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On the Origin of Magnetism and Gravitation and on the Nature of Electricity and Matter

Hans-Joerg Hochecker*

Donaustr. 22, 30519 Hannover, Germany
*Corresponding author: physics@hochecker.eu

Abstract This is a significantly improved resumption of my previous paper on gravitation [40]. I can show in a improved way that gravitation is an electric effect. To this, it is necessary to better understand the qualities of the electric charges and their forces. I start by showing that the magnetic field can be represented as an angled electric field. To this, the electric field must have two qualities: the dependence of the electric force on the velocity, and the electric anti-field. All previous cognitions on electrodynamics stay with it untouched. Then, I apply these two new qualities to gravitation, and it turns out that gravitation is an electric effect if a third quality applies to the electric field: the quantization of the energy transfer of the electric field. These three new qualities complete our picture of electrodynamics. Finally, I go to the origins of the three new qualities with the help of the early quantum mechanics. This turns out well by representing the electric charge as a space time wave, in which its frequency corresponds to its mass.

Keywords: *gravitation, magnetism, electric fields, special relativity, quantum-mechanics*

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1. Preface

It has always been my desire to better understand gravitation. And ever since (that is always) the similarities but also the differences between the gravitation and the electric force were clear to me. Now, after many years of hard work it turns out that gravitation is an electric effect. It appears that the task was to better understand the qualities of the electric charges and their forces.

It all started with a more exact analysis of magnetism. It turns out that the magnetic field can be represented as an angled electric field if the electric force is velocity-dependent and if, in addition, the electric anti-field exists. These two prerequisites can be regarded as two new qualities of the electric field (which I will describe in this work here in detail). All previous cognitions on electrodynamics stay untouched with it, which explains why these two qualities haven't stood out yet. However, due to these two new qualities we get new insights on electrodynamics, such as on the origin of magnetism. Therefore, they complete our picture of the electrodynamics.

At next, I have applied the two new qualities to gravitation and it turns out that gravitation is an electric effect if the energy transfer of the electric field to an electric charge is quantized. This last-named prerequisite is another quality of the electric field which fits in without problems and which further completes our picture.

Then, I wanted to go to the origins of the three new qualities of the electric field, which took me to the early quantum mechanics. It turns out that the electric charge can be represented as a spacetime wave, in which its frequency corresponds to its mass. From this representation of the electric charge the three new qualities of the electric field can wonderfully be derived and used. For example, the deBroglie wavelength can be calculated very simply with the help of the anti-field.

About the sectioning: This work consists of three parts: 1. On magnetism, 2. On gravitation, and 3. On quantization. Every part contains an introduction of its own and a closing remark of its own. In addition, there also is a general preface (this is this here), and, quite near to the end, a general conclusion.

2. Part 1: Magnetism as an Electric Angle-effect

2.1. Introduction to Part 1 / Motivation

The magnetic force really is fascinating: Whenever an electric charge has a velocity, a magnetic field arises, which is both perpendicular to this velocity and perpendicular to the electric field of this charge. And whenever a charged particle has a velocity perpendicular to a magnetic field, a magnetic force arises, which is both perpendicular to this velocity and perpendicular to the magnetic field.

Both the source of the magnetic field and the charged particle on which the magnetic field exerts the force have to be in motion. And the magnetic force is *always* perpendicular to the velocity of the charge on which the magnetic field has an effect.

This law on magnetism had been discovered soon, and as soon as that a problem was discovered: by changing into a reference system in which the source *or* the receiver (that is the charged particle on which the magnetic field has an effect) doesn't move the magnetic force disappears, of course. But a force cannot simply disappear. Einstein finally could solve the problem in a brilliant way by showing that not only the magnetic force but also the electric force depends on the reference system [1]. In his solution he famously postulated that the speed of light is equal for all inertial observers, or reference systems, which means that space and time are relative.

So, it was understood *when* a magnetic force arises - that is, whenever an electric charge is moving (both the one which produces the magnetic field and the one on which the magnetic field has an effect). But, *how* is the magnetic force actually being created? How is this phenomenon created? In which way does a magnetic force arise, when an electric charge is moving? This is still unknown. Einstein also had regarded the magnetic force simply as given.

Well, I think, I can explain, how the magnetic force is being created.

To be able to show how the magnetic force arises I will define two new qualities for the electric field. As the first quality, I will introduce the velocity-dependence of the electric force. This quality is valid exclusively under consideration of the second quality: the anti-field. Therefore, I then introduce the anti-field as the second quality. Finally, I show how the magnetic force results and can be calculated from these two qualities.

2.2. Velocity-Dependence of the Electric Force

I will now describe the first of the two qualities of the electric field: the velocity-dependence of the electric force which is, as said already, valid exclusively under consideration of the second quality (the anti-field).

The electric field *always* propagates (in a classical vacuum) with the speed of light $\vec{c}$. And while the electric field propagates with the speed of light, it exerts an electric force on electric charges. So, one can come to the assumption that the electric force is directly connected to the velocity with which the electric field moves relative to an electric charge. The relative velocity between an electric field and the electric charge on which the field exerts a force (I call this charge receiver) corresponds to the vector addition of the speed of light $\vec{c}$ with the velocity $\overrightarrow{v_R}$ of this charge. Therefore, the force of an electric field on a charge changes by the velocity of this charge. But, though, the force shall be all the grater the grater the velocity of the charge is relative to the field. Therefore the velocity of the receiver $\overrightarrow{v_R}$ must be subtracted from the speed of light $\vec{c}$ of the field. Therefore, the force arises by $(\vec{c}-\overrightarrow{v_R})$.

So, the force of an electric field on a charge (a receiver) changes by the velocity $\overrightarrow{v_R}$ of this charge (this receiver). This means that an *additional* force, which is proportional to the velocity $\overrightarrow{v_R}$ of the receiver, arises. This becomes particularly clear if the $\overrightarrow{v_R}$ is perpendicular to the speed of light $\vec{c}$ of the field.

In an analogous way the force of the field also changes if the source of the field has the velocity $\overrightarrow{v_S}$.

The field of a motionless charge also moves with the speed of light relative to its source,of course. If the source has the velocity $\overrightarrow{v_S}$, then the force of the field results by the vector addition of $\overrightarrow{v_S}$ and $\vec{c}$. But differently as at the $\overrightarrow{v_R}$, here the strength of the field shall be all the grater the smaller the velocity $\overrightarrow{v_S}$ of the source is relative to the field.

The $\overrightarrow{v_S}$, too, can be perpendicular to the speed of light $\vec{c}$of its field. So, an arbitrary $\overrightarrow{v_S}$ can be decomposed into one component parallel to the speed of light of the field (this is $\overrightarrow{v_{S\parallel}}$), and one component perpendicular to the speed of light of the field (this is $\overrightarrow{v_{S\perp}}$). The $\overrightarrow{v_{S\parallel}}$ must be added to $\vec{c}$ so that the strength of the field is all the grater the smaller $\overrightarrow{v_S}$ is. Whereas for the $\overrightarrow{v_{S\perp}}$ it is as for the $\overrightarrow{v_R}$, which means that the $\overrightarrow{v_{S\perp}}$ is to be subtracted from the $\vec{c}$. So, the correct and complete change of the strength of the field, which yields by the $\overrightarrow{v_S}$, corresponds to the vector: $(\vec{c}+(\overrightarrow{v_{S\parallel}}-\overrightarrow{v_{S\perp}}))$.

It is as if the $\overrightarrow{v_S}$ would be mirrored. Therefore, instead of the $\overrightarrow{v_S}$ the mirrored $\overrightarrow{v_S}$ is used for the calculation of the strength of the field, that is the $\mid\overrightarrow{v_S}=\overrightarrow{v_{S\parallel}}-\overrightarrow{v_{S\perp}}$.

Therefore, the strength of the field arises from the vector $(\vec{c}+\mid\overrightarrow{v_S})$.

Of course, the velocity with which the field propagates doesn't change due to $\mid\overrightarrow{v_S}$. But the strength of the field changes. In addition, the direction of the force of the field also changes, *without* changing the direction in which the field propagates. This means that the $\mid\overrightarrow{v_S}$ causes an angle φ between the direction in which the field propagates and the direction of the force of the field. This angle is calculated by: $\tan(\varphi)=\frac{-v_{S\perp}}{|\vec{c}+v_{S\parallel}|}$ (see Figure 2.1).

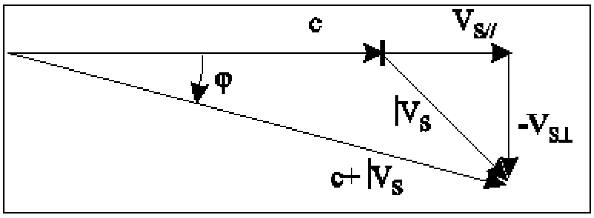


Figure 2.1.

If the strength and direction of the field change by the velocity $\mid\overrightarrow{v_S}$ of the source, then, naturally, the strength of the force, which results by $\overrightarrow{v_R}$, will also change in a proportional way.

The change of the strength of the field arises from $\mid\overrightarrow{v_S}$. However, the field still propagates with the speed of light ($\vec{c}$). This means that the force which arises from $\overrightarrow{v_R}$ regarding the speed of light $\vec{c}$ of the field will be proportional to that force, which arises by $\overrightarrow{v_R}$ regarding the $\mid\overrightarrow{v_S}$. From this proportionality we can derive, how grate the influence of the $\mid\overrightarrow{v_S}$ is on the force. If we name the part, which the $\mid\overrightarrow{v_S}$ has on the force which arises by $\overrightarrow{v_R}$, $\overrightarrow{v_{SR}}$ then we get: $\frac{v_{SR}}{|v_S}=\frac{-v_R}{c}$ (see Figure 2.2).

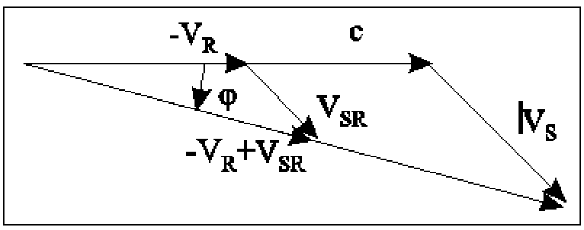


Figure 2.2.

We recognize here, in addition, that the force which arises from a $\overrightarrow{v_R}$ is turned by the angle φ in respect to $-\overrightarrow{v_R}$. This is always that way, because the $\overrightarrow{v_R}$ always produces its own force, which, independently of the direction of the $\overrightarrow{v_R}$ relative to the field, is always proportional to the strength of the field. The force which arises from $\overrightarrow{v_R}$ is: $-\overrightarrow{v_R} + \overrightarrow{v_{SR}}$, as it can be seen at Figure 2.2.

Before I come to the calculations of the forces it is necessary to introduce the second quality of the electric field, that is the anti-field, because without taking the anti-field into account the velocity-dependence of the electric force doesn't make sense.

2.3. The Anti-field

A velocity-dependence of the electric force, as I have described in the previous chapter, has *never* been observed in any experiment. This is due to the second quality which I would like to introduce here for the electric field: the anti-field. Due to the anti-field, all the electric qualities, known from the experiments, remain valid, while at the same time the combination of the velocity-dependence of the electric force with the anti-field automatically yields the magnetic force.

So, what is the anti-field? The anti-field is a field which always appears then when a field exerts a force on a charge. It resembles a reflection; this shall mean that the anti-field always propagates exactly in the opposite direction to the field. The anti-field always appears only when the field interacts with a charge. But, taken exactly, the field, too, can bee observed only when it interacts with a charge. Of the field one assumes in principle that it always exists. I make the same acceptance for the anti-field now. The anti-field shall always exist, too. In this sense one then cannot regard the anti-field as a reflection either. Here, the anti-field would rather be a field of its own which always appears together with the field. The anti-field is, just as the field, a quality of space. Both qualities, the one of the field and the one of the anti-field, always appear together. I am sure that there is a connection between the anti-field and the anti-particles or the anti-matter [2]. However, the exact connections on this are still not quite clear to me - but, though, an interesting connection on this yields in part 3 of this work.

In any case, the anti-field is just as real as the field. This means that it exerts an electric force on an electric charge, exactly as the field does. So, the electric force on a charge *always* consists of the force of the field plus the force of the anti-field. And although the anti-field always propagates exactly in the opposite direction to the field, the force of the anti-field (on a charge) still *always has the same sign as the force of the field* (on the same charge). Therefore, if the force, which arises from the speed of light of the field $\vec{c}^{+}$ (I mark the speed of light of the field with a high-ranking "+"), is positive, then the force, which arises from the speed of light of the anti-field $-\vec{c}^{-}$ (I mark the speed of light of the anti-field with a high-ranking "-"), must be positive, too. But since it always is $\vec{c}^{+} = -\vec{c}^{-}$, the force of the anti-field must be multiplied with -1.

One can say that the anti-field behaves exactly oppositely to the field.

At the force of the field the velocity of the source $\mid\overrightarrow{v_S}$ must be taken into account. At the anti-field this is exactly the same. But, however, at the anti-field the force must be multiplied with -1, therefore the strength of the anti-field arises from the vector: $-(\vec{c}^{-} + \mid\overrightarrow{v_S}) = (\vec{c}^{+} - \mid\overrightarrow{v_S})$ (see Figure 2.3).

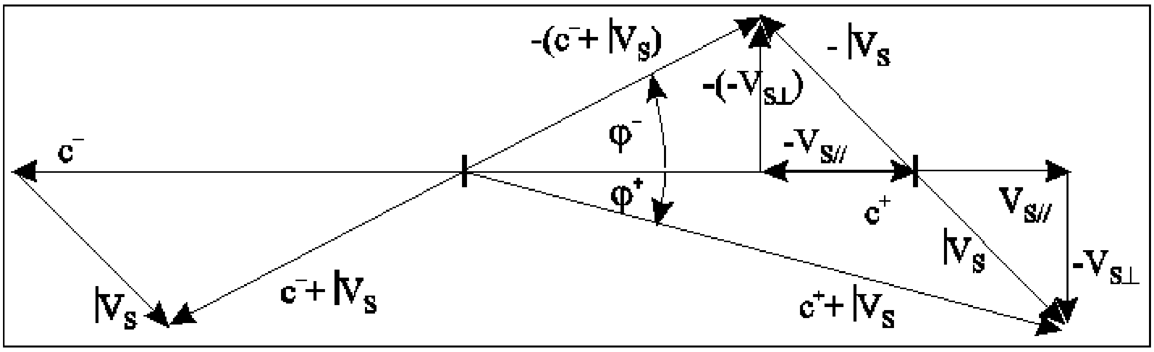


Figure 2.3.

So we see, that the anti-field changes by $-\mid\overrightarrow{v_S}$ (while the field changes by $+\mid\overrightarrow{v_S}$).

The angle φ^{-} which results from $\mid\overrightarrow{v_S}$ between the direction in which the anti-field propagates and the direction of the force of the anti-field is calculated by: $\tan(\varphi^{-}) = \frac{-(-v_{S\perp})}{|\vec{c}+(-\overrightarrow{v_{S\parallel}})|}$ (in Figure 2.3 the angle for the field is correspondingly: φ^{+}).

If the strength and direction of the anti-field change by the velocity $\mid\overrightarrow{v_S}$ of the source, then the strength of the force, which arises from $\overrightarrow{v_R}$ regarding the anti-field, will also change in a proportional way, of course.

The $\overrightarrow{v_R}$ produces a force at the-anti field which is opposite to the force which it produces at the field. At the same time, however, the anti-field propagates in the opposite direction to the field. This then would turn back the direction of the force which arises by $\overrightarrow{v_R}$. But since, in addition, it must be multiplied with -1, the force of the $\overrightarrow{v_R}$ which arises from the anti-field remains exactly opposite to the force which arises from the field.

The part which the $\mid\overrightarrow{v_S}$ has of the force, which arises at the anti-field by the $\overrightarrow{v_R}$, results from the $-\mid\overrightarrow{v_S}$, of course. The $-\overrightarrow{v_{S\parallel}}$ (of the $-\mid\overrightarrow{v_S}$) is opposite to $+\overrightarrow{v_{S\parallel}}$. This would mean that the force which arises from the $\overrightarrow{v_R}$ in the direction of the $\overrightarrow{v_{S\parallel}}$ at the anti-field is turned back, so that it would have the same direction as the force at the field. But, here too, it must be multiplied with -1 again, so that the force which arises by the $\overrightarrow{v_R}$ in the direction of the $\overrightarrow{v_{S\parallel}}$ at the anti-field is opposite to the force at the field. For the force, which arises by the $\overrightarrow{v_R}$ in the direction of the $-(-\overrightarrow{v_{S\perp}})$ (of the $-\mid\overrightarrow{v_S}$), the $-(-\overrightarrow{v_{S\perp}})$ must be multiplied with -1.

If we name the part which the $\mathsf{I}\,\overrightarrow{v_S}$ has on the force, which arises from $\overrightarrow{v_R}$ regarding the anti-field, $\vec{v}^-{}_{SR}$ (and that one of the field then correspondingly $\vec{v}^{\mp}{}_{SR}$), then the force which arises from $\overrightarrow{v_R}$ at the anti-field is: $+\overrightarrow{v_R}+\vec{v}^-{}_{SR}$. Therefore, at the anti-field the force arises by the $+\overrightarrow{v_R}$, while at the field it arises by the $-\overrightarrow{v_R}$. This also can be recognized because of $\vec{c}^+=-\vec{c}^-$. Formulated differently: by the $\overrightarrow{v_R}$ the force of the anti-field (which arises from $-(\vec{c}^-+\mathsf{I}\,\overrightarrow{v_S})$) changes in an exactly opposite way to the force of the field (which arises from $(\vec{c}^++\mathsf{I}\,\overrightarrow{v_S})$, see Figure 2.3).

As in the case of the field, the force at the anti-field, which arises from $\overrightarrow{v_R}$ regarding the speed of light $\vec{c}^-$ of the anti-field, also is proportional to the force which arises by the $\overrightarrow{v_R}$ regarding the $\mathsf{I}\,\overrightarrow{v_S}$. Here we have to paid attention particularly to the signs. So the proportionality which is valid is: $\frac{v^-{}_{SR}}{|-\overrightarrow{v_{S\parallel}}-\overrightarrow{v_{S\perp}}|}=\frac{v_R}{c^-}$ (see Figure 2.4).

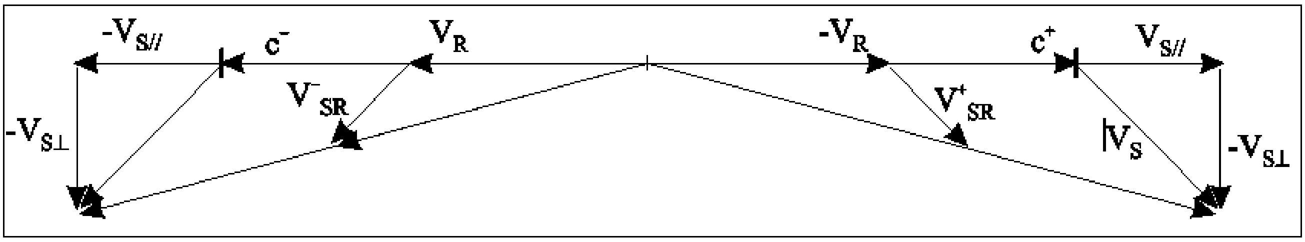


Figure 2.4.

The force which an arbitrary $\overrightarrow{v_R}$ produces at the anti-field always has the angle $\tan(\varphi)=\frac{-v_{S\perp}}{|\vec{c}^-+(-\overrightarrow{v_{S\parallel}})|}$ to $+\overrightarrow{v_R}$. This corresponds to the magnitude of the angle φ^+.

I think, that it has got clear what the anti-field is. Somehow difficult maybe here the idea that the anti-field always propagates *towards* its source. This has always to be taken into account in all considerations. It is easier to understand this connection if one considers that, in the end, both the electric field and the electric anti-field are qualities of the spacetime. This will get even clearer in part 3 of this work.

I think, that the anti-field is more than only a theoretical construct. I think, that the anti-field is exactly as real as the electric field. But, though, since both always appear together, it will be hard to observe them separated - I will say more about that in part 2 of this work, in which I treat gravitation. Both fields - the field and the anti-field - always act together and yield in the sum the forces which we know as electric and magnetic forces.

I cannot prove the existence of the anti-field. But I think that the results, which I show in this work, speak for themselves. Particularly in part 3 of this work, where I carry out the quantum mechanical considerations to part 1 and part 2, there are strong indications in favour of the existence of the anti-field.

2.4. Calculation of the Magnetic Force

Now, with the help of the two qualities of the electric force just described, I will derive the magnetic force.

To simplify the representations in the further course, it is helpful to look at the electrostatic case: The electrostatic force between two charges is calculated by Coulombs law: $F_S=\frac{q_1\cdot q_2}{r^2\cdot\varepsilon_0\cdot 4\cdot\pi}$ in which q_1 and q_2 are the electric charges, r is the distance between them, and ε_0 is the electric constant in the vacuum [3].

Now the electric force shall be dependent on the relative velocity between the field or the anti-field and the charge. In the electrostatic case ($\overrightarrow{v_S}=\overrightarrow{v_R}=0$), the relative velocity between the field or the anti-field and the charge is always the speed of light, these are $\vec{c}^+$ and $\vec{c}^-$. Thus, the electrostatic force for the field can be represented as: $\overrightarrow{F_E}=\frac{1}{2}\cdot\frac{q_1\cdot q_2}{r^2\cdot\varepsilon_0\cdot 4\cdot\pi}\cdot\frac{\vec{c}^+}{|\vec{c}|}=F_c\cdot\vec{c}^+$ with $F_c=\frac{1}{2}\cdot\frac{q_1\cdot q_2}{r^2\cdot\varepsilon_0\cdot 4\cdot\pi\cdot|\vec{c}|}$. The factor ½ arises because the actual (real) electric force results respectively half from the field and half from the anti-field. And for the anti-field it is: $\overrightarrow{F_E}=-F_c\cdot\vec{c}^-$. Thus, the sum of the field and anti-field is: $\overrightarrow{F_E}=F_c\cdot\vec{c}^+-F_c\cdot\vec{c}^-=2\cdot F_c\cdot\vec{c}^+$.

So, for the calculation of the strength of the field one uses for the electric force F_S: $\overrightarrow{F_S}=F_c\cdot(\vec{c}^++\mathsf{I}\,\overrightarrow{v_S})-F_c\cdot(\vec{c}^-+\mathsf{I}\,\overrightarrow{v_S})=2\cdot F_c\cdot\vec{c}^+$, with $F_c=\frac{1}{2}\cdot\frac{q_S\cdot q_P}{r^2\cdot\varepsilon_0\cdot 4\cdot\pi\cdot|\vec{c}|}$, where q_P is a small test charge (probe) and q_S is the charge of the source.

For the force of the field or anti-field on a motionless receiver ($\overrightarrow{v_R}=0$) one simply would replace the test charge (q_P) by the charge of the receiver (q_R).

One recognises here very well that the sum of the forces of the field and the anti-field on a motionless receiver ($\overrightarrow{v_R}=0$) is independent from $\mathsf{I}\,\overrightarrow{v_S}$.

If the receiver moves with the velocity $\overrightarrow{v_R}\neq 0$, then there is, in addition to the force which is exerted on the motionless receiver, the force from the $\overrightarrow{v_R}$.

The additional force which results from the $\overrightarrow{v_R}$ by the field plus the anti-field is: $\overrightarrow{F_R}=F_c\cdot\overrightarrow{v_R}-F_c\cdot\overrightarrow{v_R}=0$. Plus the part which the $\mathsf{I}\,\overrightarrow{v_S}$ has on the force which results from the $\overrightarrow{v_R}$ by the field plus the anti-field. This part is for the field: $F_c\cdot\vec{v}_{SR}^+=F_c\cdot[\frac{-v_R}{c^+}\cdot(+\overrightarrow{v_{S\parallel}})+\frac{-v_R}{c^+}\cdot(-\overrightarrow{v_{S\perp}})]$. And for the anti-field: $F_c\cdot\vec{v}_{SR}^-=F_c\cdot[\frac{v_R}{c^-}\cdot(-\overrightarrow{v_{S\parallel}})+\frac{v_R}{c^-}\cdot(-\overrightarrow{v_{S\perp}})]$. And the sum from the field and the anti-field yields in a parallel direction to $\overrightarrow{v_R}$: $F_c\cdot[\frac{-v_R}{c^+}\cdot(+\overrightarrow{v_{S\parallel}})+\frac{v_R}{c^-}\cdot(-\overrightarrow{v_{S\parallel}})]=F_c\cdot[\frac{-v_R}{c^+}\cdot(\overrightarrow{v_{S\parallel}})+\frac{v_R}{c^+}\cdot(\overrightarrow{v_{S\parallel}})]=0$. And the sum from the field and the anti-field yields in a perpendicular direction to $\overrightarrow{v_R}$: $F_c\cdot(\frac{-v_R}{c^+}\cdot(-\overrightarrow{v_{S\perp}})+\frac{v_R}{c^-}\cdot(-\overrightarrow{v_{S\perp}}))=F_c\cdot(\frac{v_R}{c^+}\cdot\overrightarrow{v_{S\perp}}+\frac{v_R}{c^+}\cdot\overrightarrow{v_{S\perp}})=2\cdot F_c\cdot\frac{v_R}{c^+}\cdot\overrightarrow{v_{S\perp}}$.

We notice, that by the $\overrightarrow{v_R}$ here there is a resultant force which is perpendicular to $\overrightarrow{v_R}$. This force meets exactly the conditions of the magnetic force ($\overrightarrow{F_M}$). So we can write: $\overrightarrow{F_M}=2\cdot F_c\cdot\frac{v_R}{c^+}\cdot\overrightarrow{v_{S\perp}}$.

The direction of the $\overrightarrow{F_M}$ results from the direction of the $\overrightarrow{v_{S\perp}}$ and the sign of the F_c. The F_c is positive at same charges and negative at opposite charges.

I think, that no doubt can be: by the introduction of the velocity-dependence of the electric force and by the introduction of the anti-field the magnetic force can quite obviously be derived from the electric force.

2.5. Remarks on the Magnetic Force

So we see that the F_M corresponds to the magnetic force.

And the angles φ^+ and φ^- of the electric field and anti-field correspond to the idea of the magnetic field. Now, one doesn't have to speak any more about the magnetic field, which is regarded as given, but one can speak about the angles φ^+ and φ^-, whose way of emergence is known.

On relativity:

We know that the magnetic force depends on the relative velocities. This means that the magnitude of the magnetic force depends on the reference system. And this means that the magnitude of the angles φ^+ and φ^- must also dependent on the reference system.

I have described that the angles φ^+ and φ^- result by the addition of the vector | $\overrightarrow{v_S}$ of the velocity of the source and the vector $\vec{c}^+$ or $\vec{c}^-$ of the speed of light. We know from the SRT that the speed of light is equally in magnitude for all observers. Of course, the velocity of the source $\overrightarrow{v_S}$ depends on the reference system. So, while $\overrightarrow{v_S}$ changes, the speed of light remains constant; this means: the angles φ^+ and φ^- change (in dependence of the reference system).

This is actually fascinating: the magnitudes of the angles φ^+ and φ^- depend on the observer. The angles φ^+ and φ^- aren't an abstract construct. The angles φ^+ and φ^- are really existing angles. They are the angles between the propagation direction of the field or anti-field (respectively with $\vec{c}^+$ and $\vec{c}^-$) and the direction of the force of the field or anti-field. But still, different observers will observe different angles. Well, we know such phenomena from the SRT. There, e.g., space and time also depend very really on the observer.

Of course, the transformations between inertial reference systems are carried out quite normally according to the SRT. Not only the angles φ^+ and φ^- but also the electric force changes, so that the sum of both forces yields the right acceleration.

On the magnetic force:

So, I have described the magnetic force as a result of the angles φ^+ and φ^- of the electric field. Therefore, it makes sense to want to express the magnetic force by means of the electric force.

The magnitude of the electrostatic force ($\overrightarrow{F_E}$) is (as described already): $F_E = 2 \cdot F_c \cdot c$. Hence, the magnitude of the magnetic force ($\overrightarrow{F_M}$) is: $F_M = F_E \cdot \frac{v_R \cdot v_{S\perp}}{c^2}$.

So we see, that we can calculate the magnetic force directly through the electrostatic force. We neither must calculate a magnetic field, nor the cross product from $\overrightarrow{v_R}$ and the magnetic field.

Therefore, to calculate e.g. the magnetic force of a current that flows through a straight homogeneously charged conductor on a charge (which can be considered a point charge), we proceed similarly as in the case of the calculation of the electric field, while we still must, in addition, take into account the term $\frac{v_R \cdot v_{S\perp}}{c^2}$. The $v_{S\perp}$ can be expressed in dependence of v_S, and if L is the plumb line from the charge to the conductor, and λ is the linear charge density of the conductor, and q_R is the point charge, then the integration yields: $F_M = q_R \cdot \frac{v_R \cdot v_S}{c^2} \cdot \frac{\lambda}{8 \cdot \varepsilon_0 \cdot L}$.

In the case that $v_R = v_{S\perp} = c$, it is: $F_M = F_E$. At the speed of light the magnetic force is equally in magnitude to the electric force. In the case that the source and the receiver move together parallel with the speed of light the magnetic and electric force cancel each other out mutually. This means: if charges could move with the speed of light, then they wouldn't exert any forces on each other. So such charges could move together as a group. Their mass, though, could only exist as energy, as in the case of the photons. These connections will get even more understandable in part 3. One then understands there, too, that electric charges can never be faster than their field.

On the electrodynamics:

The central statement of the electrodynamics [4] is: A changing electric field produces a magnetic field, and vice versa. This principle of the electrodynamics is very useful. However, it only represents a simplification of the actual events.

Let us consider e.g. the oscillating circuit: according to the electrodynamics a growing magnetic field builds up in the spool of the oscillating circuit due to the permanently faster decreasing current from the capacitor, and the energy of this magnetic field then keeps the current flowing due to the decreasing magnetic field. At a more exact consideration we see that attractive magnetic forces which are vertical to the direction of the current have an effect on the free charges, which produce the current, and which move parallel in the parallel windings of the spool. These magnetic forces move the free charges towards the middle of the spool, from what a magnetic force results, which slows down the current. As the current decreases, the free charges move back again, they move therefore in the opposite direction, which means, that they then drive the current. This system builds-up to the frequency of the oscillating circuit.

Let us consider as the next example the electromagnetic waves (EMW): here, too, the electrodynamics says that an ever faster decreasing electric field produces an ever faster growing magnetic field, which is the reason for the phase displacement of 90°. At a more exact consideration we see that at the emergence of the EMW the angles φ^+ and φ^-, which have been already described in detail, arise in the electric field or anti-field. An EMW arises, if an electric dipole oscillates. When the charges are removed from each other furthest, the directions of their motions change, while they stop for a moment. At this moment the angles are $\varphi^+ = \varphi^- = 0$, while the electric field is at its maximum. When they pass each other at the transit point then the electric field is (almost) zero for a moment, while φ^+ and φ^- are at their maximum (perpendicular to the direction of the motion), since the velocities of the charges $v_S$are at their maximum at this moment. In this way the alternating electric and magnetic field arises. So one could assume that the electric field and the magnetic field *don't* produce each other but that they spread alternating into space due to the way of their creation.

So one can consider the emergence of the angles φ^+ and φ^- as an additional insight on the electrodynamics.

Regarding the exact nature of the energy quanta of the EMW, the photons, I will say some more in part 3 of this work.

2.6. Closing Remark to Part 1

I think, that I have been able to describe the emergence of the magnetic force much more exactly than this was the case till now. By the two new qualities of the electric field - the velocity-dependence of the electric force and the electric anti-field - new connections arise, which don´t create any contradictions to known experimental facts, but which help us to understand the nature of the electric field and the emergence of its forces much better.

I could particularly show that the magnetic field isn't a field of its own but that it is only an angled electric field. - While, of course, taken exactly, I have shown that the field has the angle φ^{+} and the anti-field the angle φ^{-}.

3. Part 2: Gravitation as an Electric Effect

3.1. Introduction to Part 2 / Motivation

The electric forces [5,6] are immensely great compared with gravitation. At Bohr's atom model, e.g., the gravitational forces of the masses of the electric charges can be neglected. The difference of the forces is immense. At the hydrogen atom, e.g., which consists of a proton and an electron the ratio of the electric force to the gravitational force is: $\approx 2{,}41 \cdot 10^{39}$. This is a gigantic number. These facts are already known for a long time and so they seem trivial; nevertheless, I would like to show an example here to elucidate them: If the gravitational force of the protons were approximately as great as its electrical force, then the earth would need to have only a diameter of about $\approx 18\text{m}$ to exert the same forces on us as it does, and the moon would have only a diameter of about $\approx 4\text{m}$. A man then would only have a mass of: $\approx 8{,}35 \cdot 10^{-14} g$.

So, the electric forces of ordinary matter are gigantically great compared with the gravitational forces of everyday live. However, we notice nothing of these immense electric forces since ordinary matter always consists of as many protons as electrons so that their electric fields cancel each other. And although it is very clear that the resulting electric field is zero, still, the thought sticks that gravitation could be a result of these immense electric forces. Some kind of residual or side effect. Something remains.

I have thought about this problem very, very often, again and again, but it never worked out completely. At all considerations the problem was that repulsion and attraction have always cancelled each other out exactly. For any effect, which could somehow be derived from the electric charges and their fields, there always were the corresponding counter-forces, due to which the overall effect became zero.

Also by applying the velocity-dependence of the electric force the problems couldn't be overcome.

At all considerations, I always assumed that the fields of the positive and negative charges exert their forces at the same time. Until I understood that the transfer of the energy of the electric field to a charge takes place in quanta. This means that always only the fields of the positive *or* negative charges exert their forces respectively. So the electric fields of the positive and negative charges transfer their energy quanta not at the same time but after each other.

By the quantization of the energy transfer of the electric field to an electric charge gravitation can now be represented easily as an electric effect with the help of the velocity-dependence of the electric force.

I will show this gradually in the following.

3.2. Basic Idea

The basic idea with which everything started is amazingly simple. We know: same charges repel and opposite charges attract. If, now, the repulsion were a little weaker than the attraction, or the attraction were a little stronger than the repulsion, then, in the result, one would have an attraction which could correspond to gravitation.

But what can weaken the repulsion and strengthen the attraction?

Well, this is actually simple: we find exactly this sought-after connection in the velocity-dependence of the electric force.

The electric force of an electric field on an electric charge (the receiver) depends on the velocity $\overrightarrow{v_R}$ of this charge. The force is strengthened if the receiver moves towards the field (that is, he moves in the opposite direction to the field), and weakened if the receiver moves away from the field (that is, he moves in the same direction as the field).

Now, we know that there is the anti-field. Due to the anti-field the additional forces which arise from the $\overrightarrow{v_R}$ at the field and at the anti-field cancel each other exactly, so that only the electric and magnetic forces remain.

So, how can there be a gravitational effect here, at which the attraction is strengthened and the repulsion is weakened?

Well, this results automatically from the quantization of the energy transfer of the electric field to an electric charge, as I will show in the following.

3.3. The Quantization of the Energy Transfer of the Electric Field to an Electric Charge

In this chapter, I will describe the quantization of the energy transfer of the electric field to an electric charge.

Usually we ignore the electric fields of the protons and electrons if these cancel each other by superposition. But even if the forces of fields cancel each other, these fields still exist. And since these fields still exist, they still can exert their forces, therefore, transfer energy. But, they don't make this continuous and simultaneous but in quanta and after each other. In combination with the velocity-dependence of the electric force, a small residual effect results: gravitation.

Here, it is decisive to distinguish between the field and the anti-field. Till now, it has sufficed to assume that the field and the anti-field exert their forces simultaneously. At the quantization instead the field and the anti-field have to be distinguished, exactly as the positive and negative charges. So there are 4 combinations: positive field, positive anti-field, negative field, and negative anti-field. The quantization means that always only one of the fields can exert a force on a charge. If the fields of many charges superimpose, then the forces of the same fields add themselves up. This means, in the end, that a charge (as a receiver) has 4 different states between which it alters. As soon as a certain energy quantity is reached, the charge changes its state. I will say some more about this energy quantity in part 3 of this work.

The force of a field produces a velocity $\overrightarrow{v_{(t)}}$ (t is the time). The fields of the positive and negative charges exert their forces on a charge, seen statistically, in a balanced way after each other (at electrically neutral matter), so that this charge moves around a centre to and fro.

In addition to the kind of the charge, it also must be distinguished between the field and the anti-field. Here, it is that the field and the anti-field of one kind of a charge always - not only seen statistically - exert their forces after each other.

In part 1, on magnetism, we have seen that the forces which arise by a constant velocity ($\overrightarrow{v_R}$) from the field and the anti-field cancel each other. This, of course, is also valid when the field and the anti-field exert their forces after each other, since the $\overrightarrow{v_R}$ is equal in magnitude for the field and the anti-field.

Both the field and the anti-field of one type of a charge produce by their forces velocities in the *same* direction. But, though, due to the quantization the forces are not exerted simultaneously but after each other. And this means inevitably that the velocity relative to the field is different from the velocity relative to the anti-field! This, of course, concerns only the velocities which result from the forces of the field and the anti-field for one type of a charge after each other. Already existing, constant velocities are equal in magnitude for all fields, as said already.

So: The force of the field and the one of the anti-field on a charge produce velocities by which the forces of the field and the anti-field on this charge change, since the electric forces are velocity-dependent. And since the field and the anti-field exert their forces after each other, the velocity of the charge relative to the field is different from its velocity relative to the anti-field, which means that the force of the field and the one of the anti-field change in a different way. This difference is finally the gravitation. I will carry out the necessary calculations in the following chapter.

The described quantization may seem strange, on the other hand, there are numerous quantum phenomena [12] at subatomic particles - so, why should the electric charges not behave quantized when it is about the energy which they get from the electric fields?

3.4. On the Calculation of Gravitation

If the quantization shall produce gravitation, then the electric repulsion must be weakened and the electric attraction strengthened. This is *always* the case when *first* the anti-field and *then* the field exerts its force: at the repulsion (of same charges) the force of the anti-field produces a velocity in the opposite direction to the direction into which the anti-field propagates, which results in a strengthening of the force of the anti-field. Then the force of the field produces a velocity in the same direction in which the field propagates, which results in a weakening of the force of the field. The velocity produced before by the anti-field also has the same direction as the field, which causes an additional weakening of the field. So the weakening of the field is greater than the strengthening of the anti-field. Thus, altogether the weakening of the repulsion is greater than the strengthening of the repulsion. At the attraction (of opposite charges) it is analogous.

Let us now do the calculations:

The force of the field and the one of the anti-field each cause at a charge a velocity $\overrightarrow{v_{(t)}}$, in the direction of the respective force. As we have seen in part 1 of this work, the velocity $\overrightarrow{v_{(t)}}$ corresponds to a force (in part 1 that was the velocity $\overrightarrow{v_R}$ of the receiver) which also can contain a magnetic component. I will regard the magnetic component later on. Therefore, for the moment, we consider only the component of the $\overrightarrow{v_{(t)}}$ which is parallel to the speed of light $\vec{c}$ of the field or anti-field.

Since we want to integrate, it is easier to only work with the magnitudes. If the $\overrightarrow{v_{(t)}}$ has the same direction as the $\vec{c}$, then:

$$N \cdot F_c \cdot (c - v_{(t)}) = m_R \cdot \frac{dv}{dt}, \qquad (3.1)$$

where F_c is known from part 1: $F_c = \frac{2 \cdot q_S \cdot q_R}{r^2 \cdot \varepsilon_0 \cdot 4 \cdot \pi \cdot |\vec{c}|}$ - here, we are primarily interested in the forces of the fields and the anti-fields on *one* elementary charge unit, this is the q_R (the R stands for "receiver" again). The q_S (the S stands for "source" again) is an elementary charge unit which produces a field and an anti-field, which exert their forces on q_R. The N is the number of the sources, that is the number of the elementary charge units which exert their forces with their fields and anti-fields on q_R. And m_R is, of course, the mass of q_R.

The Nstands for those charges (of the sources) which are at the same place. At a spatial distribution of these charges an integration must be done over the corresponding volume. About, e.g., a homogeneous spherical distribution we know that it can be assumed that all charges are in the centre.

In part 1, the F_c still was multiplied with the factor ½ since the electric force results half from the field and half from the anti-field. Since we have learned now that the field and the anti-field exert their forces not at the same time but after each other, the factor ½ is not to be used. Instead, the field and the anti-field each exert their forces only for the half of the time. Furthermore, the charges of every *type* of charge only exert their forces for approximately the half of the time, too. Thus, the force must be multiplied with the factor 2. This factor 2 can formally be assigned to the field constant ε_0.

The $\overrightarrow{v_{(t)}}$ produces a force in addition to the force which arises from the $\vec{c}$ of the field or anti-field. If we want to know how big this additional force is, then we must know how big the $\overrightarrow{v_{(t)}}$ is in the course of time. From (3.1) we get:

$$\frac{N \cdot F_c}{m_R} \cdot dt = \frac{dv}{(c - v_{(t)})} \Rightarrow \frac{N \cdot F_c}{m_R} \cdot \int_{t_0}^{t} dt = \int_{v_0}^{v} \frac{dv}{(c - v_{(t)})} \qquad (3.2)$$
$$\Rightarrow v_{(t)} = c - (c - v_0) \cdot e^{-t \cdot Q}$$

with $t_0 = 0$ and $Q = \frac{N \cdot |F_c|}{m_R}$. Since the q_S and the q_R have signs of their own, here, the absolute value of F_c is used, since the signs are already inserted according to the respective case. The v_0 is, of course, the initial velocity; that is the velocity which the receiver already has before a field or anti-field exerts its force. At the v_0, as at the $v_{(t)}$, we also consider, for the moment, only the component which is parallel to c, while, of course, the v_0 can have the same or the opposite sign as the c.

If the $\overrightarrow{v_{(t)}}$ has the opposite direction as the $\vec{c}$, then we get:

$$N \cdot F_c \cdot (c + v_{(t)}) = m_R \cdot \frac{dv}{dt}. \tag{3.3}$$

Integrating yields:

$$v_{(t)} = -c + (c + v_0) \cdot e^{t \cdot Q}. \tag{3.4}$$

Now we can calculate the force of the fields and anti-fields of the sources on a charge, the receiver, in the course of time (that is $F_{(t)}$).

We start with the attraction (between opposite charges). At attraction, of course, the sources have the opposite sign as the receiver. The *anti-fields* of the sources exert their forces *first*. At attraction, the anti-fields of the sources have the same direction as the forces which they exert on the receiver. So it is: $F_{(t)}^{-} = N \cdot F_c \cdot (c - v_{(t)})$(the high-ranking "-" indicates the anti-field). Here, we use (3.2) for the $v_{(t)}$. Thus we get: $F_{(t)}^{-} = N \cdot F_c \cdot (c - v_0) \cdot e^{-t \cdot Q}$, in which v_0 is the velocity which the receiver already had before the anti-fields have exerted their forces. *Then* the *fields* of the sources exert their forces. At attraction, the fields of the sources have the opposite direction as the forces which they exert on the receiver. So it is: $F_{(t)}^{+} = N \cdot F_c \cdot (c + v_{(t)})$ (the high-ranking "+" indicates the field). Here, we use (3.4) for the $v_{(t)}$. Thus we get: $F_{(t)}^{+} = N \cdot F_c \cdot (c + v_0) \cdot e^{t \cdot Q}$. For the v_0, here, we must use the velocity which the receiver has after the anti-fields have exerted their forces. (This means, that we must take into account the velocity which the anti-fields have produced.) If we assume that the anti-fields have exerted their forces for the time period T, we get the velocity: $v_{(T)} = c - (c - v_0) \cdot e^{-T \cdot Q}$. Therefore: $F_{(t)}^{+} = N \cdot F_c \cdot (c + (c - (c - v_0) \cdot e^{-T \cdot Q})) \cdot e^{t \cdot Q}$.

For the moment, we assume that the anti-field and the field exert their forces equally for the same time period, therefore, that the anti-field and the field each exert their forces the half of the time. It is not quite clear if that is to be always this way. Whether it also can be different and which implications this would have, must be cleared in further, following works.

So, the total time for the field and the anti-field is $2 \cdot T$. So we can determine the average force from the field and the anti-field over the time. And then this average force shall correspond to the sum of the electrostatic force plus the gravitational force (F_G). Or said differently: We set the sum of the momenta which result by the anti-field and the field each in the time T equal to the momentum which results from the resultant force from the electrostatic force and the gravitational force in the time $2 \cdot T$. So it is:

$$\frac{\int_0^T F_{(t)}^{-} \cdot dt + \int_0^T F_{(t)}^{+} \cdot dt}{2 \cdot T} = N \cdot (F_c \cdot c + F_G)$$

$$\Rightarrow \frac{F_c \cdot 2 \cdot c \cdot (e^{T \cdot Q} - 1)}{2 \cdot T \cdot Q} = F_c \cdot c \cdot (1 + \frac{F_G}{F_c \cdot c}) \tag{3.5}$$

$$\Rightarrow e^{T \cdot Q} = 1 + T \cdot Q \cdot (1 + K),$$

with $K = \frac{F_G}{F_c \cdot c}$.

From (3.5), the time T can be calculated at which the velocity-dependence of the electric force produces, at attraction, exactly the gravitational force.

At repulsion (between same charges) we proceed analogously: The anti-fields of the sources exert their forces first. At repulsion, the anti-fields of the sources have the opposite direction as the forces which they exert on the receiver. So it is: $F_{(t)}^{-} = N \cdot F_c \cdot (c + v_{(t)})$. Here we use (3.4) for the $v_{(t)}$. Thus we get: $F_{(t)}^{-} = N \cdot F_c \cdot (c + v_0) \cdot e^{t \cdot Q}$. Then the fields of the sources exert their forces. At repulsion, the fields of the sources have the same direction as the forces which they exert on the receiver. So it is: $F_{(t)}^{+} = N \cdot F_c \cdot (c - v_{(t)})$. Here we use (3.2) for the $v_{(t)}$. Thus we get: $F_{(t)}^{+} = N \cdot F_c \cdot (c - v_0) \cdot e^{-t \cdot Q}$. For the v_0, here, too, we must use the velocity which the receiver has after the anti-fields have exerted their forces. If we assume that the anti-fields have exerted their forces for the time-period T, we get the velocity: $v_{(T)} = -c + (c + v_0) \cdot e^{T \cdot Q}$. Therefore: $F_{(t)}^{+} = N \cdot F_c \cdot (c - (-c + (c + v_0) \cdot e^{T \cdot Q})) \cdot e^{-t \cdot Q}$. To get the average force, we integrate as in the case of the attraction and we finally get:

$$\Rightarrow e^{-T \cdot Q} = 1 - T \cdot Q \cdot (1 - K). \tag{3.6}$$

From (3.6), the time T can be calculated at which the velocity-dependence of the electric force produces, at repulsion, exactly the gravitational force.

Unfortunately, the equations (3.5) and (3.6) can not be solved exactly for T. So there must be used approximation procedures which are not quite trivial.

For the attraction, that is (3.5), we get: $T_{+} = \frac{-W\left(-\frac{e^{-\frac{1}{K+1}}}{K+1}\right) \cdot (K+1) - 1}{(K+1) \cdot Q}$, were $W\left(-\frac{e^{-\frac{1}{K+1}}}{K+1}\right)$ is the Lambert-W function, and the subscript "+" at the T indicates the attraction.

For the repulsion, that is (3.6), we get: $T_{-} = \frac{W\left(\frac{e^{\frac{1}{K-1}}}{K-1}\right) \cdot (K-1) - 1}{(K-1) \cdot Q}$, were the subscript "-" at the T indicates the repulsion.

3.5. Discussion on the Calculations

The first, that we notice, is that (3.5) and (3.6), therefore T_{+} and T_{-}, are independent from the initial velocity (v_0). The v_0 is the velocity which the receiver has before the anti-field of a source exerts its force, that is, before any source exerts a force on the receiver at all. When the time during which the anti-field exerts its force is exactly as long as that one of the field (that is T for each), the v_0 is correctly cancelled.

At next, we see that T_{+} and T_{-} depend on K. And $K = \frac{m_R \cdot m_S \cdot G \cdot \varepsilon_0 \cdot 4 \cdot \pi}{2 \cdot q_S \cdot q_R}$, were G is the gravitational constant. I must go into more detail on m_S: At equation

(3.5), F_G is the gravitational force by whose amount the electric force changes. Due to the quantization always only one type of a charge (positive or negative) of the sources exert their forces on the receiver. But for the gravitational force, the masses of both types of a charge must be taken into account. In addition, the mass of the neutrons also must be taken into account (I will say more on that later). So, for electrically neutral matter, m_S always is the sum of the mass of the proton (m_{p^+}), the electron (m_{e^-}), and the neutron (m_n), so that $m_S = m_{e^-} + m_{p^+} + m_n$. (The number of the sources (that is N) doesn't appear in K.) So, for electrons and protons *as receivers*, there are two different values for K, at electrically neutral matter. Therefore, the value of T_+ or T_- depends on $m_S \cdot m_R$, but this had to be expected since the magnitude of gravitation is determined here. In the chapter "Gravitational and inert mass", I analyse the connection between m_S and T_+ and T_- more detailed.

Furthermore, we recognise that both T_+ and T_- are proportional to $1/Q$. And since $Q = \dfrac{N \cdot F_c}{m_R}$, we get, quite generally, for T the proportionality: $T \propto \dfrac{r^2 \cdot m_R}{N}$. We know that, due to the quantization of the electric force, a charge moves to and fro in the direction of the force. Therefore, the $1/T$ is the frequency with which a charge, with the mass m_R, oscillates within a gravitational field, while, of course, we know now that the gravitational field results from the sum of the electric fields of the positive and negative charges. The frequency of this electric gravitational oscillation is reversed proportional to m_R, and, because of K, it depends on $m_S \cdot m_R$. In addition, the frequency of the electric gravitational oscillation decreases with a growing distance from the source of the gravitational field, and it increases with a growing gravitational field since N is the number of the sources.

The grater N is, all the smaller T is. For an object, such as the earth, N is inconceivably great. Nearby the earth, T is correspondingly small. The electric gravitational oscillation seems more like a trembling than like a clear motion here. On the other hand, one can consider electric charges as being approximately dot-like in the first place (I will go into more detail on that in part 3 of this work), so that there is sufficient space even for the smallest motions.

It also is astonishing that $T \propto r^2$. Without a gravitational field it is $T = 0$, what also could apply to a Lagrange point. Automatically, the question comes up, which further consequences the electric gravitational oscillation could have, except, of course, that it produces gravitation. It could have effects on the processes in an atom, influence the interaction behaviour of the electric charges, or influence even the life expectancy of electric particles - or it may not.

At next, to better understand T, we regard the hypothetical case that the mass of the receiver is equal in magnitude at both at the positive and at the negative charges, that, therefore, K is always the same. We are interested in knowing whether in this case the T_+ of the attraction and the T_- of the repulsion are also equal in magnitude. Thus, we want to know, whether their difference is zero. Inserting yields: $\Delta T = T_- - T_+ = W_- + W_+ + \frac{2}{1-K^2}$, were W_- and W_+ are the Lambert-W functions for the repulsion and the attraction respectively. In our case it is: $K \ll 1$, which means that both W_- and W_+ are very near to -1. So it is: $W_- + W_+ \approx -2$. In addition it is: $\frac{2}{1-K^2} \approx 2$. And this means that $\Delta T \approx 0$, which means that the process of repulsion and the process of attraction are nearly identical. A more exact calculation shows that $\Delta T > 0$. Therefore: $T_- > T_+$, which means that even at always equal masses the T_+ and the T_- are not exactly the same. But this seems quite plausible since, overall, the force is weakened at the repulsion while it is strengthened at the attraction. The difference, though, is very small. It can be seen at the graphic 3.1 (which can be found a little below) in the difference of the slopes of the exponential functions for the forces in the course of the time.

After we have calculated T, we also can calculate $v_{(T)}$.

The first that we notice if we insert T into $v_{(T)}$ is that Q is cancelled. Thus, the $v_{(T)}$ is independent from N and from r^2. So the $v_{(T)}$ is independent from the magnitude of the source of the gravitational field, and from the position within the gravitational field, which means: the $v_{(T)}$ is independent from the strength of the gravitational field.

Since the K is not cancelled, the $v_{(T)}$ depends on $m_S \cdot m_R$. In addition, it must be distinguished whether the $v_{(T)}$ has the same or the opposite direction as the c of the field or anti-field. For electrons and protons, this results in six different values for $v_{(T)}$, which characterize the respective type of the interaction. In this sense, the $v_{(T)}$ is a quantum quantity for electric charges.

After we have calculated $v_{(T)}$, we also can calculate easily the change of the energy, which results by the force of the anti-field or field: $E = 1/2 \cdot m_R \cdot (v_{(T)}^2 - v_0^2)$. At small velocities we can calculate non-relativistically. We also could have calculated $E = F_c \cdot \int_0^T (c \pm v_{(t)}) \cdot ds = F_c \cdot \int_0^T (c \pm v_{(t)}) \cdot v_{(t)} \cdot dt$, but one doesn't get any handy equations here.

The energy, calculated here, consists of energy quanta whose magnitude results from the way of the respective interaction, which, therefore, depends on $m_S \cdot m_R$. So, there are energy quanta of different magnitude. And so we see that, at the quantization of the energy transfer of the electric field to an electric charge, the field *isn't* subdivided into quanta, as at first one could assume. The quantization rather arises from the quantum levels of the receiver.

Once again, we come back now to our hypothetical case at which the masses of the elementary charge units are equal in magnitude. We have seen that $T_- > T_+$, while, at the same time, the force at the repulsion altogether is smaller than at the attraction ($F_- < F_+$). This could compensate each other so that in the two cases the same amount of energy would be transferred, which, of course, may not be, since more energy is transferred at the attraction than at the repulsion. To check this, we calculate the $v_{(T)}$ for the attraction by adding the $v_{(T)}$ of the anti-field to the one of the field, in which, of course, the T of the anti-field is equal in magnitude as the one of the field. We get: $2c \cdot (e^{T_+} - 1) + v_0$. And for the repulsion we get: $2c \cdot (1 - e^{-T_-}) + v_0$. The difference $\Delta v = 2c \cdot ((e^{T_+} + e^{-T_-}) - 2)$ must be bigger than zero. Therefore it must be

$(e^{T_+} + e^{-T_-}) > 2$. If we call $d$the difference between T_+ and T_- , than : $T_- = T_+ + d$. And therefore: $(e^{T_+} + e^{-(T_+ + d)}) > 2$. Or more general: $(e^{T} + e^{-(T+d)}) > 2$. Conversion yields: $2 \cdot e^{T} - e^{2 \cdot T + d} < 1$. This inequality is valid, because for $T = 0$it is $2 \cdot e^{0} = 2$ and $e^{2 \cdot 0 + d} \approx 1 + d$, and for $T > 0$the $e^{2 \cdot T + d}$ increases faster than the $2 \cdot e^{T}$. And therefore it is $\Delta v > 0$, as demanded.

Although we get the correct results it seems strange that we get differently grate quanta even if the masses are all the same. This shows us that the magnitude of the quanta cannot only depend on the masses. The magnitude of the quanta rather depends also on the velocity $v_{(t)}$ of the receiver. I will go into that ingrater detail in part 3 of this work.

So we see, that $T_- > T_+$. However, the difference is negligible small, and, of course, it must be very small, because the fact that the repulsion lasts longer than the attraction means a weakening of the gravitation, which, of course, is an attraction.

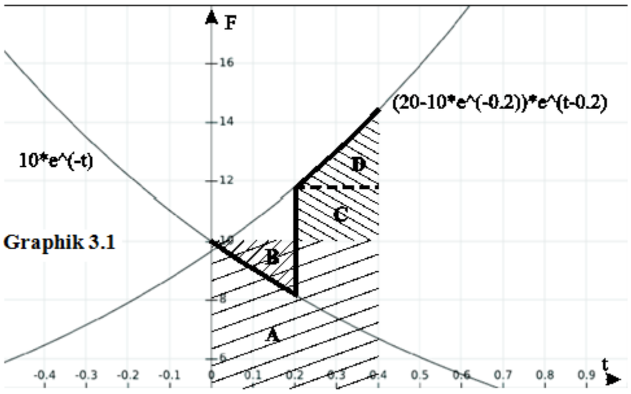
I want to go into that in a little more detail now: Since T_+ or T_- are very small, the exponential function, with which we calculate $F_{(t)}$, can be regarded, in sufficient precision, as being straight. For each, for the attraction as for the repulsion, we get one such straight for the field and one for the anti-field. The slopes of these 4 straights differ only very little from each other. These differences correspond to the difference between $c$and $c \pm v_{(T)}$ (and we know that $v_{(T)} \ll c$). From the differences of the slopes, $T_- > T_+$ arises. Approximately, $\Delta T (\approx 0)$ can be neglected. If one must know it more precisely, then, from the momentum *calculated* for the gravitation, the momentum $N \cdot (F_c \cdot c + F_G) \cdot \Delta T$ must be subtracted, to get the momentum of the actual gravitation.

At $T_- > T_+$ we also recognize that the repulsion of a *net* charge of the sources (which means that the source is *not* electrically neutral) is greater than the attraction, but, though, the difference is smaller than the gravitational force of these net charges, so it might hardly be measurable.

Alternatively, we could have set $T_- = T_+ = T$ in the first place, and then calculate T by $N \cdot (\int_0^T F_+^+ + \int_0^T F_+^- + \int_0^T F_-^+ + \int_0^T F_-^-) = N \cdot (F_c \cdot c - F_G)$. For the Tcalculated in this way, we then expect: $T_- > T > T_+$. But, though, in this case, too, the repulsion of a net charge of the sources is a little (very little) greater than the attraction. One can clarify himself these connections very well at the graphic which I show below and which shows the force in the course of the time, because there the areas correspond to the momenta.

Altogether, it remains to say that it still could get quite thrilling to evaluate the actual values for T_+^+, T_+^-, T_-^+, and T_-^-- particularly by experiments.

I illustrate in graphic 3.1 the force in the course of the time for the attraction, while, to make it better recognizable, the values are exaggerated hopelessly: $v_0 = 0$, $c = 10$, and $T_+ = 0.2$. The fat line shows that the force decreases exponentially until $T_+ = 0.2$, then it jumps, and then it increases exponentially until $T_+ = 0.4$, in which the slope is smaller when the force decreases than when it increases. From this a tiny difference already arises between the electrostatic force and the average force which results from the field and the anti-field. Therefore, regarding the areas B and D it is: D>B. The areas represent the respective change of momentum. The area A represents the change of momentum which is caused by the electrostatic force. But, what we primarily see in the graphic, is, that the difference between the average force and the electrostatic force is represented mainly by the area C. The area C results due to the jump of the force at the change from the anti-field to the field. From this, a simplified representation can be derived for the emergence of gravitation, which I will show in chapter after the next chapter briefly.



Graphik 3.1.

At the end of this chapter, I would like to say something about the neutrons briefly:

I, in principle, assume that the neutrons also participate in gravitation. But, gravitation is an electric effect. Therefore the neutrons must consist of positive and negative electric charges equal in magnitude. Because the neutron has a similar mass as the proton, I assume that the neutron consists of *one* positive and *one* negative elementary charge unit.

Alternatively, it is also possible to assume that the neutron is alternately positive and negative. This possibility results from the qualities of the field and the anti-field, as I will show in part 3 of this work. In any case, the neutron takes part in gravitation according to its mass.

3.6. Gravitational Mass and Inertial Mass

At the calculation of the $v_{(T)}$ (through the equation (3.1)) I have assumed that m_R is the inertial mass. For the calculation of the gravitational force (through the equations (3.5) or (3.6)) I have assumed that $m_R$is the gravitational mass. So, I haven't distinguished between inertial and gravitational mass.

Now it is, that, because of the quantization of the transfer of the electric energy, always only *either* the positive *or* the negative charges of the sources exert their forces on a receiver. This would mean that, for the time T, too, always only *either* the masses of the positive *or* of the negative charges of the sources are taken into account for gravitation. And, in turn, this would mean that, in the end, the gravitational acceleration of the protons would be greater than the one of the electrons. But, there isn't any single experiment, that would ever have shown such a result.

For that reason, for the mass m_S of the source both the masses of the positive and those of the negative sources are taken into account, so that $m_S = m_{e^-} + m_{p^+} + m_n$

(while the number of the sources still results by the multiplicationwith N).

In the first moment, this seems a little strange. Why should the masses, whose charges don't exert forces, should be taken into account? Let us remember, what the T is. The time $T$is the time-period of a quantum level of a receiver. Actually, it is not very clear, how the magnitude of T results. I just calculate how great T must be, so that gravitation results. Here now we recognize that the T_+ of the attraction and the T_- of the repulsion are not independent of each other.

We know that the electric fields of the positive and negative sources still exist, although they cancel each other, at electrically neutral matter. They exert equally strong attractive as repulsive forces on a receiver. One can regard these attractive and repulsive forces also as a state of tension.

From this way of looking at the state of the receiver, the following connection (which I will explain in grater detail in part 3 of this work) can be derived: A charge, which isn't exposed to any fields, is in the state of equilibrium. As soon as the field of a source exerts its force on a receiver, a velocity ($v_{(t)}$) which disturbs the state of equilibrium arises. As soon as the perturbation exceeds a certain extent, the receiver changes his quantum level. The velocity $v_{(T)}$ at which the receiver changes his quantum level depends both on the masses of the sources whose fields cause the state of tension and on the mass of the receiver.

In the end, a receiver can never be in the state of equilibrium even if he is within the fields of electrically neutral matter. Instead, he will move to and fro, in dependence of the strength of the state of tension, while the anti-fields and fields of the positive and negative charges exert their forces alternately.

So one can say that the changes of the quantum level of the receiver are caused by the anti-fields and fields of the sources, while T_+ and T_- yield from the state of tension. The state of tension for its part obeys $\frac{N}{r^2}$, as it shall be.

3.7. Simplified (alternative) Representation

To check in a simple way whether the velocity-dependence of the electric force and the quantization of the energy transfer produce gravitation, I had started with a very simple representation. Since this simplified representation contains some interesting aspects, I would like to describe it briefly here.

Essentially, I had assumed that an electric charge (with mass) doesn't get its velocity (that was in the previous chapter the $v_{(t)}$) continuously by an acceleration but that the velocity occurs spontaneously for every quantum (that was in the previous chapter the $v_{(T)}$). The energy for this spontaneous $v_{(T)}$ comes temporarily from the mass of the charge, while the relativistic change of the mass can be neglected since the $v_{(T)}$ is very small. Then the force of the field or anti-field acts on the charge and transfers exactly that amount of energy to the charge which corresponds to $v_{(T)}$. But, though, this amount of energy isn't seen in a change of the velocity of the charge, instead the mass of the charge increases until it has reached its original magnitude again. Meanwhile, the charge has been moving with the velocity $v_{(T)}$ (for the time-period T), of course. Here, I assume again that for the anti-field and for the field $T^+ = T^- = T$, since, e.g., there otherwise may be problems with the magnetic force.

Under the prerequisites mentioned, here, the $v_{(T)}$ can be calculated very easily by equating the average force from the field and the anti-field with the resultant from the electrostatic force and the gravitational force, again, as in the previous chapter, which means that we equate the momenta caused by the forces:

$$\frac{T \cdot N \cdot F_c (c \mp v_{(T)}^-) + T \cdot N \cdot F_c (c \pm (v_{(T)}^- + v_{(T)}^+))}{2 \cdot T}$$
$$= N \cdot (F_c \cdot c \pm F_G),$$

were $v_{(T)}^-$ is the velocity of the anti-field and $v_{(T)}^+$ the one of the field; and at $\pm$ and $\mp$ the upper signs correspond to the attraction and the lower to the repulsion. The N is the number of the sources, as in the previous chapter. Doing the multiplications yields: $v_{(T)}^+ = 2 \cdot \frac{F_G}{F_c}$. Since the $v_{(T)}^-$ doesn't appear in the result (it cancels itself) its value can be chosen freely. I choose (more or less arbitrarily): $v_{(T)}^- = v_{(T)}^+ = v_{(T)}$.

Now, it is easy to calculate the $T$for the mass m_R of a charge (a receiver) since the average force of the field and the anti-field shall cause the change of the velocity $2 \cdot v_{(T)}$ in the time $2 \cdot T$:

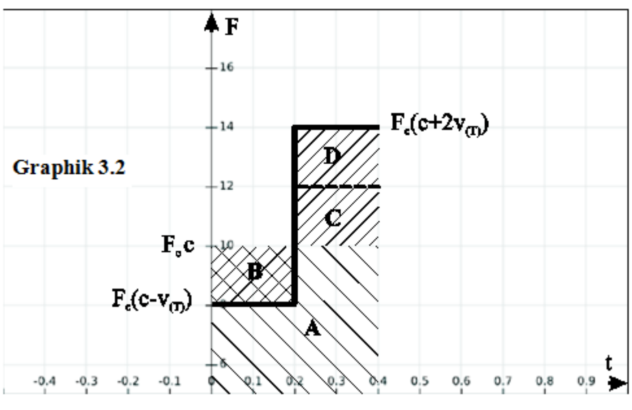
$$\frac{T \cdot N \cdot F_c \cdot (c \mp v_{(T)}) + T \cdot N \cdot F_c \cdot (c \pm 2 \cdot v_{(T)})}{2 \cdot T} = m_R \cdot \frac{2 \cdot v_{(T)}}{2 \cdot T}.$$

Doing the multiplications yields:

$$T = \frac{m_R}{N \cdot F_c \cdot \left(\frac{c}{v_{(T)}} \pm \frac{1}{2} \right)} = \frac{m_R \cdot v_{(T)}}{N \cdot F_c \cdot c},$$

where $\pm\frac{1}{2}$ is negligibly small compared with $\frac{c}{v_{(T)}}$.

We immediately recognise that, e.g., at the attraction the force of the anti-field $F_c \cdot (c - v_{(T)})$ can by no means transfer the same amount of energy as the force of the field $F_c \cdot (c + 2 \cdot v_{(T)})$ in the same time T. This means that the anti-field transfers less energy than necessary for the production of $v_{(T)}$, and the field transfers correspondingly more energy, so that the energy balance is compensated at the end (at the repulsion it is analogous).



Graphik 3.2.

In graphic 3.2 I illustrate, again, the force in the course of time for the attraction, while, to make it better recognizable, the values are, again, exaggerated hopelessly: $v_0 = 0$, $c = 10$, and $T = 0.2$. The fat line shows from $T = 0$ till $T = 0.2$ the constant force of the anti-field, then the force jumps, and then we see the constant force of the field until $T = 0.4$. The area A represents again the change of the momentum which is caused by the electrostatic force. The areas B and D are equal in size, so that the difference between the electrostatic force and the average force of the field and the anti-field is represented exactly by the area C.

At the end of this chapter we want to see now how big $v_{(T)}$ is. For a proton within the gravitational field of electrically neutral matter we get $v_{(T)p+} \approx 8.8 \cdot 10^{-28} ms^{-1}$. It is inconceivable to see, how small $v_{(T)}$is. And T isn't less small either. For a proton we get: $T_{p+} \approx \frac{r^2}{N} \cdot 456 \cdot 10^{-28} s$. For a proton on the earth's surface, $r$is the radius of the earth, and N is the number of the positive or negative charges of the earth.

I think that in this chapter the character of the quantization gets recognizable very well.

3.8. The Magnetic Part of Gravitation

At first, we shall regard the initial velocity v_0. It corresponds to the velocity v_R of the receiver from part 1 of this work where we have calculated the magnetic force. We had found out that, at motionless sources, the forces of the field and the anti-field which arise by the v_R cancel each other exactly. This is still valid on temporal average, when the fields and anti-fields exert their forces not at the same time but after each other.

If the sources move, therefore, if the fields and the anti-fields have an angle, then a magnetic force arises by the v_R (which is here now the v_0). But, since the fields and the anti-fields of the positive and negative charges alternate exactly at electrically neutral matter, no magnetic force will arise on temporal average here either. (Except of some very small effects which can arise by changes of the directions, which I will not treat further here.)

Now, we shall regard $v_{(T)}$. If the sources move (with v_S), as, e.g., the electrons in the atoms do, then there are angles between the forces of their fields and anti-fields and the directions in which their fields and anti-fields propagate. The $v_{(T)}$ for its part has the same direction as the force from which it arises.

We want to find out now which consequences the change of the direction of the force has. This time, as example, we regard the repulsion. We know that when $v_S = 0$ at repulsion always $v^-_{(T)} > v^+_{(T)}$, since for the field the $v^-_{(T)}$ is added to the initial velocity, so that it is weakened more than the anti-field is strengthened by the emergence of the $v^-_{(T)}$. In Figure 3.1 the case $v_S \neq 0$ is represented, while only one possible v_S is represented. The Figure 3.1 corresponds to the Figure 2.3 from part 1 of this work. The $v^-_{(T)}$ and the $v^+_{(T)}$ for $v_S = 0$ are represented as $v^-_{(T0)}$ and $v^+_{(T0)}$ (and they are represented far too great, so that they will be recognisable better, because in reality $v^-_{(T0)}$ and $v^+_{(T0)}$ are negligible small compared with c^+). In Figure 3.1 we can see that $v^-_{(T)}$ gets smaller in the direction of c^+ (therefore also in the direction of c^-) due to the angle φ^-. But exclusively the component of the $v^-_{(T)}$ which is parallel to c^+ is responsible for the weakening of the field, which, of course, exerts its force after the anti-field. Therefore, the weakening of the field is weakened (for $v_S \neq 0$ compared with $v_S = 0$), which means that the repulsion altogether is weakened less, so that gravitation is also weakened.

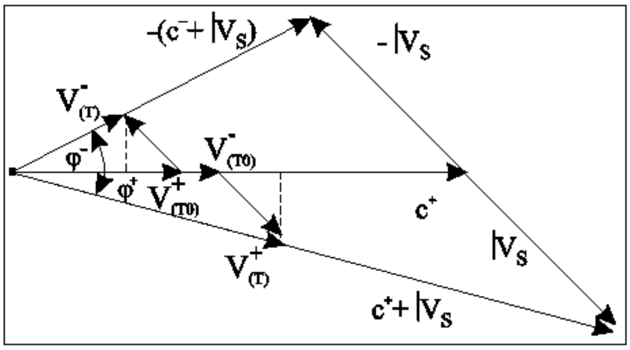


Figure 3.1.

But, of course, we know that, in the end, gravitation isn't weakened all in all; the explanation for that is that the v_S is, e.g., the velocity of the electrons in the atom. And in Figure 3.1 only one possible direction is represented for the v_S. At its motion within the atom the electron will move also in exactly the opposite direction, and there then gravitation is strengthened (by the same amount as it is weakened in the opposite direction).

This then is the conclusion of this chapter: In the end, at electrically neutral matter, with no net-currents flowing, the magnetic forces of the fields and anti-fields of the positive and negative charges compensate each other exactly. That is: there is no resultant magnetic force at gravitation. More detailed considerations, which are surely necessary here, will follow in further works.

However, one already recognizes how easily the equilibrium of the forces can be disturbed. E.g., one only would need to assume that the electron doesn't always move continuously within the atom, but, that it executes something like "quantum jumps". The equilibrium could already be disturbed. It isn't clear either yet, how accelerations have an effect.

At the end of this chapter, I still would like to draw our attention to such an equilibrium of forces to avoid irritations since the connection doesn't immediately discloses itself:

The $v_{(T)}$ always has the same direction as the force. This means that if the sign of the force changes then the direction of the $v_{(T)}$ changes, too, so that the magnetic force has the same direction both for the attraction and for the repulsion.

So, here, one could come to the incorrect assumption that a resultant magnetic force arises if a charge (a receiver) moves to and fro due to the positive and negative fields and anti-fields of an electrically neutral object (which represents the sources).

But actually, one must consider that a receiver isn't accelerated only positively but that he must also be accelerated negatively (therefore slowed down) so that he can move at all to and fro. And while the receiver slows down he continuous to move in the same direction as when he was accelerated, but here now the force has the opposite sign, and this means that the magnetic force has the opposite direction when slowing down as when accelerating, so that *no* resultant magnetic force arises.

So, although gravitation results from the quantization for the transfer of the electric energy, there don't seem to occur any considerable magnetic effects.

I nevertheless think that the magnetic part of gravitation is most likely to show deviations from classic gravitation - if there are any at all. Also a technical influence on gravitation seems here more possible then elsewhere - I remind the somehow strange results regarding the super-conductive, rotating plates [33,34,35,36]. In any case, the magnetic part of gravitation must urgently be analysed more exactly.

3.9. On General Relativity

I don't treat general relativity (GR) [7,8,9] here. However, I don't see any contradictions any way.

In GR the principles of special relativity (SR) are applied to the gravitational acceleration. The result is the description of the gravitational field as curved spacetime. The great advantage of this consideration is that the changes of spacetime, which arise in accordance with SR, can be taken into account here. So, in this way, e.g., the planetary orbits [16] are calculated more correctly than only by Newton's laws since the conditions of SR, which are to be regarded as valid, are applied to gravitation.

Since we know now that gravitation isn't a force of its own, since gravitation is an electric effect, it is necessary to apply the conditions of SR to the electric fields and anti-fields, or to their forces and accelerations. Here, the quantization of the transfer of the electric energy, as it is described in this work, is to be taken into account. The result of such an procedure must be GR here again, too.

We can regard the curvatures of spacetime of GR as some sort of resultant field. If we look more exactly, then we see the electric fields and anti-fields and the quantum levels of the electric charges to whose accelerations SR is applied. In turn the electric forces yield in their sum the conditions of GR. It principally is about two different ways of looking at the same thing, and both ways yield the same results.

GR is more general (of course). It describes gravitation without going the detour via the electric force. But, though, I cannot derive GR from the electric forces yet. This is a task for coming works.

The question, whether the curved spacetime actually exists, cannot be answered here either. I merely show that in reality the gravitational field reveals to consist of electric fields and anti-fields at a more exact consideration. For this reason I also can not make any helpful statements on the gravitational waves here, although one can suspect that the gravitational effects, from which the gravitational waves arise, exist quite independently from the existence of the curved spacetime.

3.10. Closing Remark to Part 2

I think that I could show clearly that gravitation is an electric effect. Therefore, a gravitational force of its own, without electric forces, cannot exist.

Apart from the velocity-dependence of the electric force, which is known from part 1, I only have assumed that electric charges can change between different quantum levels if their energy state changes. From this then gravitation can be calculated as an electric effect. A relativistic calculation of this electric effect then would yield GR.

Being able to present the connection between the gravitation and the electric force opens numerous new cognitions, particularly regarding the behaviour of electric charges. New approaches arise for experiments, and also new technical applications will appear hopefully soon, particularly regarding the magnetic part of gravitation.

A new, exciting world opens up, with thrilling challenges.

4. Part 3: On Quantization and on Electricity as Alternating Spacetime

4.1. Introduction to Part 3 / Motivation

We have seen that gravitation is an electric effect between electric charges. And although the electric charges exert exclusively electric forces on each other, the gravitational force is nevertheless proportional to the product of the interacting masses. This means that the electric field of a charge and also the charge itself must have a quality in which the mass of the charge is disclosed. From this quality, the quantization of the transfer of the electric energy arises, from which then the $v_{(T)}$ results, and therefore gravitation.

I will show that the mass of the electric charge is substantiated in the fact that the electric charge is a spacetime wave. Further interesting connections then arise apart from the quantization of the transfer of the electric energy. Not least, the emergence of the electric force can be understood better here, too.

4.2. The Electric Charge as a Spacetime Wave

Already deBroglie had used the equation $\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}\cdot c^2 = h\cdot f$ at his derivation of the matter waves, were m_0 is the rest mass, v the velocity, f the frequency, and hPlanck´s constant.

The term before the equality sign can be developed:

$$\frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}\cdot c^2 = m_0\cdot c^2 + \frac{1}{2}\cdot m_0\cdot v^2 + \ldots .$$

The first term after the equality sign (that is $m_0 \cdot c^2$) was ignored by deBroglie since it is constant and deBroglie was only interested in the velocity of the mass-particle.

But exactly this first term is particularly interesting for us here.

Because we can write:

$$m_0\cdot c^2 = h\cdot f_{m0} \Rightarrow f_{m0} = \frac{m_0\cdot c^2}{h}. \qquad (4.1)$$

Here, the frequency f_{m0} is assigned to a particle with the rest-mass m_0. One generally assumes that there cannot be an electric charge without mass. I additionally state that, in principle, mass without charge cannot be, either, while I always assign two opposite charges equal in magnitude to every electrically neutral mass (such as the neutron). So, if the frequency f_{m0} is assigned to a mass m_0, then this frequency is assigned to an electric charge with the mass m_0.

Here, an electric charge reveals to be an oscillation whose frequency is proportional to its mass. This is exactly the quality of an electric charge, we were looking for: the mass of an electric charge is represented in the frequency of the electric charge.

Therefore, it cannot be distinguished between the mass and the electric charge. In this sense, it doesn't make sense to distinguish between the electric charge and its field either. Much more, the electric charge is the oscillation of its field. I will describe this oscillation more exactly now.

In the first part of this work, I show that the magnetic field is an angled electric field, which means that there isn't a magnetic field of its own. In the second part of this work, I show that gravitation is an electric effect, which means that there isn't a gravitational field of its own. It almost seems as if the electric field were the most basic of all fields. And now we see that the electric field appears to be oscillation.

A field represents a spatial quality. And the most basic element of space is space itself. If the electric field is the most basic of all fields, then it seems almost compelling that the oscillation of the electric field is the oscillation of space itself. Of course, space still has, in addition, the quality of time. An electric charge is, therefore, oscillating spacetime.

We know from GR, and the gravitational waves derived from it, that oscillating spacetime contains energy. In a similar way also the oscillating spacetime of the electric charges contains energy. This energy can be transferred to charges and cause changes of the velocity, according to the forces of the electric charges.

I cannot say much about the exact composition of the spacetime and its oscillations of electric charges yet. But, I can name some qualities of these oscillations and show, at least, in principle, how they cause changes of velocity. This is carried out in the coming chapters.

4.3. Energy / Beat (interference)

The electric force is proportional to r^{-2} and arises, according to the previous chapter, from an oscillation of spacetime. If we assume that the force is proportional to the amplitude of the oscillation of spacetime, then the amplitude of the oscillation of spacetime is proportional to r^{-2}, too. This implies that the charge has a centre towards which the amplitude of the oscillation of spacetime increaseswith r^{-2}.

Since the electric force (of a motionless charge) is equal in all directions, we have to assume, for symmetric reasons, that the oscillation of spacetime of an electric charge is a spherical oscillation - which corresponds to a longitudinal oscillation. This oscillation spreads, starting out from the centre, into infinity, with an amplitude proportional to r^{-2}.

As we know by now, an electric charge consist of a field and an anti-field. All electric qualities applied similarly to the field as to the anti-field till now. Thus, I assume that the f_m applies both to the field and to the anti-field. For a motionless charge the f_{m0} of the field shall be equal to that of the anti-field. The field and the anti-field propagate with the speed of light in opposite directions. If two waves of the same frequency and opposite directions superimpose, then a *standing wave* is made. So, a motionless electric charge is a standing spherical wave whose amplitude increases towards the centre with r^{-2}, while the field moves away from the centre, and the anti-field moves towards the centre.

If an electric charge with the mass $m$moves with the velocity v_m, then the f_m changes according to the velocity, and to be more precise both the f_m of the field and that of the anti-field change. For the wave, which propagates in the same direction as the charge, the frequency increases, and for the wave, which propagates in the opposite direction as the charge, the frequency decreases. If the frequencies of two waves (which superimpose) are different, then *beat* arises.

For beat there are two frequencies: the carrier frequency and the frequency of the beat.

We first regard the carrier frequency. The carrier frequency is the average frequency of the frequencies, which superimpose. Under consideration of the relativistic time-dilatation, which arises for a charge which moves with the velocity v_m, the carrier frequency of the charge is:

$$f_m = \frac{f_{m0}}{\sqrt{1-\frac{v_m^2}{c^2}}}, \tag{4.2}$$

were f_{m0} is the frequency of the standing wave. We begun with assigning the frequency f_{m0} to the rest mass m_0. Now we see that by the introduction of the anti-field the carrier frequency corresponds exactly to the relativistic mass. Inserting (4.1) into (4.2) yields: $f_m = \frac{m \cdot c^2}{h}$. So we can retain: The entire energy of the mass is located in the carrier frequency.

The wavelength of the carrier frequency also changes according to the relativistic length-contraction and is: $\lambda_m = \lambda_{m0} \cdot \sqrt{1-\frac{v_m^2}{c^2}}$, were λ_{m0} is the wavelength of a rest mass.

Now, we regard the frequency of the beat (f_b). The frequency of the beat is the difference of the frequencies of the waves, which superimpose. Under consideration of the relativistic time-dilatation, which arises for a charge which moves with the velocity v_m, the frequency of the beat of the charge is: $f_b = f_{m0} \cdot \frac{2 \cdot v_m}{c} \cdot \frac{1}{\sqrt{1-\frac{v_m^2}{c^2}}}$. If the velocity of the mass is considerably smaller than the speed of the light (that is $v_m \ll c$), then the root term is approximately 1, so that

$$f_b = \frac{f_{m0} \cdot 2 \cdot v_m}{c} \tag{4.3}$$

is a good approximation. The beat propagates with the speed of light. So, if λ_b is the wavelength of the beat then:

$$c = f_b \cdot \lambda_b. \quad (4.4)$$

Inserting (4.1) and (4.4) into (4.3) finally yields: $\lambda_b = \dfrac{h}{m_0 \cdot 2 \cdot v_m}$. This corresponds exactly to the deBroglie wavelength which deBroglie calculated for the matter-waves of the masses (which are confirmed, e.g., by double split-experiments [11]). The $2 \cdot v_m$ is the difference of velocity, which results for the mass between the field and the anti-field.

It is really remarkable: By introducing the anti-field, the deBroglie wavelength can be represented very simply as a beat, which arises between the spacetime wave of the field and the anti-field if the mass moves with the velocity v_m.

I regard this as an excellent confirmation (no proof) for the existence of the anti-field. I think that the anti-field is not a theoretical construct but it is physical reality.

So, the mass of an electric charge isn't a small object in the centre of the charge, as it may has been imagined classically. The mass rather corresponds to the frequency with which the charge oscillates and can not be distinguished from the charge. But, due to r^{-2}, the amplitude increases very fast towards the centre, so that, at a collision, the intensity of the interaction increases very fast as the centres approach, from what a radius can be derived for the interaction, which then is likely to be assigned to the mass.

The velocity of a mass corresponds to the motion of the centre of an electric charge and arises from the difference of the frequencies of the field and the anti-field. So, an electric charge has not a mass which is struck but the frequencies of the field and the anti-field which alternate.

4.4. On the Emergence of the Electric Force

The space-time wave of the anti-field propagates with the speed of light towards the centre, while the amplitude increases with r^{-2}. The increase of the amplitude can be represented geometrically: while the anti-field propagates towards the centre a spherical surface of this anti-field decreases with r^{-2}, and the density of the points on this sphere increases correspondingly. In this sense, the space of the anti-field becomes compressed on its way towards the centre. The space compressed into the centre then leaves the centre as a field. But, though, the anti-field isn't reflected at the centre; instead it goes through the centre.

So, on its way through the centre the anti-field becomes a field. Both move in the same direction. It seems, as if they could be one and the same wave, but the field and the anti-field have different spacetime parameters. When the anti-field goes through the centre its spacetime parameters alternate, so that it becomes a field. We can call the combination of the wave of the anti-field which becomes the wave of the field the continuous wave. Thus, there are two continuous waves for every straight that goes through the centre which propagate in opposite directions. So, if a receiver moves with a velocity ($\overrightarrow{v_R}$), then the wavelengths of the continuous waves are different in the direction of the $\overrightarrow{v_R}$.

The electric force of a field and an anti-field of an electric charge, which I call source, on a receiver corresponds to the acceleration - that is the change of the velocity - of the receiver. This means that the frequencies of the continuous waves of the receiver change in the direction of the change of the velocity. And this means, formulated quite generally, that the frequency of the field of the receiver, that is f_R^+, changes in relation to that one of the anti-field, which is f_R^-. The change of f_R^+ and f_R^- is caused by the field and the anti-field of the source. Since I show in this work here that gravitation is an electric effect, it is clear that, in the first place, the force of the electric field is independent of the mass of the charge of the source. Thus, it is clear that the force of the field and the anti-field of the source is independent of the respective wavelength (these are λ_S^+ and λ_S^-). It is an important component of this work that the electric force is velocity-dependent (as it is in part 1 of this work). So we can assign to *each wave* of the field or anti-field of the source (which, of course, propagate with the speed of light) a certain change of the frequency of the field or anti-field of the receiver, which then is δf_R^+ or δf_R^-, were then, of course, δf_R^+ or $\delta f_R^-$are directly proportional to λ_S^+ or λ_S^-. In addition, we know that the electric force is proportional to r^{-2}. From that we have derived that the amplitude of the spacetime wave of the field or anti field of the source (this is A_S^+ or A_S^-) is also proportional to r^{-2}. Here this means that δf_R^+ or δf_R^- is proportional to A_S^+ or A_S^-.

The actual acceleration of the receiver is inverse proportional to its inert mass. But, in this representation of the connections there isn't a mass as such, neither inertly norgravitationally. Here, the inertia corresponds to the time-period Δt which is necessary for a δf_R^+ or δf_R^-. This time-period corresponds to the time which one wave of the source needs to move along the centre of the receiver, by which a δf_R^+ or δf_R^-arises. Of course, it isn't necessary to always consider a whole wave of the source; a fraction of one wave of the source causes a correspondingly smaller change of the frequency of the receiver. The δf_R^+ or δf_R^- cause a beat which in turn corresponds to a velocity of the receiver (including his centre). The frequency of the beat is the difference of the frequencies, and here, that is δf_R^+ or δf_R^-. So, regarding equation (4.3) it is $f_b = \delta f_R^+$ or $f_b = \delta f_R^-$. The mass of the receiver corresponds to the frequency f_{m0} and the velocity v_m corresponds to the change of the velocity of the receiver (this then is v_R). Since the waves of the source produce, in the same period Δt, always equally grate δf_R^+ or δf_R^-, we see in equation (4.3) that the change of the velocity of the receiver is exactly inverse proportional to his mass - because then $f_{m0} \cdot v_R$ is constant. So, the quality of the inertial mass (that is inertia) results quite automatically if the changes of the frequency which the waves of the source produce on the receiver are independently of the mass of the receiver (which corresponds to f_{m0}).

Here, now it becomes clear how the velocity-dependence of the electric force arises: due to a velocity $\overrightarrow{v_R}$ of the receiver the velocity with which the waves of the source move along the centre of the receiver changes, so that the time-period Δt for a δf_R^+ or δf_R^- changes, too.

If we say, independently of whether it is a field or an anti-field, that every wave of the source (this then is λ_S) causes a certain change of the frequency of the receiver (this then is δf_R), then it is: $\frac{\delta f_R}{\lambda_S} = K_R$, were K_R is a constant still to be defined. In addition, it is: $\lambda_S = \Delta t \cdot (c \pm v_{R(t)})$, were $v_{R(t)}$ is the magnitude of the component of $\overrightarrow{v_R}$, that is parallel to the speed of light c of the waves of the source. By inserting (4.3) and for $\Delta t \to 0$ we finally have: $\frac{dv_R}{dt} = \frac{(c \pm v_{R(t)}) \cdot K_R \cdot c}{2 \cdot f_{m0}}$, were, in this case, f_{m0} is the frequency of the rest mass of the receiver. This corresponds exactly to the equations (3.1) or (3.3) from part 2 of this work. Therefore, by considering (4.1) it is: $K_R = \frac{2 \cdot F_c \cdot c}{h}$.

The velocity-dependence of the electric force arises from the relative velocity between the waves of the source and the receiver. By the component of $\overrightarrow{v_R}$ that is perpendicular to the $c$of the waves of the source, the angle $\tan(\varphi_r) = \frac{v_{R\perp}}{c}$ results between the waves of the source and the receiver. Due to φ_r the δf_R^+ or δf_R^- also have a corresponding angle so that the beat also has the angle φ_r. And this means that the change of the velocity of the receiver also has the angle φ_r, what corresponds to an additional force which is proportional to the $v_{R\perp}$.

So we see that the velocity-dependence of the electric force, as I have represented it in part 1 of this work, and which means there that the $\overrightarrow{v_R}$ produces an additional force of its own, can be very well derived from the representation of the electric charge as a spacetime wave.

One important characteristic of electric charges is the duality: there are two different types of charges in which same charges repel and opposite charges attract each other. This duality is mirrored in the duality of the field and the anti-field. This duality of the electric charges results when the field of the one type of a charge corresponds to the anti-field of the other type of a charge, and vice versa. In this way, one receives changes of the velocity which correspond to the direction of the force. Here, it is decisive that there always is only one type of an interaction between the source and the receiver: either always only the fields interact with the fields and the anti-fields with the anti-fields or always only the fields interact with the anti-fields. For purely practical reasons, I decide that always only the field of the source interacts with the field of the receiver and the anti-field of the source with the anti-field of the receiver. Another difference in the interaction arises from the relative direction of the motion: when the receiver and the waves of the source move towards each other, then they produce exactly the opposite δf_R as when they move in the same direction.

We first consider the repulsion between same charges. The field of the source (λ_S^+) interacts with the field of the receiver (f_R^+). At repulsion the frequency of the wave of the receiver becomes grater when the wave moves towards the source (I then call his frequency f_{R1}^+), and it becomes smaller, when the wave moves away from the source (I then call his frequency f_{R2}^+). (I draw the connections symbolically in Figure 4.1. To not overload the Figure I *don't* represent the amplitude of the waves with r^{-2}, instead I draw it just "flat". M_S and M_R are the centres of the source and the receiver respectively, while the source is in a grate distance from the receiver.) So, if the fields of the source and of the receiver move towards each other then f_R^+ gets greater, and vice versa. If, on the other hand, the anti-fields of the source and of the receiver move towards each other, then exactly the inverse happens: then f_R^- gets smaller, and vice versa. So, the frequency of the continuous wave which moves towards the source gets greater, and the frequency of the continuous wave which moves away from the source gets smaller, what corresponds to a repulsion.

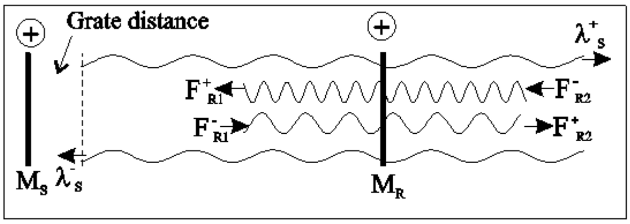


Figure 4.1.

We now consider the attraction between opposite charges. Here, the field of the one charge is the anti-field of the other charge. Thus, the field of the source (λ_S^+) interacts with the anti-field of the receiver (therefore with f_{R1}^- and f_{R2}^-). So, the field of the source corresponds to the anti-field of the receiver. Since λ_S^+ moves towards f_{R2}^-, the f_{R2}^- becomes smaller and the f_{R1}^- becomes correspondingly greater - very analogous to the anti-fields at the repulsion. The λ_S^-, in turn, corresponds to the field of the receiver so that f_{R1}^+ becomes smaller and f_{R2}^+ greater. So, the frequency of the continuous wave which moves towards the source gets smaller, and the frequency of the continuous wave which moves away from the source gets grater, what corresponds to a attraction.

As we know, the field and the anti-field of the source don't exert their forces at the same time but after each other. Therefore, the frequencies of the two continuous waves always change only on one side, in which these changes of the frequencies spread from the centre of the receiver with the speed of light.

The changes of the frequencies of the receiver arise because the wave of the field or anti-field of the source causes an oscillation (that is a spacetime wave) in the centre of the receiver which spreads from the centre and which superimposes the wave of the field or anti-field of the receiver. The changed frequencies of the receiver correspond to a velocity and yield the beat which corresponds to the matter-waves.

According to this logic, we can assume for the anti-particles [32] that the field and the anti-field of an anti-particle are switched compared with a normal particle.

About the vacuum one can say that it is filled densely with the spacetime waves of the positive and negative electric charges - only the centres of charges (that are particles) are rare there. [13]

Perhaps it hasn't got as clear by the descriptions up to now, but it is remarkable: Electric charges consist exclusively of spacetime. The mass corresponds to their frequency, and the forces, which they exert on each other, result from the changes of their spacetime waves. So, in the end, all matter we know only consists of spacetime.

4.5. On the Emergence of the Electric Quantization

The quantization of the transfer of the electric energy (which I call shorter "electric quantization") leads to gravitation. I will show now, how this quantization results.

The electric quantization means that the receiver can only be in certain quantum levels, in which always only the fields *or* the anti-fields of *one* type of a charge of the sources can cause changes of the frequency of the receiver. The beat arising in this process corresponds to the velocity $v_{R(t)}$. The electric quantization then results by the fact that the receiver changes his quantum level as soon as the changes of the frequency (and therefore also the $v_{R(t)}$) have reached a certain magnitude. If we call the time-period of a quantum level generalized T, then the quantum levels change each time when $v_{R(T)}$ is reached.

The beat is calculated from the difference of the frequencies of the field and the anti-field of the receiver. In an analogous way we also can calculate the difference of the wavelengths of the field and the anti-field of the receiver. Generalized (that is, for the moment, without distinguishing between the field and the anti-field, and between the positive and negative charges), this difference is for each quantum level:

$$\delta\lambda_R = \frac{2 \cdot v_{R(T)}}{f_{R0}}, \tag{4.5}$$

were f_{R0} is the frequency of the rest mass of the receiver. (To avoid mistakes: the $\delta\lambda_R$ *isn't* the wavelength of the beat).

In part 2 of this work we have seen that $v_{R(T)}$ is a somehow complicated exponential function of T, in which T depends on $K = \frac{m_R \cdot m_S \cdot G \cdot \varepsilon_0 \cdot 4 \cdot \pi}{q_S \cdot q_R}$. But, we know that K and therefore also T is very small and for values near zero the slope of the exponential function is ≈ 1. So we can say, in good approximation, that $v_{R(T)}$ is proportional to $m_R \cdot m_S$ and therefore also to $f_{R0} \cdot f_{S0}$ (in which the f_{S0} represents the frequencies of the rest masses of the sources.) This means that $\delta\lambda_R$ is roughly independent of f_{R0}, and approximately proportional to f_{S0}. This means that $\delta\lambda_R$ results almost exclusively from the frequencies of the waves of the *sources*. The electric quantization then arises by the fact that the magnitude of the $\delta\lambda_R$ at which the quantum level of the receiver changes each time is proportional to the frequencies of the waves of the sources. Or formulated a little differently: the magnitude of the changes of the wavelength of the receiver is, for every quantum level, proportional to the frequencies of the waves of the sources.

Here now it may be interesting to realize the magnitudes of the quantization: in part 2 of this work, I have assessed the time-period of a quantum level of a proton on the earth's surface in strongly simplified terms. It is: $T_{p+} \approx \frac{r^2}{N} \cdot 456 \cdot 10^{-28} s$. The number N of the positive or negative charges of the earth is $N \approx 3.57 \cdot 10^{51}$, and for the radius of the earth it is $r^2 \approx 3.969 \cdot 10^{13}$, so that $T_{p+} \approx 5 \cdot 10^{-64} s$. On the other hand, the time-period of the frequency of the mass of a proton is: $T_{mp+} \approx 4.5 \cdot 10^{-24}$. Here we see, despite the only very rough estimation, how unbelievably small the change is, which a quantum causes at a charge. The reason for that could be the condensation of the space in the centre.

Now, I want to try to find a descriptive interpretation for the connections on the electric quantization. We know that the fields and the anti-fields of the sources don't exert their forces at the same time but after each other, with the consequence that the frequencies of the continuous waves always change only on one side of the receiver, with respect to the centre. From that, the the following interpretation arises: the imbalance between the frequencies on the one and the other side of the centre cannot exceed a certain magnitude, just as if a difference in pressure would arise. As soon as the imbalance has reached a certain magnitude, the charge alters its quantum level. The imbalance corresponds to a difference in the wavelengths between the two sides (with respect to the centre) of a continuous wave, and this imbalance is proportional to the frequencies of the waves of the sources, so that, therefore, it can be all the bigger, the bigger the frequencies of the waves of the sources are.

But, in addition, we also know that although always only the fields or anti-fields of one type of a charge can exert their forces, nevertheless the masses of the respective other type of a charge have to be taken into account for gravitation, too. For this, there is the following interpretation: we know that the field of the one type of a charge corresponds to the anti-field of the other type of a charge, and we know that always only the ones of the same kind interact with each other. So, if, therefore, the fields of the one type of a charge of the sources interact with the field of the receiver, then the anti-fields of the other type of a charge of the sources counteract, but this *without* being able to actually exert their forces. Instead, these anti-fields of the other type of a charge of the sources will support the receiver, so that the difference of the wavelength, which the fields of the sources, that interact with the receiver, can cause, gets appropriately grater.

This interpretation is, of course, still very vague, and the reason for that is that it still isn't clear at all which spacetime parameters the waves of the electric charges have. It also isn't clear at all, in which way different spacetime waves influence each other. On this topic, I have made some general considerations in my work "Theory of objects of space" [39]. This work here represents a first specification of my considerations then. But, there is still a long way to go. However, we already receive important notes. So, e.g., we can assume that the spacetime parameters of the waves of the electric charges must overall fulfil, for gravitation, the parameters of GR.

4.6. Effects on Gravitation

In part 2 of this work, we have calculated $v_{R(T)}$ or T only for small, *non-relativistic* velocities, and we can make here exactly the same. But, though, these non-relativistic velocities are not always to be neglected, since, as we can see, $\delta\lambda_{R(T)}$ is proportional to the frequencies of the waves of the sources and these frequencies are directly proportional to the velocities of the sources and the receivers, and this, of course, is also relevant for non-relativistic velocities. This means, in the end, that there is a *velocity-dependence* for *gravitation*, *too* (just as for the electric force). And as in the case of the electric force, also at gravitation, the changes of the field and the anti-field cancel each other. And this means that, at gravitation, too, we get a force which corresponds to the magnetic force [15,26-31]. From this then, among other things, the gravitational waves arise! [37,38]

For grater, relativistic velocities the increase of the mass has to be taken into account, of course. Since the average frequency from the field plus the anti-field of a source changes, not only the inertial mass of a source changes but in the same way the gravitational mass changes, too. I still cannot say here exactly which consequences this has on gravitation since I cannot know yet whether I know all the relevant factors. However, for the moment, it seems as if the gravitational force of a mass increases by its velocity *in the direction* of the velocity.

Perpendicular to the velocity of a source the frequencies of the field and the anti-field of the source change exactly in the same way (so there isn't any beat). Due to the relativistic time-dilatation, the average frequency perpendicular to the velocity v_S of a source becomes: $f_S^+ = f_S^- = f_{S0} \cdot \sqrt{1 - \frac{v_S^2}{c^2}}$. For the moment, this means that the gravitational force gets *smaller* perpendicular to v_S. If this is correct, then, e.g., the velocities of the electrons within the atom shells must be taken into account, and also the atomic nuclei could have relevant velocities, e.g., inside the sun.

A horizontally rotating mass on the earth's surface also should get lighter - but, though, so insignificantly, that it would hardly be measurable. There have already been corresponding experiments [33,34,35,36] with superconductive rotating plates. The results achieved there are considerably bigger than the relativistic changes let expect, though. If the results would be confirmed, one would need to look for other causes. The superconductivity could be relevant. As we know by now, electric charges are spacetime waves. Some of these spacetime waves could develop resonances at superconductivity so that the frequencies and amplitudes of the spacetime waves of the charges the rotating plate consists of change, so that the weight of the plate changes. One could go even so far to assume that the resonant spacetime waves of the charges of the plate change the spacetime waves, which come from the earth, and go through the plate, in such a way that gravitation changes above the rotating plate. But all this is very very speculative. As far as it concerns the meaning of the rotation of the plate, I would suspect that not the rotation itself but the cause for the rotation (that is the drive) has meaning.

In this work here, we have already seen multiple times that there seem to be different factors which have the potential to be able to influence gravitation, and although it will need much effort, I believe that a more exact look will be worthwhile, because we finally want to better understand gravitation, to see how we can use it.

4.7. The Electromagnetic Waves

The electromagnetic waves (EMW) [17,18,19,20] transfer their energy by energy quanta, the photons [10]. We know that photons are influenced by gravitation, and since we have understood now that gravitation is an electric phenomenon, photons must therefore have electric qualities. In addition, we know that photons are *not* influenced by electric fields, therefore, photons must be electrically neutral. But photons always move with the speed of light, therefore, they cannot consist of opposite electric charges equal in magnitude, since beat isn't possible for the speed of light. We know that photons can collide, similar to mass particles. Therefore, a momentum is assigned to the photons, which arises from the speed of light multiplied with the mass which corresponds to the frequency of the photons. Photons cannot have a rest mass since they always move with the speed of light.

I will design a construct, now, that corresponds to all these qualities of a photon, in the hope, that it is as similar to the actual photons as possible.

It finally turns out that a photon resembles very much to an electric charge: it is a *spherical* spacetime wave whose amplitude increases towards the centre, and it consists of a field and an anti-field. The essential difference compared with an electric charge is that the field and the anti-field of a photon *don't* move relatively to the centre, while the centre moves with the speed of light. The magnetic part of the photon is represented by the angle φ of the electric field, as I have described in part 1 of this work.

At a particle with mass, the kinetic energy is the increase of its relativistic mass. This increase of the mass corresponds to an increase of the average (carrier-) frequency of the field plus the anti-field of this mass (see equation 4.2). The frequency of a photon corresponds exactly to this additional frequency which a particle with mass has due to its kinetic energy. The frequency of the photon corresponds to a mass, and so this mass corresponds to the kinetic energy of the photon. So, if a photon looses its complete kinetic energy at an interaction, no rest mass is left. The kinetic energy of the photon is: $E_{kinP} = m_P \cdot c^2 = f_P \cdot h$, were m_P is the mass and f_P the frequency of the photon. And the momentum of the photon is: $P_P = m_P \cdot c = \frac{f_P \cdot h}{c}$.

EMW, such as radio waves, consist in dependence of the amplitude of many photons. The individual photons of an EMW are, similar as in the case of a laser, in resonance.

I will describe now, how it happens that photons are effected by a gravitational field but not by an electric (net) field.

At an electric charge, the field and the anti-field propagate with the speed of light in opposite directions and the differences of their frequencies cause beat, which corresponds to a velocity of the electric charge. At a photon instead, the field and the anti-field *don't* propagate relative to each other, they are static to each other. Correspondingly, at a photon, the beat also will be static. This static beat doesn't change the velocity of the centre of the photon. So we recognize that changes of the frequency of the field and the anti-field of a photon don't cause any changes of the velocity at the photon.

As in the case of an electric charge at a photon, too, always only the frequency of the field *or* the anti-field changes, according to its quantum level, in which, each time, the frequency on one side of the centre changes in an opposite way as on the other side. And, of course, positive and negative charges will cause exactly opposite changes of the frequencies at a photon.

So, the fields and anti-fields of the sources cause a static beat at a photon as a receiver. This static beat doesn't produce a velocity at the photon. But, we know that photons are influenced by gravitation, which means that the velocity-dependence of the electric force must be valid for photons. We achieve this by saying that the velocity which corresponds to the static beat of a photon has to be taken into account so at the velocity-dependence of the electric force as if it were an actual velocity. This can be justified by the fact that the (interaction-) behaviour of the photon changes due to the static beat, even if its velocity doesn't change.

For the frequency of a photon, only the average frequency from its field plus its anti-field is relevant, while the static beat only has meaning for the velocity-dependence of the electric force. The average frequency changes both for positive and for negative charges of the sources always by the amount which corresponds to gravitation. The static beat instead changes for positive and negative charges of the sources exactly oppositely, so that it is zero on average.

Therefore, for a photon, that propagates parallel to the gravitational field, the frequency (and therefore the *energy*) of the photon changes according to gravitation.

At a photon that propagates perpendicular to the gravitational field the average frequency changes perpendicular to the direction in which the photon propagates. According to our assumption, a photon shall fall according to gravitation. This means that, for a photon that propagates perpendicular to the gravitational field, the *direction* in which it propagates changes. This change of the direction results from the change of the average frequency (perpendicular to the direction in which this photon propagates) and not from the appropriate static beat - thus, a resultant average frequency arises in the new direction. The fields and anti-fields of *one* type of a charge of the sources always change the average frequency of a photon only by the amount which corresponds to gravitation (since, as described, the field and the anti-field of the photonchange oppositely). Therefore, if a photon propagates perpendicular to the electric field of a net charge, then its direction will change only by the amount which corresponds to the gravitational force of the *net charge*, which will be negligibly small, at least in laboratories. But, in addition, the trajectory of the photon is shifted parallel, due to the net charges; I still must calculate whether this is measurable under laboratory conditions.

Of course, the magnitude of the change of the direction in which the photon moves is proportional to the component of the speed of light of the photon which is perpendicular to the gravitational field.

At an electric charge as a receiver, the changes of the frequency spread with the speed of light, starting from the centre. At a photon as a receiver, this isn't possible since it already moves with the speed of light. At an electric charge as a receiver, the changes of the frequencies arise from the superposition with an oscillation which is produced by the fields and anti-fields of the sources in the centre of the receiver and which spreads from there with the speed of light. The changes of the frequencies of a photon also arise from the superposition with an oscillation which is produced by the fields and anti-fields of the sources, but this oscillation, which I call superposition-oscillation, does not have to arise in the centre of the photon. The superposition-oscillation can rather appear in the whole area of the photon *at the same time*. The reason for that is, that the fields and anti-fields of the sources, which cause the superposition-oscillation, already exist in the whole area of the photon, and they just cause a change of the photon when the photon is in the corresponding quantum level. But, of course, just because the photon has the ability to change as a whole at the same time, this *doesn't* have to happen. Instead, every interaction with a photon must be analysed carefully, to find out the temporal and spatial sequence in accordance with which the frequencies of the photon change. I will not do this in this work here, though. This is a task for future works.

Independently of the temporal and spatial sequence in accordance with which the frequencies of the photon change, even if the whole photon changes at the same time, the centre of the photon always moves with the speed of light, of course.

We recognize, here, a striking similarity to the entanglement: on the one hand, events can take place simultaneously, on the other hand, the centres still move with the speed of light. Actually, I wouldn't have taken the possibility of the simultaneity into consideration at all if I didn't know that entanglement exists [24,25]. Thanks to the unbelievable phenomenon of entanglement, now it is easy to understand, how it is possible that photons are influenced by the fields and anti-fields of the sources although they move with the speed of light. But, though, I am still far away from being able to convey the simultaneity at the change of a photon to the entanglement of two photons. My first thought about entangled photons would be that they are parts of the same system which can always change only at the same time, while, of course, they always keep the speed of light - I cannot say much more here yet. But it seems very obvious, though, that this simultaneity can, if it is possible for photons, happen also at electric charges, which, of course, are very similar to the photons.

In principle, the entanglement must be coupled to some time phenomenon, perhaps similar as in my description in my "Theory of objects of space" [39]. This could mean that the field and the anti-field are also connected by a time phenomenon - but, really, this is an other building site.

A photon consists, exactly as an electric charge, of a field and an anti-field. At the photon, though, the field and the anti-field are static to each other. If, now, two identical photons meet exactly centrically with exactly opposite velocities then this corresponds to the origin of two couples, of which each consists of one field and one anti-field, and which move in opposite directions (with the speed of light). And this corresponds, in the end, to the creation of two opposite electric charges - but they are at the same place, of course, so that they recombine immediately again. But, if the two photons, which produce the couple of charges, don't have exactly identical frequencies, then beat can arise, with the consequence that the electric charges have opposite velocities, in which, of course, here, it is necessary to consider the conservation of momentum and energy, particularly regarding the masses.

In addition, there are experiments [21,22] particularly with strong magnetic fields [23] which indicate that a couple of charges, that may exist for a short moment, can also arise from only *one* photon. I don't know yet, how this happens. But, it seems, in principle, to be possible that the field and the anti-field of a photon become part of an electric charge again.

4.8. Remarks on Particle Physics

Although electric charges are spacetime waves, they also have, due to the fast increase of their amplitude towards the centre, particle character, because the intensity of their interactions increases very fast when the distance decreases.

If the distance between two protons becomes very small, e.g., inside a sun, their frequencies can get into a kind of resonance so that they don't repel any more, and they form a unit, an atomic nucleus. At this, the neutrons seem to serve as a connection. One can imagine an atomic nucleus as a complex assembly of oscillations. To merge a proton and an electron seems to be more difficult (then the creation of an atomic nucleus), otherwise this would happen also inside a sun. The reason for that could be the great difference of the frequencies between the proton and the electron. Instead, the electrons form the atom shell. At this, it is interesting that the deBroglie wavelengths, which arise from the velocities which are assigned to the electrons in the atom shell, correspond approximately to the diameter of the atom shell. Therefore, we can imagine that the waves of the beat of the electrons form the atom shell. Here, complex superposition patterns arise, from which the atomic orbitals of the electrons may result.

We recognize the strong interaction in these considerations. I still can say nothing to the weak interaction here.

Of course, we know that electric charges consist of quarks [14]. This could mean that the frequencies of the electric charges have sub-structures which correspond to the quarks. On the other hand, the existence of the quarks is observable only at particle collisions so that it cannot be said, whether they exist already before the collision. It is very well possible that the quarks arise only at the collision. Two particles, which collide with each other, don't simply move at straight trajectories with steady velocities towards each other. The particles will rather oscillate, specially when the distances become very small, and they will leave their straight trajectories, while, of course, their waves superimpose. At such a process complex superposition patterns can arise. A complex assembly of oscillating spacetime arises, from which all possible particles can result. For reasons, which I don't know, many of these particles seem to exist only for a very short time. Among others, the quarks also arise. The fact, that the elementary particles can be assembled of quarks, shows us that the superposition of the waves obeys to fixed rules, at the collisions of particles.

A remark on the Higgs-Boson: In this work here, I have defined the mass as a spacetime wave, while the inertia results from the time which is necessary for a change of the frequency. On the other hand, it makes sense, in the context of particle physics, to define the Higgs-Boson. Therefore, it is necessary to find out, what corresponds to the Higgs-Boson if the mass is understood as a spacetime wave. In the end, the Higgs-Boson must be connected directly with the frequency of the mass, as it is defined in equation (4.1). And at collisions, the Higgs-Boson always arises in a way which is connected directly to the frequency of the mass.

A remark on the frequency of the gravitational oscillation: we have seen that the electric charges oscillate due to gravitation with extremely high frequencies. The question is, now: which meaning has this gravitational frequency at collisions? Well, I don´t know yet; but, since the gravitational frequency is proportional to the mass of the electric charge, there could be a connection to the Higgs-Boson here, too.

The graviton, which is mentioned occasionally, is, as I would think, most likely to be connected to the quantization of the transfer of the electric energy, since this, after all, is responsible for gravitation.

These short remarks on particle physics shall show that particle physics is very well compatible with the idea that particles are spacetime waves.

4.9. Closing Remark to Part 3

We have seen, here, in part 3, that it makes sense to regard the electric charge as a spacetime wave whose amplitude increases towards the centre with r^{-2}, because, regarding the charge as a spacetime wave, allows us to better understand the qualities of the electric charges and their forces. So it turns out that the quality of the relativistic mass of an electric charge corresponds to the *frequency* of its spacetime wave, while the deBroglie wavelength of the matter-waves turns out to be the *beat* (interference) of the frequencies of the field and the anti-field of the spacetime waves of an electric charge. The velocity-dependence of the electric force, and the quantization of the transfer of the electric energy, due to which gravitation results, also result to be qualities of the spacetime waves of the electric charges, while electromagnetic waves are a special manifestation of these spacetime waves.

We finally recognise that, perhaps, even almost all forces can be explained by the forces between the spacetime waves of which the electric charges consist, and which also yield the electric forces. This seems obvious if we consider that space and time are the most basic quantities of physics.

But, the cognition that, in the end, all matter, that we know, consists of oscillating spacetime is particularly fascinating, here.

4.10. Conclusion

In this work, we have learned more about the qualities of the electric charges and their forces, which helps us to better understand magnetism, and to recognize gravitation as an electric effect.

Essentially, it is about three qualities: the velocity-dependence of the electric force, the electric anti-field, and the quantization of the transfer of the electric energy.

In part 1, I show that the magnetic field isn't a field of its own, but that it is only an angled electric field, in which the angle of the electric field has to be regarded relativistically.

In part 2, I show that gravitation is an electric effect, which means that there cannot be a gravitational force of its own without electric forces. Overall, of course, the electric forces, which produce gravitation, yield the conditions of GR.

In part 3, I finally describe the electric charge to be a spacetime wave, whose amplitude increases towards the centre with r^{-2}, from what then the mentioned qualities of the electric charges and their forces can be derived. The relativistic mass corresponds to the frequency of this spacetime wave.

Besides a better understanding of the electric charges and their forces, and a better understanding of gravitation, which will hopefully lead to new experiments and applications soon (which I point out in this work occasionally) I would like to highlight that a new field has entered the stage of physics: the electric anti-field.

Particularly interesting is the cognition, because it has not only physical but perhaps also philosophical meaning, that, in the end, all matter, that we know, consists of oscillating spacetime.

References

[1] A. Einstein, Zur Elektrodynamik bewegter Körper Annalen der Physik 17, 891-921 (1905).

[2] PAM Dirac: The Quantum Theory of the Electron. In: Proceedings of the Royal Society of London. Series A, Containing Papers of a Mathematical and Physical Character. A, Nr.778, 1928, S.610-624.

[3] Dieter Meschede: Gerthsen Physik. 23. Auflage, Springer, Berlin/Heidelberg/New York 2006, ISBN 3-540-25421-8.

[4] James Clerk Maxwell, A Dynamical Theory of the Electromagnetic Field, Royal Society Transactions 155, 1865, Seiten 459-512.

[5] Introduction to Electrodynamics (3rd Edition), D.J. Griffiths, Pearson Education, Dorling Kindersley, 2007.

[6] Electromagnetism (2nd Edition), I.S. Grant, W.R. Phillips, Manchester Physics, John Wiley & Sons, 2008.

[7] Dirac, Paul (1996), General Theory of Relativity, Princeton University Press.

[8] Einstein, Albert (1916), "Die Grundlage der allgemeinen Relativitätstheorie", Annalen der Physik 49.

[9] Hartle, James B. (2003), Gravity: an Introduction to Einstein's General Relativity, San Francisco: Addison-Wesley.

[10] M. Planck: Zur Theorie des Gesetzes der Energieverteilung im Normalspectrum. In: Verhandlungen der Deutschen physikalischen Gesellschaft. 2, Nr. 17, 1900, S. 245, Berlin (vorgetragen am 14. Dezember 1900).

[11] Roger Bach, Damian Pope, Sy-Hwang Liou, Herman Batelaan Controlled double-slit electron diffraction In: New Journal of Physics, Roger Bach et al 2013 New J. Phys.15 033018.

[12] JoernBleck-Neuhaus: ElementareTeilchen. Von den Atomenüber das Standard-Modell biszum Higgs-Boson. 2., überarbeitete Auflage. Springer, Berlin Heidelberg 2013.

[13] J. Baez. What´s the energy density of the vacuum?, 2006.

[14] M. Gell-Mann: A Schematic Model of Baryons and Mesons in Phys. Lett. 8, 1964, 214-215.

[15] Moshe Carmeli, John G. Hartnett, Firmin J. Oliveira On the anomalous acceleration of Pioneer spacecraft Int.J.Theor.Phys. 45 (2006) 1074-1078.

[16] Albert Einstein: Erklärung der Perihelbewegung des Merkur aus der allgemeinen Relativitätstheorie. In: Sitzungsberichte der Preußischen Akademie der Wissenschaften.

[17] Chandrasekhar Roychoudhuri, Rajarshi Roy: The nature of light: What is a photon? In: Optics and Photonics News. 14, Nr. 10, 2003, ISSN 1047-6938, Supplement, S. 49-82.

[18] Harry Paul: Photonen: Eine Einführung in die Quantenoptik. 2. Auflage. Teubner, Stuttgart 1999, ISBN 3-519-13222-2. (Teubner-Studienbücher Physik).

[19] Klaus Hentschel: Einstein und die Lichtquantenhypothese. In: Naturwissenschaftliche Rundschau. 58(6), 2005, ISSN 0028-1050, S. 311-319.

[20] Liang-Cheng Tu, Jun Luo, George T. Gillies: The mass of the photon. In: Reports on Progress in Physics. 68, Nr. 1, 2005, S. 77-130.

[21] J D Franson Apparent correction to the speed of light in a gravitational potential In: New Journal of Physics, J D Franson 2014 New J. Phys.16 065008.

[22] Berestetskii V B, Lifshitz E M and Pitaevskii L P 1980 Quantum Electrodynamics (Oxford: Pergamon).

[23] H. Grote: On the possibility of vacuum QED measurements with gravitational wave detectors In: Phys. Rev. D 91, 0220022 - 7 January 2015.

[24] Max Born, Albert Einstein: Albert Einstein, Max Born. Briefwechsel 1916-1955. München (Nymphenburger) 1955, S. 210.

[25] Simon Gröblacher, Tomasz Paterek, Rainer Kaltenbaek, Caslav Brukner, Marek Zukowski, Markus Aspelmeyer, Anton Zeilinger: An experimental test of non-local realism. In: Nature. 446, 2007, S. 871-875. (Abstract).

[26] Jacob Biemond The MagneticFfield of Pulsars and the Gravito-Magnetic Theory Trends in Pulsar Research (Ed. Lowry, J. A.), Nova Science Publishers, New York, Chapter 2 (2007).

[27] Shervgi S. Shahverdiyev Unification of Electromagnetism and Gravitation in the Framework of General Geometry Proceedings of the workshop in "Fizika" N 12, 2004.

[28] Friedrich W. Hehl An Assesment of Evans´Uunified Field Theory Foundations of Physics 38 (2008) 7-37.

[29] Bahram Mashhoon, Frank Gronwald and Herbert I.M. Lichtenegger Gravitomagnetism and the Clock Effect Lect.Notes Phys. 562 (2001) 83-108.

[30] Sumana Bhadra Electromagnetic Mass Models in General Theory of Relativity Ph.D. thesis, Sambalpur University, Jyoti Vihar, Burla – 768019, Orissa, India (2007).

[31] J.H. Field Forces Between Electric Charges in Motion: Rutherford Scattering, Circular Keplerian Orbits, Action-at-a-Distance and Newton's Third Law in Relativistic Classical Electrodynamics arXiv:physics/0507150v3 (2007).

[32] Weinberg, S. (1995). The Quantum Theory of Fields, Volume 1: Foundations. Cambridge University Press.

[33] M. Tajmar and C. J. de Matos Extended Analysis of Gravitomagnetic Fields in Rotating Superconductors and Superfluids ARC Seibersdorf research GmbH, A-2444 Seibersdorf, Austria and ESA-HQ, European Space Agency, 8-10 rue Mario Nikis, 75015 Paris, France.

[34] M. Tajmar, F. Plesecu, B. Seifert and K. Marhold Measurement of Gravitomagnetic and Acceleration Fields Around Rotating Superconducters AIP Conf. Proc. 880, 1071 (2007).

[35] Martin Tajmar, Florin Plesescu, Klaus Marhold and Clovis J. Matos Experimental Detection of the Gravitomagnetic London Moment Space Propulsion, ARC Seibersdorf research GmbH, A-2444 Seibersdorf, Austria and ESA-HQ, European Space Agency, 8-10 rue Mario Nikis, 75015 Paris, France (2006).

[36] V.V. Roschin and S. M. Godin Experimental Research of the Magnetic-Gravity Effects Institute for High Temperatures, Russian Academy of Science.

[37] Misner, C. W.; Thorne, K. S.; Wheeler, J. A. (1973). Gravitation. W. H. Freeman.

[38] Einstein, A (1918). "Ueber Gravitationswellen". Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften Berlin. part 1: 154-167.

[39] H.-J. Hochecker Theory of Objects of Space At: http://www.hochecker.eu.

[40] Hans-Joerg Hochecker Magnetism as an Electric Angle-effect and Gravitation as an Electric Effect International Journal of Physics Vol. 3, No. 4, 2015, pp 175-201.