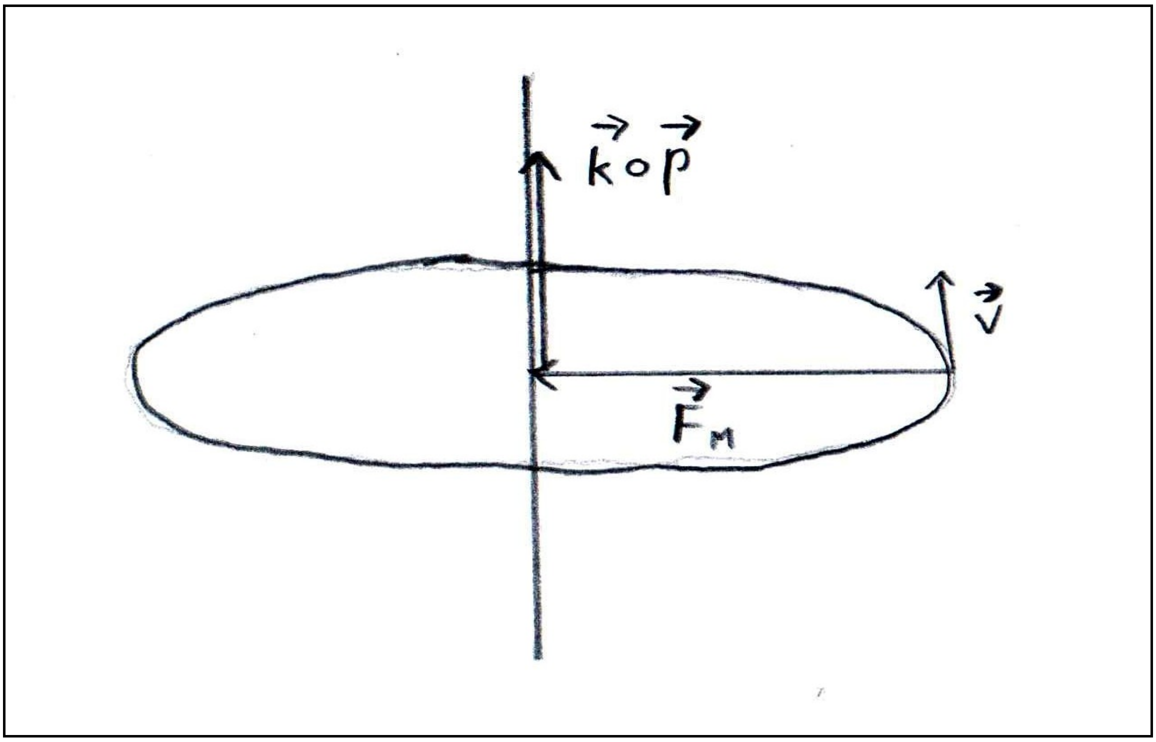


Fig. 6: Vortex / Force in the medium; Source: Own representation

3. DISCUSSION

1. Apart from the facts presented in this paper, are there other possibilities than a rotary structure to bring together magnetic moment, force, angular momentum and electromagnetic field?

2. Would spacetime curvature be superfluous if the medium described in this paper filled the space, since in this medium both divergences and gradients are used for calculation?

3. What significance would the ring vortices described in this paper have in bringing together the atomic nuclear forces and in positioning the electrons orbiting the nucleus?

4. What implications does the situation presented in this paper have for the theory of wave-particle duality?

5. What impact does the situation presented in this paper have on the physical subfield of quantum mechanics in general?

6. Are there other areas of physics that are influenced by the issues presented in this paper and if so, which ones and how?

4. CONCLUSION

In summary, the model of the proton, neutron and electron as a vortex-like structure in a medium that has both mass and charge is able to unite the five nuclear forces and is also able to explain the wave-particle duality. An explanation for a convention of "up" and "down" was also shown by the model presented here.
The logical conclusion that ring vortices form in the medium between particles with the same energy is the innovation that emerges from the assumptions of this paper. The ring vortex structure therefore ensures a balance of forces and energy that holds both the external and internal structure of the atomic nucleus together.
Furthermore, the wave vector $\vec{k}$ could be clearly defined through the rotary structure. This shows that the particle generates a wave during its rotation.
The question remains open as to how exactly the medium in which these processes take place

is defined and what precise properties it has. From a mathematical point of view, both distortions and density states play a role here. This also means that space is not empty, but must be filled with this medium.
The facts and conclusions presented in this paper provide a sufficient explanation for all physical processes surrounding atomic particles. This raises questions about other areas of physics.

5. CONFLICTS OF INTEREST

The author(s) declare that no conflict of interest exists regarding the publication of this article.

6. PROOF OF FINANCING

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