

# Magnetism as an electric angle-effect and gravitation as an electric effect

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Abstract: At first, I regard magnetism. I can show that the magnetic force is an electric angle-effect by establishing two postulates: the dependence of the electric force on the velocity, and the existence of the anti-field. With the help of a third postulate, this is the quantization of the energy-transfer of the electric field, I then show that gravitation is also an electric effect. So, the three postulates describe three qualities of the electric field by which magnetism and gravitation can be derived. I finally carry out quantum-mechanical considerations at which the three postulates will be excellently confirmed. For the correct classification of this work I must mention that the theory of special relativity is absolutely considered as being correct and that it is an important and necessary component of this work.

Keywords: Gravitation, magnetism, electric fields, special relativity, quantum-mechanics

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## General preface

At first, magnetism had engaged me. It is clear that the magnetic force results from the motions of electric charges. There isn't known much more about the origin of the magnetic force, and magnetism is simply regarded as given. For me, this was unsatisfactory. I believed that it has to be possible to explain the origin of the magnetic force much more fundamentally and more basic. From considerations on another work I had come to the conviction that there must be an angle between the direction, in which the electric field propagates, and the direction, in which the electric force actually acts. From this, the first of three postulates arose: the dependence of the electric force on the velocity (I call that the velocity-dependence of the electric force). From this first postulate, it should had been possible to derive the origin of the magnetic force, but it didn't turn out well. I finally recognized that it was necessary to introduce a second postulate: the existence of the anti-field. Both postulates seem a little daring, but in the course of this work they are confirmed in an impressive way. Both postulates can be represented even quantum-mechanically.

With the help of these two postulates the magnetic force can faultlessly be derived from the electric force.

Apart from magnetism, gravitation has always interested me, too. There always was the assumption that there could be a connection between the electric force and gravitation. Therefore, I examined whether such a connection could be found with the help of the two postulates. But it didn't turn out well for a long time. Until I recognized that a third postulate is still necessary: the quantization of the energy-transfer of the electric field.

With the help of these three postulates it can now faultlessly be shown that gravitation is actually an electric effect.

The three postulates describe three qualities of the electric field, in the end. Magnetism and gravitation then can be derived from these three qualities of the electric field quite easily.

To confirm the won cognitions about magnetism and gravitation, I finally carry out a quantum-mechanical consideration. Doing so, the three postulates are confirmed in an excellent way. The quantum-mechanical considerations have got a little more extensive, but this is only because many new connections reveal, primarily due to the anti-field.

For the correct classification of this work, I must mention that the theory of special relativity (SR) isn't only considered as being unconditionally correct but that it is also an important and necessary component of this work.

About the sectioning: This work consists of three parts in accordance with its contents.

In the first part, I introduce the first two postulates and derive magnetism.

In the second part, I introduce the third postulate and derive gravitation.

In the third part, I finally carry out the quantum-mechanical considerations.

Yes, this work here has got quite extensive, but I think that it is worthwhile to take the time to read it. I assure that it is about thoroughly sound considerations whose developments have taken much time, and I think that I don't exaggerate if I claim that the cognitions which I win here, if they will be confirmed, can have fundamental meaning.

## Part 1: Magnetism as an electric angle-effect

### 1.1 Introduction to part 1 / Motivation

The magnetic force is really somehow strange: 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? 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 explain the origin of magnetism I will state two assumptions (in the sense of postulates). Every postulate for itself yields wrong results. Only the combination of both postulates yields the correct results. I will introduce these two postulates in the following chapters and then calculate the magnetic force with their help.

As the first postulate I will introduce the velocity-dependence of the electric force. This postulate yields wrong results. Only by the introduction of the second postulate these faults are corrected again. The second postulate demands the existence of the anti-field. Both postulates together describe the electric forces fault-free and in addition they clearly enable the derivation of the origin of the magnetic force (the magnetism).

### 1.2 The velocity-dependence of the electric force

I will now describe the first of the two postulates: the velocity-dependence of the electric force.

The electric field *always* moves with the speed of light  $\vec{c}$  (within a classical vacuum, of course). And while the electric field moves with the speed of light, it exerts an electric force on electric charges. So, one can come to the assumption that the electric force emerges due to the velocity with which the electric field moves relatively to an electric charge. The relative velocity between an electric field and the electric charge, on which the field exerts a force (as said: I call this charge receiver), corresponds to the vector addition of the speed of light  $\vec{c}$  and the velocity of this charge  $\vec{v}_R$ . Thus, the electric force on a charge changes due to the velocity of this charge. But the force shall be all the greater, the greater the relative velocity is. Therefore the velocity of the receiver  $\vec{v}_R$  must be *subtracted* from the speed of light  $\vec{c}$ .

So, the force of the field on a charge changes due to the velocity  $\vec{v}_R$  of this charge. But how big is this force at all? Or asked differently: How strong is the field, or how big is the strength of the field?

Well, in the same way in which the force of the field on a charge emerges due to its relative velocity to this charge, the strength of the field emerges due to the relative velocity between the field and its source, too. And here, it is also the same: the greater the relative velocity is, all the greater the strength of the field is. But here

the strength of the field increases in the direction in which the source moves. Therefore, here, the velocity of the source  $\vec{v}_S$  must be added to the speed of light  $\vec{c}$ . However, this only applies to the component of  $\vec{v}_S$  which is parallel to the speed of light of the field.

So we recognise:

Both, the strength of the electric field and the force of the field on an electric charge are proportional to the relative velocity between the electric field and the electric charge.

That is already the first postulate. Although it isn't exactly a postulate because in part 3 of this work I can substantiate quantum-mechanically this proportionality between the relative velocity and the electric force very well. This substantiation will be a little more extensive but I already can say this: it is all about the energy-transfer between the charge and the field.

The change of the strength of the field is particularly important in respect to this first postulate, if the source of the field moves with the velocity  $\vec{v}_S$ . Here it is necessary to decompose  $\vec{v}_S$  into two components: one component parallel to the speed of light of the field, that is  $\vec{v}_{S\parallel}$ , and one component vertical to the speed of light of the field, that is  $\vec{v}_{S\perp}$ .

Due to  $\vec{v}_{S\parallel}$ , the strength of the field becomes, as said, stronger in the direction of  $\vec{v}_{S\parallel}$ , therefore  $\vec{v}_{S\parallel}$  is *added* (not subtracted as  $\vec{v}_R$ ) to the speed of light  $\vec{c}$ .

The component  $\vec{v}_{S\perp}$  is perpendicular to  $\vec{c}$ . Thus,  $\vec{c}$  does not change due to  $\vec{v}_{S\perp}$ . The component  $\vec{v}_{S\perp}$  produces its own, *additional* force. Therefore,  $\vec{v}_{S\perp}$  has the same meaning as  $\vec{v}_R$ . Thus,  $\vec{v}_{S\perp}$  must be *subtracted* from  $\vec{c}$  (similar as it is for  $\vec{v}_R$ ). So, the correct and complete change of the strength of the field, which yields due to  $\vec{v}_S$ , corresponds to the vector:  $(\vec{c} + (\vec{v}_{S\parallel} - \vec{v}_{S\perp}))$ .

It is as if  $\vec{v}_S$  is mirrored. So, instead  $\vec{v}_S$  the mirrored  $\vec{v}_S$ , that is  $|\vec{v}_S = \vec{v}_{S\parallel} - \vec{v}_{S\perp}$ , is used for the calculation of the strength of the field.

So, according to the 1st postulate, the strength of the field arises from the vector  $(\vec{c} + |\vec{v}_S)$ .

So, the strength of the field arises, according to the 1st postulate, by the addition of the velocity of the source  $|\vec{v}_S$  with the speed of light  $\vec{c}$ , with which the field moves. This means: The direction, in which the field moves, that is the direction of the speed of light  $\vec{c}$ , *isn't* any more the same direction, in which the field acts, because the direction, in which the field acts, corresponds to the direction of the vector  $(\vec{c} + |\vec{v}_S)$ .

So, due to the velocity of the source  $\vec{v}_S$  not only the strength of the field but also the direction, in which it acts, changes, *without* the direction in which it moves changing.

If we decompose  $\vec{v}_S$  (as done) into one component parallel to  $\vec{c}$  (that is  $\vec{v}_{S\parallel}$ ) and one component vertical to  $\vec{c}$  (that is  $\vec{v}_{S\perp}$ ), the angle  $\varphi$  between  $\vec{c}$  and  $\vec{v}_S$  is calculated by:  $\tan(\varphi) = \frac{v_{S\perp}}{|\vec{c} + \vec{v}_{S\parallel}|}$ .

The postulate also states that the force of the field on a charge (the receiver) changes due to the velocity  $\vec{v}_R$  of this charge. This means in principle nothing else than that there is an additional force which is directly proportional to  $\vec{v}_R$ . For the field of a motionless source this is trivial. But how is it, if the field has the angle  $\varphi$ , due to the  $\vec{v}_S$  of the source?

Well, the additional force, that arises due to  $\vec{v}_R$ , will also have the angle  $\varphi$  towards  $\vec{v}_R$ . Furthermore, the additional force, which arises due to  $\vec{v}_R$ , will be proportional to the strength of the field, which, of course, depends on the  $\vec{v}_S$  of the source.

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

### 1.3 The anti-field

The introduction of the velocity-dependence of the electric force has consequences which can not be, since they contradict *all* experiences with electric forces. To undo these consequences again, which can not be at all, I introduce the anti-field. And, in addition, the combination of the velocity-dependence of the electric force with the anti-field yields automatically the magnetic force.

So, what is the anti-field? The anti-field is a field which always appears then when a field has an effect on a charge. It resembles a reflection; this shall mean that the anti-field always moves exactly in the opposite direction to the field. The anti-field only always appears when the field interacts with a charge. But, taken exactly, the existence of the field only can be proven when it interacts with a charge, too. The field is fundamentally regarded as always existing. I am making the same supposition for the anti-field now. The anti-field shall always be existing, too. In this sense then the anti-field cannot be understood 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, exactly 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 are still not quite clear to me - but, though, in this regard an interesting connection turns out in part 3 of this work.

In any case, the anti-field is real, exactly as the field. This means that it exerts an electric force on an electric charge, exactly as the field. Thus, the electric force on a charge *always* composes of the force of the field plus the force of the anti-field. And although the anti-field always moves exactly in the opposite direction to the field, the force of the anti-field (on a charge) *always has the same sign as the force of the field* (on the same charge). Therefore, if the force, which arises due to 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 due to 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 always  $\vec{c}^+ = -\vec{c}^-$ , the force of the anti-field must be multiplied with -1.

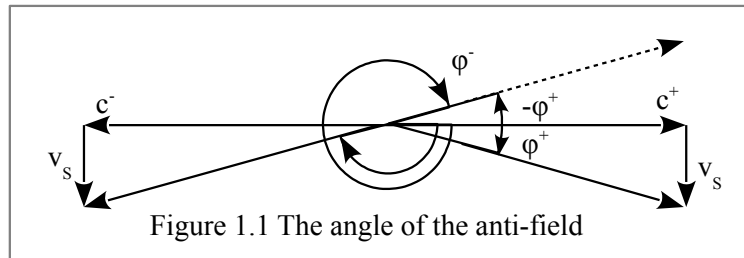


Figure 1.1 The angle of the anti-field

We have postulated that the strength of the field changes due to the velocity  $\vec{v}_s$  of the source. Well, the same applies to the anti-field, the strength of the anti-field also changes due to  $\vec{v}_s$ . But it has to be taken into account, though, that the anti-field moves in the opposite direction to the field. In addition, the force of the anti-field must be multiplied with -1. This considerations become particularly clear in the case that  $\vec{v}_s = \vec{v}_s^\perp$ , which means that  $v_{s\parallel} = 0$ . In that case it is: If the angle of the field related to the direction  $\vec{c}^+$  is  $\varphi^+$  (see Figure 1.1), then, because of  $\vec{c}^+ = -\vec{c}^-$ , the angle of the anti-field  $\varphi^-$  related to the direction  $\vec{c}^+$  would be:  $\varphi^- = 180^\circ - \varphi^+$ . And due to the multiplication with -1 we get (still related to the direction  $\vec{c}^+$ ):  $\varphi^- = (180^\circ - \varphi^+) + 180^\circ = 360^\circ - \varphi^+ = -\varphi^+$  (if  $v_{s\parallel} = 0$ ). Short and good: If the strength of the field has the angle  $\varphi^+$ , then the strength of the anti-field has the angle  $\varphi^- = 360^\circ - \varphi^+$  (if  $v_{s\parallel} = 0$ ).

I think that it become clear what the anti-field is. Most difficultly seems the idea that the anti-field always moves *towards* the source. This has always to be taken into account in all considerations.

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. Since both always appear together, it will be hard, though, to detect them separated - I will say more about that in part 2 of this work, in which I treat the gravitation. Both fields - field and anti-field - always act together and yield in the sum the effects which we know as electric and magnetic effects. I cannot prove the existence of the anti-field. But I think that the results, which I present 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 which underline the existence of the anti-field.

#### 1.4 The magnetic force

I will derive the magnetic force from the two postulates now.

To simplify the representations in the further course, it is helpful to look at the electrostatic case: The electro-

static force between two charges is calculated by Coulombs law:  $F_S = \frac{q_1 \cdot q_2}{r^2 \cdot \epsilon_0 \cdot 4 \cdot \pi}$ , in which  $q_1$  and  $q_2$  are the electric charges,  $r$  is the distance between them, and  $\epsilon_0$  is the permittivity of free space [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 the relative velocity between the field, or anti-field and the charge is always the speed of light  $\vec{c}^\pm$ . So the electrostatic force can be represented by:  $F_S = \frac{q_1 \cdot q_2}{r^2 \cdot \epsilon_0 \cdot 4 \cdot \pi} \cdot \frac{\vec{c}}{|\vec{c}|} = F_c \cdot \vec{c}$ , with

$$F_c = \frac{q_1 \cdot q_2}{r^2 \cdot \epsilon_0 \cdot 4 \cdot \pi \cdot |\vec{c}|}$$

So, for the calculation of the strength of the field we can use for the electric force  $F_Q$ :  $F_Q = F_c \cdot (\vec{c} + |\vec{v}_S)$ ,

with  $F_c = \frac{q_S \cdot q_P}{r^2 \cdot \epsilon_0 \cdot 4 \cdot \pi \cdot |\vec{c}|}$ , where  $q_P$  is a small test charge, and  $q_S$  is the charge of the source.

To calculate the force of the field, or anti-field on a motionless receiver ( $\vec{v}_R = 0$ ) one simply would use the charge of the receiver ( $q_R$ ) instead of the test charge ( $q_P$ ).

When the receiver moves with the velocity  $\vec{v}_R \neq 0$ , an additional force arises due to  $\vec{v}_R$ , in addition to the force which was exerted on the motionless receiver.

The force due to  $\vec{v}_R$  is, in principle, an individual force, and in the case of the *field*, for the force which arises due to  $\vec{v}_R$ , the  $-\vec{v}_R$  has to be used, and the force due to  $\vec{v}_R$  is turned by the angle  $\varphi^+$ . The magnitude of the force due to  $-\vec{v}_R$  is proportional to the strength of the field.

The anti-field has the opposite sign to the field. Only due to  $\vec{c}^+ = -\vec{c}^-$  the force of the anti-field then has the same sign as the field. However, since there is the same  $\vec{v}_R$  for the field as well as for the anti-field, and since the anti-field acts oppositely to the field, for the effect (force) of the anti-field the  $-(\vec{v}_R)$  has to be used (for the field that is  $-\vec{v}_R$ ), therefore  $+\vec{v}_R$ . The magnitude of the force, which arises due to the anti-field, is proportional to the strength of the anti-field.

These connections can be best shown graphically (see Figure 1.2).

Notice, that in Figure 1.2  $\vec{v}_R$  (!) is represented.

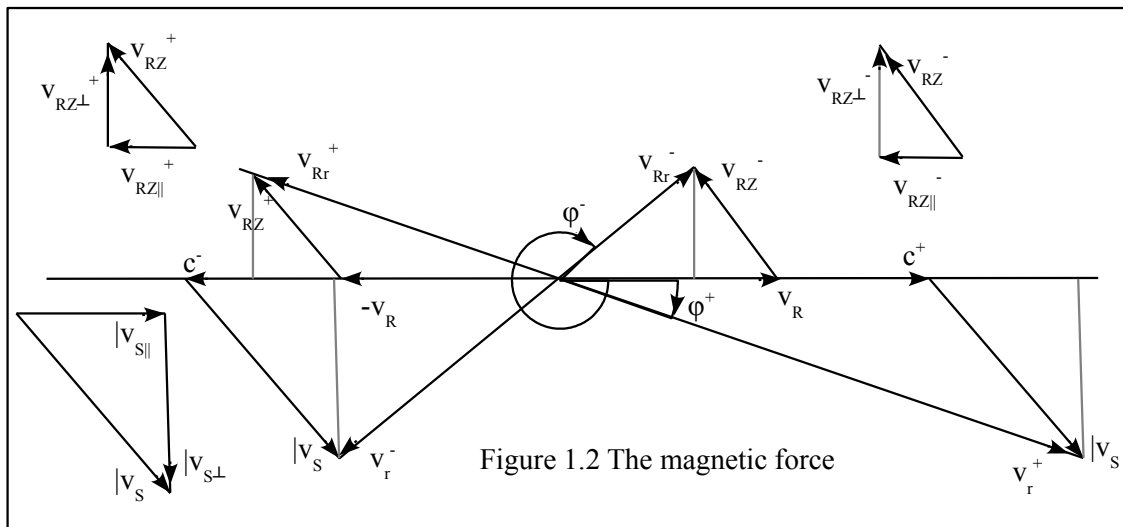


Figure 1.2 The magnetic force

The force, which results due to  $\vec{v}_R$ , is turned by the angle  $\varphi^+$ , or  $\varphi^-$  with respect to  $\vec{v}_R$ , and it is proportional to the strength of the field, or anti-field. We are interested now in the resultant force of the field and the anti-field which arises due to  $\vec{v}_R$ . At this, we relate the direction of this resultant force to the direction of  $\vec{v}_R$ .

The velocity of the source  $|\vec{v}_S$  can be decomposed: into one component parallel to the speed of light of the field, or anti-field, that is  $|\vec{v}_{S||} = \vec{v}_{S||}$ , and into one component vertical to the speed of light of the field, or

anti-field, that is  $|\vec{v}_{S\perp}^-| = -v_{S\perp}^-$ .

Due to  $|\vec{v}_{S\parallel}|$ , the strength of the field changes in the direction of the speed of light of the field, or anti-field. If we want the additional force, which results due to  $\vec{v}_R$ , to be proportional to the strength of the field, then the change of the strength of the field, which results due to  $|\vec{v}_{S\parallel}|$ , must be taken into account, too.

We get the desired proportionality by forming similar triangles. We form two similar triangles *each* both for the field and for the anti-field.

For the field we form the first of the two triangles from  $\vec{c}^+$ ,  $|\vec{v}_S^+$  and the resultant of the addition of this two vectors, that is  $\vec{v}_r^+$ . Here,  $F_c \cdot \vec{v}_r^+$  is the strength of the field. To form the second triangle for the field we take  $-\vec{v}_R$  and draw a line parallel to  $|\vec{v}_S^+$ . The intersection point with the direction of  $\vec{v}_r^+$  yields  $\vec{v}_{Rr}^+$ . And  $\vec{v}_{Rr}^+$  is proportional to  $\vec{v}_r^+$ , which means that  $F_c \cdot \vec{v}_{Rr}^+$  is the force which results due to  $\vec{v}_R$ , when the source of the field has the velocity  $\vec{v}_S$ .

The third side of the triangle is formed by  $\vec{v}_{RZ}^+$ . And  $F_c \cdot \vec{v}_{RZ}^+$  is the *additional* force which arises in *addition* to  $F_c \cdot \vec{v}_R$ , when the source moves with  $\vec{v}_S$ . And it is exactly this additional force that we are interested in.

We can derive from the similar triangles for the absolute values:  $\frac{v_{EZ}}{v_E} = \frac{|v_Q|}{c} \Rightarrow v_{EZ} = \frac{v_E \cdot |v_Q|}{c} = \frac{v_E}{c} \cdot |v_Q|$ .

Exactly as  $|\vec{v}_S^+$  the  $\vec{v}_{RZ}^+$  can be decomposed into one component parallel to  $\vec{c}^+$  (that is  $v_{RZ\parallel}^+$ ) and one vertical to  $\vec{c}^+$  (that is  $v_{RZ\perp}^+$ ). Of course, the components of  $\vec{v}_{RZ}^+$  are in the same way proportional to the components of  $|\vec{v}_S^+$  as  $\vec{v}_{RZ}^+$  is proportional to  $|\vec{v}_S^+$ .

So we get:  $v_{RZ\parallel} = \frac{v_R}{c} \cdot |v_{S\parallel}|$  and  $v_{RZ\perp} = \frac{v_R}{c} \cdot v_{S\perp}$ .

The corresponding considerations apply to the *anti-field*, but here, of course, we use  $+\vec{v}_R$  instead of  $-\vec{v}_R$ .

Now we are interested in the resultants, both the one parallel to  $\vec{c}^\pm$  and the one perpendicular to  $\vec{c}^\pm$ .

For the resultant parallel to  $\vec{c}^\pm$  of the field and the anti-field we get:

$$(-\vec{v}_R + (-\vec{v}_{S\parallel} \cdot \frac{v_R}{c})) + (+\vec{v}_R + (\vec{v}_{S\parallel} \cdot \frac{v_R}{c})) = 0.$$

It has to be taken into account that here also we need to use  $-\vec{v}_{S\parallel}$  for the field and  $+\vec{v}_{S\parallel}$  for the anti-field.

So, no forces result parallel to  $\vec{c}^\pm$ .

For the resultant perpendicular to  $\vec{c}^\pm$  of the field and the anti-field we get:

$$|\vec{v}_{S\perp}^-| \cdot \frac{v_R}{c} + |\vec{v}_{S\perp}^+| \cdot \frac{v_R}{c} = 2 \cdot v_{S\perp} \cdot \frac{v_R}{c}.$$

It has to be taken into account here that the  $|\vec{v}_{S\perp}^+$  of the field and the  $|\vec{v}_{S\perp}^-$  of the anti-field produce forces in exactly opposite directions. But the additional forces that result due to  $\vec{v}_R$  by the field and the anti-field are exactly oppositely, too. This cancels each other, so that the forces which  $\vec{v}_R$  produces due to  $|\vec{v}_{S\perp}^\pm$  by the field and the anti-field always have the same sign.

So the additional force which results due to  $\vec{v}_R$  when the source moves with the velocity  $\vec{v}_S$  is:

$$F_M = F_c \cdot 2 \cdot \frac{v_R \cdot |\vec{v}_{S\perp}|}{c}.$$

The multiplication by the factor 2 appears because the forces from the field and the anti-field are added up. But, actually, the field and the anti-field deliver only together the electric force which is actually measured. So, if one liked to express the force in relation to what is actually measured, then the factor 2 is simply to be deleted.

Well, we immediately see that the resultant force, which I have already marked with  $F_M$ , corresponds exactly to the magnetic force.

It has to be taken into account that  $F_c$  is negative for same charges and positive for opposite charges.

This force ( $F_M$ ) is always perpendicular to  $\vec{v}_R$ . The direction of  $F_M$  always results from the direction into which  $-\vec{v}_R$  is turned by the angle  $\varphi^+$ , or into which  $+\vec{v}_R$  is turned by  $\varphi^-$ . And the direction of the

angle  $\varphi^\pm$  results from the direction of  $\vec{v}_S$ . The direction in which the force  $F_M$  then actually acts depends on the sign of  $F_c$ .

Let us now look at some special cases.

If  $\vec{v}_S=0$  then  $\vec{v}_{S\perp}=0$  and therefore  $F_M=0$ . If the source of the field doesn't move, then no additional force arises due to  $\vec{v}_R$ . This means that the additional forces, which result due to  $\vec{v}_R$  from the field and at the anti-field, cancel each other out exactly.

If  $\vec{v}_R=0$  then  $F_M=0$ . This is completely independently of whether the field and the anti-field have an angle  $\varphi$  or not valid. If  $\vec{v}_R=0$ , no additional force results. The change of the direction and of the strength of the field and of the anti-field, which can result due to  $\vec{v}_S$ , cancel each other out exactly when  $\vec{v}_R=0$ .

We recognize through these two examples that the equation for  $F_M$  meets all the requirements on the electric force. In addition,  $F_M$  delivers exactly the magnetic force.

I think that no doubt can insist: Due to the introduction of the velocity-dependence of the electric force, and due to the introduction of the anti-field the magnetic force can clearly be derived from the electric force.

### 1.5 Remarks on the magnetic force

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

The angle  $\varphi$  of the electric field corresponds to the idea of the magnetic field here. Now one doesn't have to speak any more about the magnetic field, which is regarded as given, but one can speak about the angle  $\varphi$ , whose way of emergence is known.

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 angle  $\varphi$  also depends on the reference system.

I had described that the angle  $\varphi$  results from the addition of the vector  $|\vec{v}_S$  of the velocity of the source and the vector  $\vec{c}$  of the speed of light. We know from special relativity (SR) that the speed of light is equally big for all inertial observers. Of course, the velocity  $\vec{v}_S$  of the source depends on the reference system. So, while  $\vec{v}_S$  changes,  $\vec{c}$  remains constant; this means: the angle  $\varphi$  changes (in dependence of the reference system).

This is actually fascinating: the magnitude of the angle  $\varphi$  depends on the observer. The angle  $\varphi$  isn't an abstract construct. The angle  $\varphi$  is an really existing angle. It is the angle between the direction, in which the field propagates (with  $\vec{c}$ ), and the direction in which the field has an effect. And still, different observers will see different angles. But such phenomena are known from SR. For instance the really existing dependence of space and time on the velocity of the observer.

The transformations between inertial reference systems are carried out very normally, of course, according to SR. Not only the angle  $\varphi$  (that causes the magnetic force) but also the electric force changes so that the sum of both forces yields the right acceleration.

So, I have described the magnetic force as a result of the angle  $\varphi$  of the electric field. Therefore it makes sense to express the magnetic force by means of the electric force.

The magnitude of the electrostatic force ( $F_S$ ) is (as described already):  $F_S = F_C \cdot c$ . So the magnitude of the magnetic force ( $F_M$ ) is:  $F_M = F_S \cdot \frac{v_R \cdot |\vec{v}_{S\perp}}{c^2}$ .

So we can calculate the magnetic force directly through the electrostatic force. We must neither calculate a magnetic field nor the cross product from  $\vec{v}_R$  and the magnetic field.

In the case that  $\vec{v}_{S\perp} = v_R = c$ , we get  $F_M = F_S$ . At the speed of light the magnitude of the magnetic force is equally to the magnitude of the electric force. In the case that the source and the receiver move parallel, 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. Therefore, such charges could move together as a

group. But, though, their masses could only exist in form of energy, as in the case of photons.

### 1.6 Calculation of the magnetic force of a current flowing through a conductor

Let us consider a spherical surface of the radius  $r$  and with the charge  $q_s$  of the source at its centre that moves with the velocity  $\vec{v}_s$ . We want to know the magnitude of the magnetic force in the distance  $r$  of the source and in the angle  $\theta$  (see Figure 1.3).

Well, we decompose  $\vec{v}_s$  again into one component parallel to  $\vec{c}^\pm$  (that is  $\vec{v}_{s\parallel}$ ) and one vertical to  $\vec{c}^\pm$  (that is  $\vec{v}_{s\perp}$ ). For the angle  $\theta$  we have:  $\sin(\theta) = \frac{v_{s\perp}}{v_s}$ . Thus the equation for  $F_M$  becomes:

$$F_M = F_c \cdot \frac{v_R \cdot |v_s|}{c} \cdot \sin(\theta).$$

To calculate the magnetic force which a current flowing through a conductor exerts on a charge, we have to integrate over the angle  $\theta$  under consideration of the distance  $r$ .

For  $\theta=0^\circ$  or  $\theta=180^\circ$  we have  $F_M=0$ , as it shall be. And for

$\theta=90^\circ$  we have  $F_M = F_c \cdot \frac{v_R \cdot |v_s|}{c}$ , which is the maximum magnitude in the distance  $r$ .

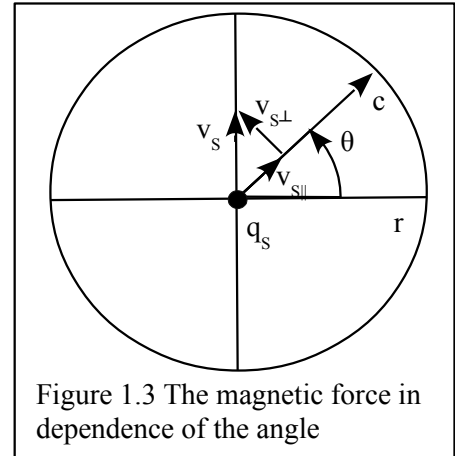


Figure 1.3 The magnetic force in dependence of the angle

### 1.7 Electrodynamics

An electromagnetic wave is created when an electric dipole oscillates.

When the distance between the charges is at its maximum the motion-directions of the charges changes - in this moment the charges are motionless. And in this moment the angle of the field (or anti-field) is zero ( $\varphi = 0$ ), while the electric field is at its maximum. When the charges pass by each other (the distance between them is zero), the electric field is (almost) zero for a moment (perpendicular to the motion-direction), while  $\varphi$  is at its maximum, because the velocity  $\vec{v}_s$  of the charges is at its maximum in this moment. This is the way, the alternating electric and magnetic field arises.

In this regard, there is the very well known statement: A changing electric field produces a magnetic field and vice versa. This is in principle the central statement of electrodynamics [4]. It shall explain why e.g. a photon can exist so far away from its source.

In this work here I have defined the magnetic field by the angle  $\varphi$ . The problem is: I couldn't explain why a change of the angle  $\varphi$  should produce an electric field. This question must remain open.

However, I have an idea how it could be, of course.

Let us consider a single oscillating electric charge. Due to the oscillation, energy is transferred to the electric field. The energy amount which is transferred to the field per time is limited. In the consequence, the space area of the electric field which is exerted to oscillate also is limited. Said differently: the spatial limitation of the oscillation of the electric field arises from the amount of energy per time available. The reason for that is simple: a certain frequency of the oscillation of the electric field *requires* (!) a certain energy amount, for a certain space area. If only a limited energy amount is available, then this will excite only a limited space area to oscillate, of course (this assumption is confirmed in part 3 of this work).

If the charge oscillates only for a limited time-*period*, then the oscillation of the field is limited spatially also in motion-direction (its length in motion-direction ( $\vec{c}$ ) is limited); this then would be an energy quantum, that is e.g. a photon.

The magnetic part, that is the angle  $\varphi$ , arises automatically. When a charge oscillates, then it moves, of course, and due to this motion the angle  $\varphi$  is created naturally.

So, due to the oscillation of a charge at first only a spatially limited oscillation of its electric field (and always its anti-field, of course) arises, and this oscillation of the field is stamped with the angle  $\varphi$ , which arises from the motion of the charge.

Usually a charge doesn't oscillates alone. Usually dipoles oscillate. But that's the same thing: here, too, actually only the electric fields oscillate while  $\varphi$  arises automatically due to the motion. The mutual depend-



ence in the appearance of the electric and magnetic fields arises because the angles  $\varphi$  are always then at their maximum, when the electric fields cancel each other out mutually. Therefore, one could assume that the electric field and the magnetic field *don't* produce each other mutually but that they appear alternately due to the way they are created. The stability of the formation arises from the energy amount which a space area must contain for an oscillating electric field.

So e.g. a photon is the spatially limited oscillation of an electric field, which contains the angle  $\varphi$ .

The statement of the electrodynamics, that a changing electric field produces a magnetic field and vice versa, arises by the fact that changes of the electric field are always accompanied by motions of charges, and this motions produce  $\varphi$ . All electrodynamic processes are based, in principle, on events which are similar to these which create the electromagnetic waves - with similar consequences regarding the alternating electric and magnetic fields.

In this sense the angle  $\varphi$  can be applied to electrodynamic processes, too. The angle  $\varphi$  is suitable to explain the emergence of magnetism here, too.

## 1.8 Conclusion / Closing remark to part 1

I believe that I could show that the angle  $\varphi$  of the electric field suffices completely to describe the emergence of the magnetic force.

I had to make 2 assumptions (postulates) regarding the qualities of the electric field: the velocity-dependence of the electric force and the anti-field. This two assumptions permit to describe the electric and magnetic forces completely and consistent.

I think that the success justifies these two assumptions.

The description of the electromagnetic waves isn't complete yet. However, there isn't anything wrong with the angle  $\varphi$ . The angle  $\varphi$  is in principle not suitable to describe the propagation behaviour of the electric field in space. The angle  $\varphi$  describes only the emergence of the magnetic force. For the description of the electromagnetic waves other connections will be probably necessary - there will be more about that in part 3 of this work.

However, I think that I could show that the magnetic field isn't a field of its own but that it is only an angled electric field.

## Part 2: Gravitation as an electric effect

### 2.1 Introduction to the gravitation as an electric effect

Based on the two postulates from part 1, the velocity-dependence of the electric force and the anti-field, I want to show now that gravitation is also an electric effect.

To be able to do so, I introduce a third postulate: the quantization of the energy-transfer of the electric field. I will describe this third postulate in detail in the following, and with its help I will show that gravitation is an electric effect. In part 3 of this work I then represent, among others, the postulate quantum-mechanically, that means that I describe *how* the quantization of the energy-transfer of the electric field takes place.

The electric forces [5, 6] are immensely great compared with the gravitational forces. There have already been many attempts to explain gravitation by the immense electric forces. Thanks to the quantization of the energy-transfer of the electric field I have succeeded here in showing that gravitation is an electric effect. And this in conformity with special relativity (SR) and general relativity (GR) [7-9].

### 2.2 Immense forces

Ordinary, everyday matter consists of exactly as many positively charged protons as negatively charged electrons. This means that ordinary matter is electrically neutral. The electric fields of the protons and electrons cancel out (each other mutually).

Most of us have learned, already in the school lessons, that the electric force is much greater than the gravitational force. For instance, at Bohr's atom model the gravitational forces of the masses of the charges can be neglected. The difference of the forces is immense. For instance, the ratio of the electric force to the gravitational force is at the hydrogen atom, which consists of a proton and an electron:

$$\frac{\frac{q_{p+}q_{e-}}{4\pi\epsilon_0 r^2}}{\frac{m_p m_e G}{r^2}} = \frac{q_{p+}q_{e-}}{4\pi\epsilon_0 m_p m_e G} = \frac{1.6 \cdot 10^{-19} \cdot 1.6 \cdot 10^{-19}}{4 \cdot 3.14 \cdot 8.8 \cdot 10^{-12} \cdot 9.1 \cdot 10^{-31} \cdot 1.6 \cdot 10^{-27} \cdot 6.6 \cdot 10^{-11}} \approx 2.41 \cdot 10^{39},$$

where  $q_{p+}$ ,  $q_{e-}$ ,  $m_p$ ,  $m_e$  are the charges and masses of the electron and the proton,  $\epsilon_0$  is the electric permittivity of free space,  $G$  is the gravitational constant and  $r$  is the distance between the charges. Since both the electric force and the gravitational force obey  $\frac{1}{r^2}$ ,  $r^2$  cancels out, which means that the ratio of the forces is independent of the distance between the charges.

At all events the result is amazing:  $2.41 \cdot 10^{39}$ ! This is a gigantic number. These facts are already known for a long time and therefore seem trivial, but, nevertheless, I would still like to show some examples here to the clarification: The earth with all her grate mass of  $\approx 6 \cdot 10^{24} \text{ kg}$  exerts a force of 10N on a test mass of 1 kg, which is on her surface, therefore in the distance of  $\approx 6.3 \cdot 10^6 \text{ m}$  from the earth's centre. How many electric charges does one need probably to obtain the same force in the same distance? Well, this is easy:

$\frac{q_1 q_2}{4\pi\epsilon_0 r^2} = 10 \text{ N}$ . If, to begin with, we assume that the two charges are equally grate ( $q_1 = q_2 = q$ ), we get:

$$q \approx \sqrt{10 \cdot 4\pi\epsilon_0 (6 \cdot 10^6)^2} \text{ C} \approx 200 \text{ C} \text{ (C = Coulomb)}.$$

And, how many unit charges do we need for such a charge quantity? Well, this is also easy: The unit charge

is  $\approx 1.6 \cdot 10^{-19} \text{ C}$ , this yields  $\frac{200}{1.6 \cdot 10^{-19}} \approx 1.25 \cdot 10^{21}$  unit charges. Ordinary matter (that is e.g. no ions,

isotopes and no anti-matter) always consists (unless at the hydrogen) of equally many protons, electrons and neutrons. If we add up the masses of a proton, an electron and a neutron we get  $\approx 2 \cdot 1.6 \cdot 10^{-27} \text{ kg}$ .

This mass contains 2 unit charges (one proton and one electron). So, how much matter do we get if the  $\approx 1.25 \cdot 10^{21}$  unit charges, which form 200C, consist half of electrons and half of protons? We get:

$$\frac{1.25}{2} \cdot 10^{21} \cdot 2 \cdot 1.6 \cdot 10^{-27} \approx 2 \cdot 10^{-6} \text{ kg}. \text{ So, a mass of } \approx 2 \cdot 10^{-6} \text{ kg} = 2 \text{ mg} \text{ of ordinary matter contains 200C}$$

(positive *and* negative charges).

We imagine now (as a thought experiment) that charges always are attractive (therefore, like charges are also attractive and not repulsive). In this case 2 masses of only  $\approx 2 \text{ mg}$  in a distance of  $\approx 6.3 \cdot 10^6 \text{ m} = 6300 \text{ km}$  would exert a force of 10N on each other. Said casually: we could replace the whole earth and the test mass of 1 kg by these two tiny masses of  $\approx 2 \text{ mg}$  and would get the same force nevertheless.

In an analogous way one could replace the mass of the earth by a charge quantity which is in a mass of  $\approx 500 \text{ t}$  (t = metric ton). For the force of 10N one then needs a charge quantity which is in a mass of only  $\approx 8.35 \cdot 10^{-19} \text{ kg} = 0.000835 \text{ pg}$ . In this, the ratio of the quantities is preserved: the  $\approx 500 \text{ t}$  correspond to the mass of the earth and the  $\approx 8.35 \cdot 10^{-19} \text{ kg}$  correspond to the 1kg test mass. Said casually: we could replace the whole earth by a rock ball of only  $\approx 18 \text{ m}$  radius and the test mass of 1kg would be a tiny, small, hardly visible dust particle. In this analogy even the moon would have only a radius of  $\approx 4 \text{ m}$ . He would be only a small rock, 380000km far away.

We see clearly at these examples how tremendous the electric forces, hidden in matter, are.

### 2.3 Quanta

So the electric forces, which are in matter, are gigantically grate compared to the gravitational forces, which we now from everyday life. However, we notice nothing of these immense electric forces since ordinary matter always consists of equally many protons and electrons so that the electric fields cancel out (each other).

But: even if the electric fields of the protons and electrons cancel out, they still are there. These immense electric fields exist. We do just as if these enormous electric fields wouldn't exist at all. But they exist and

they may not be ignored.

No matter how enormous and gigantic the electric fields of the mass of the earth and the everyday objects surrounding us may be, the positive and negative fields always cancel out. They act exactly oppositely. And even though it is absolutely clear that the resultant electric field is zero, the thought sticks that gravitation could be a result of these immense electric forces. A kind of rest 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 always cancelled out exactly. For any effect, which could somehow be derived from the electric charges and their fields, there always were the corresponding counter-forces, through what the resultant effect became zero.

At all considerations I always assumed that the fields of the positive and negative charges act simultaneous. Until it got clear to me that the electric field acts quantized. The quantization of the electric effect means that always only *one* quantum acts at the time. Or said differently: two (or more) quanta *never* act simultaneous. Therefore always only *one* field (positive *or* negative) acts at the time.

The quantization of the energy-transfer is a generally known phenomenon (e.g. at photons) [10]. It has to be completely legitimately to assume that the electric field also acts quantized. To say it clearly: the field itself isn't quantized but the energy, which the field transfers to a charge, is quantized, this will get clearer later.

If I assume that the electric field acts quantized, then the gravitational force can be very easily derived as a result of the electric forces. From the calculation of the gravitation (as a result of the electric forces) the magnitudes of the quanta of the electric effect then can be calculated, too.

I will show in the following how the gravitational force can be derived from the electric forces.

## 2.4 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 bit weaker than the attraction, or if the attraction were a little bit stronger than the repulsion, then we would have as a result an attraction, which could correspond to the gravitation.

But what can weaken the repulsion and strengthen the attraction?

Well, this is actually simple: we have seen exactly this wanted connection already at the velocity-dependence of the electric force (the 1st postulate in part 1 of this work).

The electric force of an electric field on an electric charge (the receiver) depends on the velocity  $\vec{v}_R$  of this charge. The force is strengthened, if the receiver moves towards the source, and weakened, if the receiver moves away from the source. For the moment, to keep it simple, we want to assume that the velocity of the source  $\vec{v}_S$  is zero ( $\vec{v}_S=0$ ). In this way we avoid the magnetic part of the electric force, for the moment.

We know now that there also is the anti-field. If the source of the field is motionless ( $\vec{v}_S=0$ ), then the additional forces, which result due to  $\vec{v}_R$  at the field and at the anti-field, cancel each other exactly mutually so that only the pure electric force (that is the electrostatic force) remains.

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

Well, this arises automatically from the quantization of the energy-transfer of the electric field.

I will explain this gradually now.

## 2.5 Energy-transfer by quanta

The quantization of the energy-transfer of the electric field means that always only a limited energy-quantity is transferred from the field, or anti-field to the charge. This energy-quantity then causes a corresponding velocity-change  $\Delta v$  at the charge (which of course also depends on the mass and the (initial) velocity of the charge).

When  $\vec{v}_S=0$  then  $\Delta v$  is parallel to the direction  $\vec{v}$  in which the field, or anti-field moves (which of course moves with the speed of light).

After a  $\Delta v$  has come into being due to the field, or anti-field of a charge, then, following, a new  $\Delta v$  can come into being due to the field, or anti-field of an other charge. So the fields, or anti-fields of the charges (sources) transfer their quanta to the receiver alternately.

We have seen that the everyday masses surrounding us contain very, very much electric charge consisting of

very, very many positive protons and negative electrons. This means that very, very strong positive and negative electric fields act on every electric charge (whose effects cancel out, of course). At the same time I have stated that the electric fields act only quantized, thus they transfer their energy only quantized. This shall mean that always only one quantum can act at the time. Since the positive field is just as strong as the negative field, this means that one quantum of the positive field and one quantum of the negative field always act *alternately*, seen statistically.

Every quantum transfers an energy to the charge which causes a velocity-change  $\Delta v$ . The  $\Delta v$ 's which are transferred by positive and negative fields point in opposite directions and they are, at ordinary matter, equally strong, thus they cancel out. But always only one quantum acts at the time; and for the duration of this time, the  $\Delta v$  caused by this quantum exists. The  $\Delta v$ 's (thus the quanta of the electric field) are very, very small indeed (as I will show). Therefore a charge, on which strong (and equally strong) positive and negative electric fields have an effect, moves very, very often with  $\pm \Delta v$  back and forth (it oscillates). The centre of all these small motions doesn't move on average, if the positive and negative fields are equally strong.

## 2.6 Arbitrarily many $\Delta v$ 's per time

Let us now imagine a charge on the earth's surface. The electric fields which are produced by the gigantic number of the earth's protons and electrons are inconceivably great. The number of the quanta which have an effect on a electric charge, which is on the earth's surface, is appropriately gigantically great. But still, always only *one* quantum acts at the time. The number of the quanta which can act per time-unit is arbitrarily great. Thus the time-*period* (or time-*interval*) of effectiveness of a quantum can be arbitrarily small. It is only important that the quantum transfers its energy, and for doing so, a time-*period* going against zero (but which never becomes zero!) suffices. The sum of the quanta (therefore of the  $\Delta v$ 's) per time-unit finally yields the acceleration.

So, the  $\Delta v$  produced by a quantum exists for a time-period  $\Delta t$ . Actually, the magnitude of  $\Delta t$  doesn't play a role for the following considerations. It is only important that always only one quantum can act at the time, no matter how short this time is, so that there can always be only one  $\Delta v$  at the time.

These connections, too, will get much clearer in part 3.

## 2.7 Field and anti-field with $\Delta v$

So, a quantum transfers an energy amount which produces a  $\Delta v$ .

In which way the  $\Delta v$  is created, if, e.g., there is an acceleration process, I cannot say yet. I assume, for the simplicity, that the  $\Delta v$  arises spontaneously as soon as a quantum has had an effect on a charge (in part 3 of this work I will say some more about that).

Both the field and the anti-field transfer quanta. I call the quanta of the anti-field anti-quanta and I label them always with a high-ranking "-". And I label the quanta of the field with a high-ranking "+". So, every quantum produces a  $\Delta v^+$  and every anti-quantum a  $\Delta v^-$ .

The  $\Delta v^+$  strengthens or weakens the effect of the field and the  $\Delta v^-$  strengthens or weakens the effect of the anti-field, in the way already described.

Something important was said here now: *the anti-field has its own quanta*. Since always only one quantum can act at the time, quanta and anti-quanta can not act simultaneous but only after each other.

At the positive and negative electric fields it was that positive and negative quanta have statistically acted alternately if the fields were equally strong. It is different at the quanta and anti-quanta: field and anti-field are coupled with each other so that to every quantum that acts there always is an anti-quantum, and quantum and anti-quantum *always* act after each other, not only statistically. (I will later say something about the order, that is whether the quantum or the anti-quantum acts first.) So there are positive quanta and anti-quanta, and negative quanta and anti-quanta.

The most important cognition is here: since the anti-field has its own anti-quanta, the field and the anti-field don't act simultaneous but only after each other.

From this an important consequence arises: we had noticed that the velocity  $\vec{v}_R$  of a charge doesn't has any effect because the effects which  $\vec{v}_R$  has on the field and on the anti-field cancel out. This is still valid, even while the field and the anti-field don't act simultaneous but only after each other, because the  $\vec{v}_R$  is equally

for both the field and the anti-field. But, the quantum produces a  $\Delta v^+$  and this  $\Delta v^+$  must be added to the  $\Delta v^-$  of the following anti-quantum (or vice versa if first the anti-quantum and then the quantum acts). Thus, the velocities at the field and anti-field are no longer equally - these velocities are namely  $\Delta v^+$  and  $\Delta v^+ + \Delta v^- = 2 \cdot \Delta v$ .

Due to the effects of  $\Delta v^+$  or  $\Delta v^-$  the effects of the quanta and the anti-quanta are *no longer* exactly equally grate.

So we recognize: due to the fact that the quanta and the anti-quanta act only *after each other*, their effects differ by  $|\Delta v^+|$  or  $|\Delta v^-|$  (in which of course:  $|\Delta v^+| = |\Delta v^-|$ ).

Now, of course, there will usually be several (actually very many) couples of quanta and anti-quanta (I call them quantum-couples) acting successively. However, the difference in the effects between the quanta and the anti-quanta of every quantum-couple is *always* only  $|\Delta v|$ . Although the  $|\Delta v^+|$  and  $|\Delta v^-|$  of the previous quantum-couples can add up, particularly if the field is only positive or only negative, the velocity arising from that is only a constant velocity for every following quantum-couple, and the effect of a constant velocity cancels out by the field and the anti-field.

## 2.8 Gravitation by $\Delta v$

A basic assessment which I have made here is that the effect, therefore the force, of the electric field ( $F_E$ ), depends on the relative velocity ( $v_r$ ) between the field and the electric charge (on which the field has an effect).

As we have seen in part 1, for a motionless charge, it is  $\vec{v}_r = \vec{c}$ , therefore  $\vec{F}_E = F_c \cdot \vec{c}$ , with

$$F_c = \frac{q_1 \cdot q_2}{r^2 \cdot 4 \cdot \pi \cdot \epsilon_0} \cdot \frac{1}{|\vec{c}|}.$$

Due to the effect of a quantum a  $\Delta v^+$  arises, and due to the anti-quantum a  $\Delta v^-$ . If the quantum acts first, the effect of the force is:  $F_c \cdot (c \pm \Delta v^+)$  ( $\pm$  because of positive and negative charges). And for the following anti-quantum the effect of the force then is:  $F_c \cdot (c \mp (\Delta v^+ + \Delta v^-)) = F_c \cdot (c \mp 2 \cdot \Delta v)$ . The anti-field *always* moves (or propagates) in an opposite direction to the field. Therefore if, e.g., the effect of the field is strengthened by the  $\Delta v^+$  of the quantum then the effect of the anti-field is weakened by  $\Delta v^+ + \Delta v^- = 2 \cdot \Delta v$  (and vice versa). For that reason I have written once  $\pm$  and once  $\mp$ .

The effects of the quanta and the anti-quanta can be added:  $F_c \cdot (c \pm \Delta v) + F_c \cdot (c \mp 2 \Delta v) = F_c \cdot (2c \pm \Delta v)$ .

The  $2c$  stands for the effects which the quantum and the anti-quantum would have if the charge remained in rest (therefore if  $\Delta v^+ = \Delta v^- = 0$ ).

If we subtract this "rest effect" ( $2c \pm \Delta v - 2c = \pm \Delta v$ ) then  $\pm \Delta v$  remains.

The  $\pm \Delta v$  shall change the electrical force by the amount of the gravitational force.

The gravitational force always is attractive, though, while the electric force can be attractive or repulsive.

We actually know that the electric attraction and repulsion cancel out at electrically neutral objects.

How is that with the  $\pm \Delta v$ ? If the  $\pm \Delta v$  shall correspond to gravitation, then it must strengthen the electric attraction and weaken the electric repulsion.

Lets consider the repulsion (e.g. between two protons): The quantum acts first, it produces (due to the repulsion) a  $\Delta v^+$  which points in the same direction as the  $c$  of the field. This corresponds to a weakening of the effect (the  $\Delta v^+$  moves away from the field). Then the anti-quantum acts, it produces a  $\Delta v^- = \Delta v^+$  which is added to the  $\Delta v^+$  of the quantum ( $\Delta v^+ + \Delta v^- = 2 \cdot \Delta v$ ). Since the anti-field moves in the opposite direction to the field the  $2\Delta v$  causes a strengthening of the effect. We recognize here that the strengthening of the effect is twice as grate as the weakening. Since here the effect is a repulsion, the result is a strengthening of the repulsion (by  $\Delta v$ ).

But gravitation causes a weakening of the repulsion. Well, this is easy: instead of the quantum acting first and the anti-quantum second, at the repulsion the anti-quantum acts first and the quantum second. Then the weakening is exactly twice as grate as the strengthening, thus a weakening of the repulsion arises by  $\Delta v$  (per quantum-couple).

For the attraction (e.g. between an electron and a proton) it is analogous: at attraction, the  $\Delta v^+$  points in the opposite direction to the  $c^+$  of the field and in the same direction to the  $c^-$  of the anti-field (I label the speed of light of the field with a high-ranking "+", and speed of light of the anti-field with a high-ranking

“-”). If the quantum acts first and the anti-quantum second then a strengthening arises by  $\Delta v$  and a weakening by  $2\Delta v$ . Since the attraction is strengthened by the gravitation, the anti-quantum must act first and the quantum second here, too. Then, a strengthening of the attraction arises per quantum-couple by  $\Delta v$ . So we recognize: to get gravitation the anti-quantum is first and the quantum second. Then, the repulsion is weakened and the attraction strengthened.

I think that this works very well and seems plausible.

But, which is the magnitude of  $\Delta v$  to get gravitation?

Well, that is easy. The electrical force is:  $F_E = F_C \cdot (c \pm \Delta v) = F_C \cdot c \pm F_C \cdot \Delta v$ . The part  $F_C \cdot \Delta v$  shall correspond to the gravitational force. Therefore:  $F_C \cdot \Delta v = F_G \Rightarrow \Delta v = \frac{F_G}{F_C}$

Inserting yields:  $\Delta v = c \frac{m_1 m_2 G \varepsilon_0 4\pi}{q_1 q_2}$ ,

where  $m$  = mass,  $q$  = charge,  $G$  = gravitational constant,  $\varepsilon_0$  = electric permittivity of free space and  $c$  = speed of light.

For two protons we get a  $\Delta v_{PP}$ :

$$\Delta v_{PP} \approx \frac{3 \cdot 10^8 \cdot (1.6 \cdot 10^{-27})^2 \cdot 8.8 \cdot 10^{-12} \cdot 6.6 \cdot 10^{-11} \cdot 4 \cdot 3.14}{(1.6 \cdot 10^{-19})^2} \text{ms}^{-1} \approx 2.2 \cdot 10^{-28} \text{ms}^{-1}.$$

We recognize here how inconceivable small the quanta of the electric field are. Every quantum (here between two protons) causes only a velocity-change of  $\Delta v \approx 2.2 \cdot 10^{-28} \text{ms}^{-1}$ . Protons can be accelerated very strongly in accelerators. One can calculate easily how unbelievably many quanta are necessary for such accelerations.

So, what do we have: the electric force doesn't act continuous but in quanta. Every quantum transfers (to the charge on which it has an effect) an energy which produces a velocity-change  $\Delta v$ . From the time ( $\Delta t$ ) per  $\Delta v$ , the acceleration ( $a = \Delta v \cdot \Delta t^{-1}$ ) results, which arises due to the electric force. Due to the  $\Delta v$  the electric force changes by the amount of the gravitational force. The time  $\Delta t$  per  $\Delta v$  corresponds to the resultant force of the electric and the gravitational force. The  $\Delta v$  is calculated by the ratio of the gravitational force to the electric force. With other words:

The masses of the charges determine the quantization of the electric force, or the quantization of the electrical energy.

The bigger the masses of the interacting charges are, all the bigger  $\Delta v$  is, thus all the bigger the quanta are (they transfer more energy).

I label the  $\Delta v$  of the gravitation of the masses from now on always with  $\Delta v_m$ .

To be clear: it is not that the electric field is quantized. The quanta of the  $\Delta v_m$  only appear when the electric field interacts with an electric charge.

## 2.9 Many elementary particles act (also neutrons)

The magnitude of  $\Delta v_m$  *always* arises from the analysis of the interaction between *two* elementary particles.

Ordinary matter consists of protons, electrons and neutrons. I will treat the neutrons later. So, a charge (a proton (p) or an electron (e)) will be effected either by the quantum-couple of a proton or by the quantum-couple of an electron. This happens exactly alternately at electrically neutral matter (seen statistically).

So there are, in principle, 3 different values for  $\Delta v_m$  at ordinary matter:  $\Delta v_{mPP} \approx 2.2 \cdot 10^{-28}$ ,

$$\Delta v_{mPe} \approx 1.2 \cdot 10^{-31} \text{ and } \Delta v_{mee} \approx 7.1 \cdot 10^{-35}.$$

For more exotic particles, with masses different of those of the protons and electrons, the corresponding  $\Delta v_m$ 's have to be calculated correspondingly. So the  $\Delta v_m$  is a characteristic quantity for every interacting particle-couple.

No matter how many elementary particles may interact (e.g. between the earth and a proton or an atom or a 1kg mass), the origin of every field always is a single elementary particle, and every field remains (even if they superimpose). Always only *one* quantum acts at the time, which is created by *one* field of *one*

elementary charge unit (or an elementary particle). Seen statistically, all fields of all charges act with equally many quanta per time (if the distance is the same).

Taken exactly, always one quantum and one anti-quantum act successively, of course, thus always a quantum-couple acts.

Said briefly: *Always* only *two* elementary particles interact with each other at the time (or the field of *one* charge with *one* charge).

An interesting question arises here: Can we regard the atomic nucleus as a single particle?

I cannot answer this question here in conclusion, however, I find it more sensible to look at the protons and neutrons of the atomic nucleus one by one. Particularly because of the neutrons. Here it also has to be taken into account that the actual mass of the protons in the atomic nucleus is not the same as the mass of a free proton.

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

Here, there is the problem now to assign the right mass to the positive and negative elementary charge unit of the neutron. From the correct assignment of the masses the corresponding  $\Delta v_m$ 's will then result. For the calculation of the gravitation the assignment of the masses to the elementary charge units inside the neutron isn't such important, though, as long as the  $\Delta v_m$ 's are calculated correctly.

We also can assume that the neutron is alternately positive and negative. This possibility arises 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 the gravitation according to its mass.

## 2.10 On the magnitude of $\Delta v_m$

We know: The magnitude of the electric force  $F_E$  is proportional to the relative velocity between the field and the electric charge, on which the field has an effect. This is then the reason, that the  $\Delta v_m$  can change the  $F_E$  in a way that the gravitational force results. As we have seen in part 1 of this work, it is, taken exactly, the magnitude of the electrostatic force  $F_S$  that changes.

So,  $F_S$  changes due to  $\Delta v_m$  in a way that a resultant force results:  $F_S \pm F_G$ .

The force  $F_S$  is expressed by the acceleration  $a_S$  which  $F_S$  causes. The  $a_S$  results by  $\Delta v_m$ . It is:

$a_S = \frac{\Delta v_m}{\Delta t}$ . Due to  $\Delta v_m$  the magnitude of  $F_S$  changes, and this means, that the magnitude of  $a_S$  changes.

But  $a_S$  *doesn't* change its magnitude by changing  $\Delta v_m$ , but by changing the magnitude of  $\Delta t$ . To say it very clearly: The magnitude of  $\Delta t$  changes due to the fact that the electric force depends on the relative velocity. If this weren't so, then  $a_S$  and therefore also  $\Delta t$  wouldn't change due to  $\Delta v_m$ .

The magnitude of  $\Delta v_m$  can not change since the magnitude of  $\Delta v_m$  corresponds to the magnitude of the gravitational force ( $F_G$ ). In part 3 of this work I will show how it becomes, that the magnitude of  $F_S$  changes by changing the magnitude of  $\Delta t$ .

Therefore, the  $\Delta t$  for a  $\Delta v_m$  of a mass (m) is:  $F_S - F_G = m \cdot \vec{a}_S \Rightarrow \Delta t = \frac{\Delta v_m \cdot m}{|\vec{F}_S - \vec{F}_G|} = \frac{\Delta v_m \cdot m}{F_c \cdot (|\vec{c} - \Delta \vec{v}_m|)}$ .

The same is also valid if we consider the  $\Delta v_m^+$  of the field and the  $\Delta v_m^-$  of the anti-field separately, because we know, that the field and the anti-field don't act simultaneously but after each other. When the magnitudes of  $F_S^+$  and  $F_S^-$  of the field and the anti-field change due to  $\Delta v_m^+$  and  $\Delta v_m^-$ , then the magnitudes of  $\Delta v_m^+$  and  $\Delta v_m^-$  *don't* change, but the magnitudes of the respective periods of time  $\Delta t^+$  and  $\Delta t^-$  change.

So, the magnitude of  $\Delta v_m$  corresponds to  $F_G$ . Therefore the magnitude of  $\Delta v_m$  must strongly remain unchanged. But how is it, if a mass, on which a field has an effect, already has a constant velocity  $\vec{v}_R$ ?

The velocity  $\vec{v}_R$  produces its own, additional force  $-F_c \cdot \vec{v}_R$ .

The energy-transfer of the electric field is carried out in quanta. These quanta produce the  $\Delta v_m$ 's. The direction of the  $\Delta v_m$  is always the same as the direction of the force of the electric field on the charge. But the

direction of the force of the field can change due to  $\vec{v}_R$ , if  $\vec{v}_R$  has a component perpendicular to the propagation direction  $\vec{c}^\pm$  of the field, or anti-field, since  $-F_c \cdot \vec{v}_R$  has to be added. But if  $\Delta v_m$  is no longer parallel to  $\vec{c}^\pm$ , then the component of  $\Delta v_m$  in the direction of  $\vec{c}^\pm$  is smaller than  $\Delta v_m$ . Through this then the gravitational force would be smaller, too, and this cannot be. The conclusion out of that is, that the magnitude of the quanta also depends on the relative velocity. Or said differently: due to the additional force

$$-F_c \cdot \vec{v}_R \text{ an additional } \Delta \vec{v}_R \text{ results, which is proportional to } \vec{v}_R. \text{ Therefore we get: } \Delta \vec{v}_R = -\Delta \vec{v}_m \cdot \frac{v_R}{c}.$$

So, the magnitude of  $\Delta v_m$  which is produced by a quantum is:  $\Delta v_m = \frac{F_G}{F_S} \cdot (\vec{c} - \vec{v}_R)$ . I label the  $\Delta v_m$  for

$$\vec{v}_R=0 \text{ with } \Delta v_{m0} = \frac{F_G}{F_S} \cdot \vec{c}.$$

For the component of  $\vec{v}_R$ , which is parallel to  $\Delta \vec{v}_{m0}$ , the changes of  $\Delta \vec{v}_{m0}^+$  of the field and of  $\Delta \vec{v}_{m0}^-$  of the anti-field are symmetrical, so that the difference remains  $1 \cdot \Delta \vec{v}_{m0}$ , which means that the gravitational force remains unchanged.

Due to the change of the magnitude of  $\Delta v_m$ , which is caused by  $\vec{v}_R$ , the magnitude of  $F_S$  also changes correspondingly, of course. And this means that the magnitude of the  $\Delta t$  for the  $\Delta v_m$  also changes according to the change of the magnitude of  $F_S$ .

As said,  $\vec{v}_R$  shall be an already existing (initial) velocity of a mass. This shall mean that  $\vec{v}_R$  is equally grate for both for the anti-field and for the subsequently acting field. And this means that the  $\Delta v_m$  of the anti-field and of the field change symmetrically due to  $\vec{v}_R$ . And this means that the gravitational force doesn't change due to  $\vec{v}_R$ .

That the magnitude of  $F_S$  changes symmetrically due to  $\vec{v}_R$ , and that this doesn't have any influence on the gravitational force, has already been described in earlier chapters. Here I would like to remind (not only but mainly to avoid mistakes) that the magnitude of  $\Delta t$  of  $a_s$  changes due to  $\vec{v}_R$ , of course. And here, too, the field and the anti-field change symmetrically. The change of the magnitude of  $\Delta t$ , which is caused by  $\vec{v}_R$ , is to be distinguished from the change of the magnitude of  $\Delta t$ , which is caused by the change of the magnitude of  $\Delta v_m$ , which is caused by  $\vec{v}_R$ .

The acceleration, which the electric force causes, is made by  $\Delta v_m$ . Of course the electric force isn't only changed by  $\vec{v}_R$  but also by  $\Delta v_m$ . But the magnitude of  $\Delta v_m$  is also changed by both by  $\vec{v}_R$  and also by  $\Delta v_m$ .

For the better understanding, we now will calculate the acceleration of the electric force. We get:

$$F_c \cdot (\vec{c} - (\vec{v}_R + \Delta \vec{v}_m)) = m \cdot a \Rightarrow a = \frac{F_S \cdot (\vec{c} - (\vec{v}_R + \Delta \vec{v}_m))}{c \cdot m} \quad (2.1).$$

$$\text{And for } \Delta v_m \text{ we get: } \Delta \vec{v}_m = \frac{F_{G0}}{F_c} \cdot (\vec{c} - (\vec{v}_R + \Delta \vec{v}_m)) \Rightarrow \Delta \vec{v}_m = \frac{F_G}{F_S} \cdot \frac{(\vec{c} - \vec{v}_R)}{(1 + \frac{F_G}{F_S})} \quad (2.2).$$

$$\text{Inserting (2.2) into (2.1) yields: } \vec{a} = \frac{F_S}{m \cdot c} \cdot \frac{(\vec{c} - \vec{v}_R)}{(1 + \frac{F_G}{F_S})}.$$

Here it necessarily has to be taken into account that  $F_S$  has a sign. At same charges  $F_S$  is positive and at opposite charges  $F_S$  is negative.

We recognize here that  $\vec{v}_R$  doesn't have any effect in the sum from anti-field and field, since  $\vec{c}$  has opposite signs at the anti-field and at the field.

The  $\Delta \vec{v}_m$  is expressed in the term  $(1 + \frac{F_G}{F_S})$ , in which the direction of  $\Delta \vec{v}_m$  results from the sign of  $F_S$ .

## 2.11 The magnetic component of $\Delta \vec{v}_m$ , or of gravitation

Due to  $\Delta \vec{v}_m$ , the acceleration of the electric force results - this is the acceleration of a charge (that has mass) by an electric field. How is it now, if the charge, which produces the field, that is the source of the field,



moves with a velocity  $\vec{v}_S$ ? It is clear that then the field has the angle  $\varphi^+$ , and the anti-field has the angle  $\varphi^-$ , which are known from part 1. In part 1 I have shown that the velocity  $\vec{v}_R$  of the receiver (that is the electric charge on which the field exerts its force) produces an additional force which corresponds exactly to  $\vec{v}_R$  and which is turned by the angle  $\varphi^+$ , or  $\varphi^-$ .

Well, the same is valid for  $\Delta \vec{v}_m$ , of course, and this means, that  $\Delta \vec{v}_m$  is also turned by the angle  $\varphi^+$ , or  $\varphi^-$ . In short:  $\Delta \vec{v}_m$  has a magnetic component - I call this magnetic component the magnetic part of  $\Delta \vec{v}_m$ . We now want to know the meaning of the magnetic component of  $\Delta \vec{v}_m$ .

Let us first think about what the magnetic component of  $\Delta \vec{v}_m$  means for a constant velocity  $\vec{v}_0 = \vec{v}_R$  of the receiver.

Due to  $\vec{v}_R$ , the  $\Delta \vec{v}_m^+$  of the field and the  $\Delta \vec{v}_m^-$  of the anti-field change symmetrically. If, therefore, e.g.  $\Delta \vec{v}_m^-$  increases due to  $\vec{v}_R$ , then  $\Delta \vec{v}_m^+$  decreases by the same amount.

From  $\Delta \vec{v}_m = \frac{F_G}{F_S} \cdot (\vec{c} - (\vec{v}_R + \Delta \vec{v}_m))$  we see that  $\Delta \vec{v}_m$  changes due to  $\vec{v}_R$  by  $\frac{\vec{v}_R}{(1 + \frac{F_G}{F_S})} \approx \frac{F_G}{F_S} \cdot \vec{v}_R$ . So  $\Delta \vec{v}_m$

changes due to  $\vec{v}_R$  proportionally exact in the same way, as  $\vec{c}$  changes due to the subtraction of  $\vec{v}_R$ .

As described in part 1,  $\vec{v}_R$  produces the magnetic force by having its own, additional electric effect. This means that  $\frac{F_G}{F_S} \cdot \vec{v}_R$  also produces exactly the magnetic force. Therefore, only the change of  $\Delta \vec{v}_m$ , which is

caused due to  $\vec{v}_R$ , that is  $\frac{F_G}{F_S} \cdot \vec{v}_R$ , is to be turned by the angle  $\varphi$ .

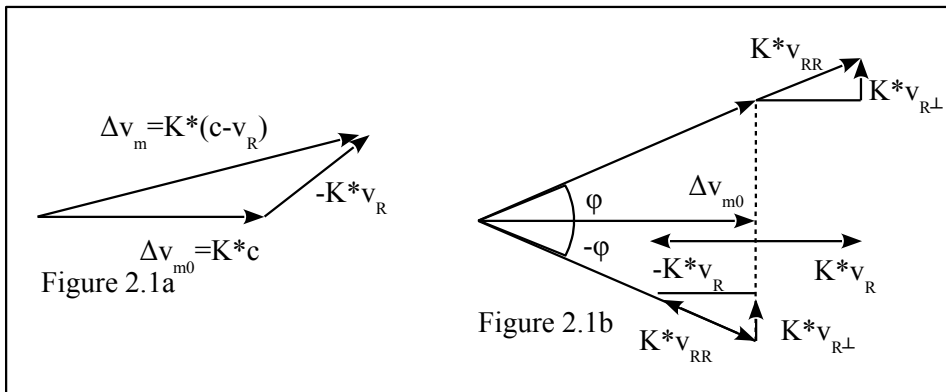
It has to be taken into account here compellingly that, due to  $\vec{v}_R$ , not only the amount but also the direction of  $\Delta \vec{v}_m$  changes. This can be seen in Figure 2.1a, where  $K = \frac{1}{(1 + \frac{F_G}{F_S})} \approx \frac{F_G}{F_S}$ , and  $\Delta \vec{v}_{m0}$  is the  $\Delta \vec{v}_m$

when  $\vec{v}_R = 0$ .

So, if  $\vec{v}_S$  is the velocity of the source (with  $\tan(\varphi) = \frac{v_{S\perp}}{|\vec{c} - v_{S\parallel}|}$ ), we get for the magnetic force ( $F_M$ ):

$$F_c \cdot v_{R\perp} = F_M = F_c \cdot \frac{v_R \cdot v_{S\perp}}{c^2 \cdot (1 - \frac{v_{S\parallel}}{c})}$$

to  $\vec{v}_R$ , and which results, when  $\vec{v}_R$  is turned by the angle  $\varphi$  (here,  $\vec{v}_R$  is the parallel component of this resultant - see part 1).



The connections get particularly clear if  $\vec{v}_R$  is parallel to the speed of light  $\vec{c}^\pm$  of the field, or anti-field ( $\vec{v}_R \parallel \vec{c}^\pm$ ). I have represented this in Figure 2.1b.

So we see that, due to the change of the magnitude of  $\Delta \vec{v}_m$ , which is caused by  $\vec{v}_R$ , exactly that magnetic force results, that corresponds to  $\vec{v}_R$ .

When electrically neutral matter moves with the velocity  $\vec{v}_S$ , then the positive and negative charges move all together with the velocity  $\vec{v}_S$ , and this means, that the fields and anti-fields of the positive and

negative charges have the same angle  $|\varphi|$  respectively. The magnetic forces, which result due to the same  $\vec{v}_R$ , are for charges with opposite signs, which move together in the same direction, oppositely. This means, that the magnetic forces cancel each other out mutually. So, if electrically neutral matter moves with the velocity  $\vec{v}_S$ , no magnetic forces result, as long as the charges, on which the fields and anti-fields of the electrically neutral matter have an effect, move with constant velocity ( $\vec{v}_R$ ).

But how is it with  $\Delta\vec{v}_m$  (or more precise with  $\Delta\vec{v}_m^+$  and  $\Delta\vec{v}_m^-$ )?

At two charges of the same sign,  $\Delta\vec{v}_m$  is repulsive. If the sign of one of the two charges is changed, then the sign of  $\Delta\vec{v}_m$  changes, too. This means that the magnetic force has the same direction (and the same magnitude) in both cases.

So one could come to the incorrect assumption that a resulting magnetic force arises, if a charge moves to and fro with  $\pm\Delta\vec{v}_m$  due to the positive and negative fields and anti-fields of an electrically neutral object.

But, fortunately, this isn't the case, because this would have undreamt-of consequences.

Actually, it has to be considered, that the charge, which moves to and fro with  $\pm\Delta\vec{v}_m$ , isn't accelerated only positively but that it must be accelerated also negatively (therefore slowed down), so that it can move at all to and fro. But at the slowing down (the negative acceleration) the field, or anti-field that slows down the charge has the opposite sign to the field, or anti-field that had accelerated the charge. But during the slowing down the charge moves in the same direction as when it was accelerated, and this means that the magnetic force has at the slowing down the opposite direction as at the acceleration.

Short and good: due to the alternating positive and negative accelerations (by  $\pm\Delta\vec{v}_m$ ) the magnetic forces cancel each other out mutually. Therefore, no resulting magnetic forces arise due to the velocity  $\vec{v}_S$  of electrically neutral matter perpendicular to the  $\Delta\vec{v}_m$ 's of a charge, which is moved by the positive and negative fields and anti-fields of this electrically neutral matter.

Here, an additional effect arises - I call this secondary effects - which results from the fact that the  $\Delta\vec{v}_m$ , which is to be slowed down, has the angle  $\varphi$ . Due to this, a small - I call it secondary - magnetic force arises parallel to the motion-direction of the field, or anti-field therefore parallel to the gravitational force. These "secondary" forces also should cancel each other out mutually due to the alternating positive and negative accelerations, but perhaps a more exact sight would be worthwhile here.

And as soon as electric currents flow, everything changes anyway. I haven't gone here through all the possibilities yet at all - this would blow up the frame of this work here anyway.

Particularly interesting seems to me the possibility that the velocities  $\vec{v}_S$  of the sources of the fields and anti-fields can change in the course of time - the sources are accelerated. This is valid, e.g., for the electrons of atoms. Due to these accelerations, the angles  $\varphi^\pm$  of the fields and anti-fields change in the course of time. Thus, while a charge is accelerated by these fields positively and negatively, the angles  $\varphi^\pm$  change. Certainly some interesting effects may arise here, but they might be quite small, though.

Summarizing, it can be said, that the magnetic part of  $\Delta\vec{v}_m$ , which can be described as the magnetic part of gravitation and which results due to the velocity  $\vec{v}_S$  of the source of the fields and anti-fields, has no greater influence on gravitation - at least not at electrically neutral matter.

A small note: we have seen in this chapter that the magnetic force results from the change of  $\Delta\vec{v}_m$ . Now one could have the impression that the statement from part 1 (about magnetism), which says that the magnetic force is a result of the velocity-dependence of the electric force, is wrong. But it has to be considered that the change of  $\Delta\vec{v}_m$  also corresponds to a change of the electric force, since  $\Delta\vec{v}_m$  produces the acceleration of the electric force.

## 2.12 On the magnitude of $\Delta\vec{v}_m$ : The $|\vec{v}_Q$ .

We have seen that the electric force of the field, or anti-field on the receiver (this is an electric charge with mass) changes due to the velocity  $\vec{v}_R$  of the receiver. In addition,  $\vec{v}_R$  produces a  $\Delta\vec{v}_R$ , which is proportional to  $\Delta\vec{v}_{m0}$  and which is subtracted vectorially from  $\Delta\vec{v}_{m0}$ , so that  $\Delta\vec{v}_m = \frac{F_G}{F_S} \cdot (\vec{c} - \vec{v}_R)$ .

In a similar way the velocity  $\vec{v}_S$  of the source also causes a change of the electric force on the receiver -

and  $\vec{v}_S$  has to be taken into account at  $\Delta \vec{v}_m$ , too. But this cannot be made simply by a vectorial subtraction, as in the case of  $\vec{v}_R$ , since an angle  $\varphi$  arises due to  $\vec{v}_S$  between the propagation-direction of the field, or anti-field (with  $\vec{c}^\pm$ ) and the direction of the force of the field, or anti-field.

In the previous chapter I have described and calculated the consequences of  $\vec{v}_S$  - it was essentially all about the magnetic force. In this chapter, I will have a try, to embed  $\vec{v}_S$  into the equation of the force and of  $\Delta \vec{v}_m$ .

We had stated that for  $\vec{v}_S=0$  it is valid:  $\Delta \vec{v}_m = \frac{F_G}{F_S} \cdot (\vec{c} - \vec{v}_R - \Delta \vec{v}_m)$ .

When the receiver has the velocity  $\Delta \vec{v}_m$ , and if  $\vec{v}_S \neq 0$ , then  $\Delta \vec{v}_m$  is turned by  $\varphi$  and the magnitude of  $\Delta \vec{v}_m$  changes proportionally to  $\Delta \vec{v}_m$ , which means, that an additional velocity is added up to  $\Delta \vec{v}_m$ , which I call  $\Delta(\Delta \vec{v}_m)$ . We know that, if  $\vec{v}_S=0$ ,  $\Delta \vec{v}_m$  is *always* parallel to  $\vec{c}^\pm$ . This means that  $\Delta(\Delta \vec{v}_m)$  is parallel to  $|\vec{v}_S$ . The magnitude of  $\Delta(\Delta \vec{v}_m)$  results from the proportionality:

$$\frac{\Delta(\Delta v_m)}{\Delta v_m} = \frac{|\vec{v}_S}{c} \Rightarrow \Delta(\Delta v_m) = \Delta v_m \cdot \frac{|\vec{v}_S}{c} = \frac{F_G}{F_S} \cdot c \cdot \frac{|\vec{v}_S}{c} = \frac{F_G}{F_S} \cdot |\vec{v}_S|.$$

With the velocity  $\vec{v}_R \neq 0$  of the receiver it is a little more difficult since  $\vec{v}_R$  *doesn't* have to be parallel to  $\vec{c}^\pm$  if  $\vec{v}_S=0$ . The additional velocity which has to be added up to  $\vec{v}_R$ , and which I call  $\Delta(\vec{v}_R)$ , is now parallel to a  $|\vec{v}_S$ , which is turned by the angle  $\theta$  - the angle  $\theta$  is the angle *from*  $\vec{c}^\pm$  *to*  $\vec{v}_R$ . So, to calculate  $\Delta(\vec{v}_R)$  we must turn  $|\vec{v}_S$  by the angle  $\theta$ . This can be seen in Figure 2.2.

I label the  $|\vec{v}_S$ , which is turned by the angle  $\theta$ , with  $|\vec{v}_{S\theta}$ .

So,  $\Delta(\vec{v}_R)$  is parallel to  $|\vec{v}_{S\theta}$ . The magnitude of  $\Delta(\vec{v}_R)$  results from

$$\text{the proportionality: } \frac{\Delta(v_R)}{v_R} = \frac{|\vec{v}_{S\theta}}{c} \Rightarrow \Delta(v_R) = \frac{v_R \cdot |\vec{v}_{S\theta}}{c}.$$

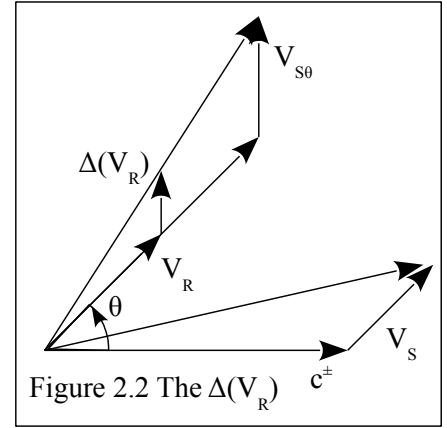


Figure 2.2 The  $\Delta(\vec{v}_R)$

The acceleration of the receiver is made by  $\Delta \vec{v}_m$ . For  $\vec{v}_S=0$ ,  $\Delta \vec{v}_m$  changes due to  $\vec{v}_R$  by  $-\vec{v}_R \cdot \frac{F_G}{F_S}$ . For

$\vec{v}_S \neq 0$ ,  $\vec{v}_R$  changes by  $\Delta(\vec{v}_R)$ . Therefore,  $\Delta \vec{v}_m$  changes correspondingly by  $-\Delta(\vec{v}_R) \cdot \frac{F_G}{F_S}$ .

So, under consideration of  $|\vec{v}_S$ , we finally can write for  $\Delta \vec{v}_m$ :

$$\Delta \vec{v}_m = \frac{F_G}{F_S} \cdot (\vec{c} - (\vec{v}_R + \Delta(\vec{v}_R)) - (\Delta \vec{v}_m + \Delta(\Delta \vec{v}_m))) = \frac{F_G}{F_S} \cdot (\vec{c} - \vec{v}_R - \Delta \vec{v}_m - |\vec{v}_S - |\vec{v}_{S\theta} \cdot \frac{v_R}{c}).$$

For the force we get correspondingly:  $F_c \cdot (\vec{c} - \vec{v}_R - \Delta \vec{v}_m - |\vec{v}_S - |\vec{v}_{S\theta} \cdot \frac{v_R}{c}) = \vec{a} \cdot m = \frac{\Delta \vec{v}_m}{\Delta t} \cdot m$ .

The mathematical representation, which I show here, is for certain far away from being elegant, but after all, it corresponds to the conditions - it suffices to be able to represent the connections. In this work here I primarily would like to convey the ideas, all about which it is here. I will try to get a better mathematical representation in the following works.

## 2.13 Closing remark to part 2

And what's about the gravitational waves? It is frequently said that the gravitational waves are for the gravitation, what the electromagnetic waves are for the electric field. So, actually it could be very well possible to derive the gravitational waves from the way in which I calculate gravitation in this work here. But I haven't checked this yet, though.

I don't treat general relativity (GR) here. However, I cannot see any contradictions anyway. And not only that there seems to be no contradictions, it seems as if there is quite excellent conformity with GR. The curvature of space-time in GR can be understand as a kind of resultant field. If we look more exactly, then we see the quanta and anti-quanta of the electric field. In turn the effects of these quanta yield 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 then my reflections on gravity. GR describes the gravitation *without* presupposing that

the electric force exists. I describe merely the connection between the electric force and gravitation.

GR describes the effect of the gravitation, this is the acceleration, as a result of the curvature of space-time. The great advantage of this way of looking at gravity is that here the changes of space-time, which result in accordance with SR, can be taken into account. In this way, e.g., the orbits of the planets are calculated more correctly than only by Newton's laws, since the conditions of SR, which must be considered as valid, are applied to gravitation.

The equivalence principle connects gravitation with SR. I show in this work here that gravitation is an electric effect. In the next part of this work (that is part 3), I show, that the equivalence principle can be derived directly from the gravitation as an electric effect. So, in the end, I represent not only the connection between gravitation and the electric force, but also the one between the electric force and SR. But, though, I am still far away from being able to represent this mathematically. But this isn't the aim of this work anyway. However, in any case, I think, that I have managed to show that gravitation is no force of its own, or no field of its own. Gravitation is an electric effect.

### Part 3: Quantum-mechanical considerations

#### 3.1 Motivation

So we have seen that the gravitational force isn't an independent force. Gravitation is much more an electric effect. The electric force changes due to  $\Delta \vec{v}_m$ , so that gravitation results. And  $\Delta \vec{v}_m$ , for its part, is proportional to the product of the masses which are just in interaction with each other ( $\Delta \vec{v}_m \propto m_1 \cdot m_2$ ).

So, the force, which two electric charges exert on each other, is influenced by their masses. This means that the electric *field* of a charge is influenced by its masses, because only in such a way, it can be explained, how it comes, that the magnitude of  $\Delta \vec{v}_m$  depends on the product of the masses.

Said more simply: The electric field of a charge must contain some information which tells about the mass of this charge.

So the question is: Which mechanism is the reason that  $\Delta \vec{v}_m \propto m_1 \cdot m_2$  is valid?

This is the question which I try to answer in this 3rd part.

Furthermore, I will try to show quantum-mechanically how the quantization of the energy-transfer takes place, by which then  $\Delta \vec{v}_m$  results. Here, the use of the anti-field will be confirmed excellently. In addition, the velocity-dependence of the electric force can wonderfully be represented quantum-mechanically.

#### 3.2 Mass as a wave

DeBroglie had already stated in his derivation of matter waves:  $\frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \cdot c^2 = h \cdot f$  (3.1), where  $m_0$  is the rest

mass,  $v$  is the velocity,  $f$  is the frequency and  $h$  is Planck's constant.

The first part of this equation can be developed:  $\frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} \cdot c^2 = m_0 \cdot c^2 + \frac{1}{2} \cdot m_0 \cdot v^2 + \dots$  (3.2).

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

But exactly this first part is particularly interesting here.

Because we can write:  $m_0 \cdot c^2 = h \cdot f_m \Rightarrow f_m = \frac{m_0 \cdot c^2}{h}$  (3.3).

Here, a frequency  $f_m$  is assigned to the *rest mass* of a particle.

With other words: the rest mass of a particle is characterized by  $f_m$ . Therefore, we could assume that the rest mass oscillates (a proton e.g. with unbelievable  $f_m \approx 2,2 \cdot 10^{23} \cdot s^{-1}$ ).

But what is it, that oscillates there?

Well, we can ask the same question also regarding the electromagnetic waves (EMW). We don't really know, what EMW are. But, I showed in the first part of this work that there isn't an independent magnetic field

because the magnetic field is nothing else but an angled electric field. In the second part of this work I showed that there isn't an independent gravitational field either because the gravitational field is also only an electric effect. Thus, there is only the electric field, in the end. And this electric field oscillates.

So, the electric field seems to be the most basic of all fields. A field is a three-dimensional spatial structure. And the most basic element of a spatial structure is space itself.

Thus, I come to the assumption that oscillating electric fields are nothing else then oscillating space.

But what shall that be, oscillating space?

Well, we know that space and space are not always the same. We know from SR that the space-time parameters change in dependence of the velocity of an object. We know from GR that there are gravitational waves, and that these gravitational waves transport energy.

So, oscillating space is nothing else but the oscillation of the space-time parameters.

These oscillations of space contain energy (just as any other oscillation does) which, in principle, doesn't mean anything else here, then that the oscillations of space can influence each other mutually.

So the energy of a mass is nothing else but the energy which is stored in a space-oscillation.

In a way, we can imagine a mass as a motionless quantum, unlike the quanta of the EMW (the photons) which always move with the speed of light. But, though, there are even further differences between the masses and the photons - that will get clear in the further course of this work.

To be able to describe the oscillation of space, we can assign a density to space. If space is compressed, the density increases, and if space is stretched, the density decreases.

These density-fluctuations of the oscillating space are nothing else then length-fluctuations by which the course of time also is influenced. And if these length-fluctuations influence other objects, then this corresponds to an energy-transfer.

So, mass is oscillating space. The electric force acts, just as gravitation, in all direction equally. So it makes sense, due to symmetry, to assume that the oscillating space of a mass is a spherical oscillation. And this means that it is a longitudinal oscillation. This oscillation spreads, by starting from the centre of the mass (particle), *as a wave* into infinity!!

The amplitude of the wave corresponds to the maximum stretching or compression of space. Here, too, the power of the waves is (as in the case of EMW) proportional to the square of the amplitude, particularly since I assume a harmonic wave - but more about that later.

The wave spreads, as the electric field, with the speed of light. By doing so, the wave maintains its wavelength. So, while the wave passes a place, the density of space changes at this place with the frequency of the wave.

One can say: the wave is moving space-density.

The areas with a high space-density and these with a low space-density spread together with the speed of light - therefore, they don't move relatively to each other.

So, what do we get now, if two of this space-time waves superimpose?

Well, the space-density declares the distances of points in space. So the space-time waves move these points in space relatively to each other, in an area. Thus, when waves superimpose, the space-densities of the waves simply can be added up. An example: If an area of a space-time wave that has a low space-density superimposes with an area of another space-time wave, that also has a low space-density, then the space-density of the first space-time wave is additionally reduced by the other space-time wave.

So, the amplitude of the space-time wave describes the space-density. But this amplitude isn't constant.

The amplitude of the space-time wave of a mass decreases by  $\frac{1}{r^2}$ , by starting from the centre of the mass

(particle). Through this, the gravitational force decreases with  $\frac{1}{r^2}$ . I will show later, in the chapter on the

velocity-dependence of the electric force, why this is so.

In the centre of the mass, the amplitude is to become infinite. This means that the density of the space oscillates there between zero and infinite. So the centre of the mass is a prominent place. This is important since we have stated that a mass *isn't* a spatially limited area. A mass, or its space-time wave rather extends into infinity. This also is valid for the energy, which is to be assigned to a mass, it extends into infinity. But, of course, the amplitude of the space-time wave of a mass decreases really very fast due to the  $r^{-2}$ -dependence. This makes the centre an excellent place also regarding the energy. The centre has an additional, special meaning for the *interactions* of a mass (e.g. with fields), which I will describe more exactly later.

As I have already described in part 2 on gravitation, there cannot be a mass without electric charge. Also

electrically neutral particles, such as the neutrons, consist of positive and negative electric charges equal in magnitude. We recognize here now, that mass is nothing else then the frequency with which the electric field of an electric charge oscillates. The energy of the mass is in this oscillation. The force of the electric field is still of electrical nature.

### 3.3 Energy / Beat (interference)

As we know by now, an electric charge has not only a field but also an anti-field.

Therefore, there is a  $f_m$  of the mass of the charge not only for the field but also for the anti-field.

The field and the anti-field move in opposite directions, both with the speed of light, and both shall have the *same* frequency  $f_m$  for a motionless charge. When two equal waves, which move in opposite directions, superimpose, then a *standing wave* is made.

So, the following picture arises: A mass is a standing spherical wave whose amplitude decreases with  $r^{-2}$  from the centre. In this picture the space-time wave of the anti-field moves towards the centre of the mass, while its amplitude increases with  $r^{-2}$ . And after the centre, the space-time wave of the anti-field becomes the space-time wave of the field (while its amplitude then decreases with  $r^{-2}$  again). It is almost as if it were the same wave whose amplitude changes towards the centre of the mass with  $r^{-2}$  - it may be a little hard to imagine this for a three-dimensional spherical wave, but that's the way it is.

But, though, the depiction, just described, only applies to motionless charges.

So, what is, when the charge of the mass  $m$  moves with the velocity  $v_m$ ?

Well, we know that the frequency of a wave changes in dependence of the velocity of its source.

This is also valid for the  $f_m$  of a mass, and to be more precise, it is valid for both, for the  $f_m$  of the field, which I call  $f_m^+$ , and for the  $f_m$  of the anti-field, which I call  $f_m^-$ .

For the wave, that moves in the same direction as the mass, the frequency increases, and for the wave, that moves in the opposite direction as the mass, the frequency decreases.

If the frequencies of two waves are different, then *beat* arises. This doesn't only apply to waves which move in the same direction *but also to waves which move in opposite directions*, as this is the case for the field and the anti-field.

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

At first, we consider the carrier frequency. For a motionless mass the frequency of the field is equal to the frequency of the anti-field:  $f_{m0}^+ = f_{m0}^- = f_{m0}$ . When the mass moves with  $v_m$ , then, by taking into account

the relativistic time-dilatation, we get for the carrier frequency ( $f_m$ ):  $f_m = \frac{f_{m0}}{\sqrt{1 - \frac{v_m^2}{c^2}}}$  (3.4).

Thus, the frequency  $f_m$  changes in dependence of the velocity  $v_m$  in the same way as the mass  $m$ .

Therefore, the change of the frequency  $\Delta f_m$  is exactly as big as the change of the mass  $\Delta m$ , in dependence of the velocity  $v_m$ . This corresponds exactly to the finding, that mass is oscillational energy, and that the magnitude of the mass is directly proportional to the frequency, as we know from equation 3.3.

From equation 3.2 we know that the change of the mass ( $\Delta m$ ) corresponds to the kinetic energy, which corresponds to  $v_m$ . And, in exact concurrence,  $v_m$  also yields  $\Delta f_m$ .

Of course, in dependence of  $v_m$ , not only the frequency  $f_m$  of the mass (or the space-time wave) changes but also the wavelength  $\lambda_m$ . The wavelength changes according to the relativistic length-contraction and is

$\lambda_m = \lambda_{m0} \cdot \sqrt{1 - \frac{v_m^2}{c^2}}$  (3.5), where  $\lambda_{m0}$  is the wavelength of a motionless mass.

Let us now consider the frequency  $f_{mS}$ , or wavelength  $\lambda_{mS}$  of the beat.

The frequency  $f_{mS}$  of the beat is the difference of the frequencies of the waves which superimpose (inter-

fere). By taking into account the relativistic time-dilatation we get here:  $f_{mS} = f_{m0} \cdot \frac{2 \cdot v_m}{c} \cdot \frac{1}{\sqrt{1 - \frac{v_m^2}{c^2}}}$  (3.6).

For smaller velocities ( $v_m$ ) of the mass, compared with the speed of light  $c$  (that is  $v_m \ll c$ ), the root term

is approximately 1, so that, in good approximation, it is valid:  $f_{mS} = f_{m0} \cdot \frac{2 \cdot v}{c}$  (3.7).

Of course, we are interested in the wavelength  $\lambda_{mS}$  of the beat. The beat moves with the speed of light.

Therefore, it is  $c = f_{mS} \cdot \lambda_{mS} \Rightarrow f_{mS} = \frac{c}{\lambda_{mS}}$  (3.8).

We know the frequency  $f_{m0}$  of a motionless mass from equation (3.3). Thus, inserting (3.3) and (3.8) in

(3.7) yields:  $\lambda_{mS} = \frac{h}{2 \cdot m_0 \cdot v_m}$  (3.9)!!

This corresponds exactly to the deBroglie wavelength, which was calculated by deBroglie for the matter-waves of masses (which were confirmed, e.g., by double-split experiments [11]).

It is really remarkable: By introducing the anti-field, the deBroglie wavelength can very simply be represented as a beat, which arises between the space-time waves of the field and the anti-field, when the mass moves with  $v_m$ .

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

But, of course, the anti-field moves towards the mass. If the velocity of the mass changes, then the frequencies of the field and the anti-field change correspondingly, too. It is easy to imagine that the change of the frequency of the field propagates with the speed of light away from the centre of the mass, since the field moves with the speed of light away from the mass. In association with the anti-field, this idea feels somehow harder. But, that's exactly the way it shall be: The anti-field always changes *together* with the field. And this change spreads with the speed of light, as, e.g., the changes of the frequencies. In the chapter "The electric force as a quantum-mechanical effect / The entanglement", which is to appear later, is an outline/Figure which shows this connections very clearly. We recognize there that actually only the frequency of the anti-field changes while the change of the field is a consequence of the change of the anti-field.

### 3.4 The magnitude of $\Delta v_m$

So, we have seen that mass is a space-time wave. Based on that, I want to try now to explain how  $\Delta v_m$  results.

We remember: the magnitude of  $\Delta v_m$  is proportional to the product of the masses which interact with each other ( $\Delta v_m \propto m_1 \cdot m_2$ ).

But, at the same time, the magnitude of  $\Delta v_m$  is independent of the distance  $r$  between these two masses, because both the electric force and the gravitational force are proportional to  $r^{-2}$ , of course. Therefore, the energy, which is needed for a  $\Delta v_m$ , is independent of the distance  $r$ , while the energy, which the field can transfer to a mass (this is the intensity of the wave), is proportional to  $r^{-2}$ . In addition, the energy, which is needed for a  $\Delta v_m$ , is dependent on the initial velocity  $v_0$ , which the mass already has (because the increase

of the kinetic energy  $\Delta E_K$  by a  $\Delta v_m$  is  $\Delta E_K = \frac{1}{2} \cdot m_0 \cdot ((v_0 + \Delta v_m)^2 - v_0^2) \neq \frac{1}{2} \cdot m_0 \cdot \Delta v_m^2$ , or a little more

exact:  $\Delta E_K = m_0 \cdot \left( \frac{1}{\sqrt{1 - \frac{(v_0 + \Delta v_m)^2}{c^2}}} - \frac{1}{\sqrt{1 - \frac{v_0^2}{c^2}}} \right) \neq \left( \frac{m_0}{\sqrt{1 - \frac{\Delta v_m^2}{c^2}}} - m_0 \cdot c^2 \right)$ .

So, on the one hand we have noticed that the space-time wave transfers the energy by quanta, so that the velocity of the mass doesn't change continuously but always only in steps of  $\Delta v_m$ . On the other hand we see that the intensity of the wave is proportional to  $r^{-2}$ , and that the energy for a  $\Delta v_m$  depends on the initial velocity  $v_0$ . Thus, I conclude, that the energy of the space-time wave of an electric charge with mass is not subdivided into energy-quanta. I rather assume that the space-time wave is a homogeneous wave, which transfers its energy always only in quanta. And every quantum produces one  $\Delta v_m$ . So now we want to find out, how these quanta are created.

We already know quite something.

The  $\Delta v_m$  is inconceivably small. Therefore, the energy, which is necessary for one  $\Delta v_m$ , is also very small

(at least as long as  $v_0 \ll c$ ).

In order to get one  $\Delta v_m$ ,  $f_m^+$  and  $f_m^-$  have to change a tiny little bit. This change spreads out starting from the centre.

The centre is a very special place, because only if a field has reached the centre (with the speed of light), the velocity of the mass changes.

It is almost as if the centre would be the only place at which  $f_m^+$  and  $f_m^-$  can be changed.

To change  $f_m^+$  and  $f_m^-$ , energy is needed. Since the velocity always changes only in steps of  $\Delta v_m$ , it is obvious to assume that for the change of  $f_m^+$  and  $f_m^-$  an energy-threshold must be exceeded always first.

The force of the electric field is proportional to  $r^{-2}$ . There is a simple geometric reason for that: the field spreads spherically and the magnitude of the surface of this sphere is proportional to  $r^{-2}$ .

It surprised me to find out that it is possible to explain the emergence of the quanta, which produce the  $\Delta v_m$ 's, in a simple geometric way, too. But this is still very incomplete, though. I would nevertheless like to describe the basic idea here since it provides a possible explanation about the emergence of the  $\Delta v_m$ 's.

My hypothesis begins with the centre of the mass, or charge.

At the centre, the amplitude becomes almost infinite ( $A \rightarrow \infty$ ). This means that the space-density oscillates between zero and infinity. But this isn't possible. Concluding from this, I put forward the hypothesis that there is a spatial area in the centre of a mass, which *doesn't* oscillates. I call this area (a little simple) *zero-area*.

Since the zero-area doesn't oscillates with  $f_m$ , it can be excited to oscillate by an external wave (that is the field of an other charge). But now, it shall be, that the energy-quantity, which a space-area can absorb, is limited. As soon as the energy-quantity, which the zero-area can absorb, is reached, it passes this energy as a whole on to  $f_m^+$  and  $f_m^-$ . Then the zero-area can be filled once more. - All this sounds very makeshift now, and I actually believe that there is a clearer, more basic connection, but I haven't found that yet. So I will go into detail with this makeshift explanation now.

The following questions arise: How big is the zero-area, how grate is the energy which a space-area can absorb, and on what does this depend?

To answer these questions, I have used - as often - a simple logic.

At first, the question is: how does the energy for a  $\Delta v_m$  changes, when the magnitude of the masses, which interact with each other, changes?

Let  $M_2$  be the mass, on which a field has an effect, and  $M_1$  the mass, whose charge produces this field. It is:  $\Delta v_m \propto M_1 \cdot M_2$ . The kinetic energy, which is needed for a  $\Delta v_m$  of  $M_2$  (when  $v_0=0$ ), is

$$E_K = \frac{1}{2} \cdot M_2 \cdot \Delta v_m^2. \text{ So it is valid: } \boxed{E_K \propto M_2 \cdot (M_1 \cdot M_2)^2 \Rightarrow E_K \propto M_2^3 \cdot M_1^2}! \quad (3.10).$$

Here, it immediately stands out that the energy, which is necessary for a  $\Delta v_m$ , is proportional to the 3rd power of  $M_2$ , exactly as a volume.

From this, I conclude that the volume ( $V_N$ ) of the zero-area of  $M_2$  is directly proportional to  $M_2^3$ ,  
 $V_N \propto M_2^3$ .

And since  $V_N \propto r^3$  ( $r$  is the radius of the volume  $V_N$ ), we get for the radius of the volume  $V_N$ :  $r \propto M_2$ . This seems plausible because we mustn't forget that  $M_2 \propto f_{m2}$ . The stationary spherical wave of  $M_2$  results from  $f_m^+$  and  $f_m^-$ , which both propagate with the speed of light. So it is  $c = f_{m2} \cdot \lambda_{m2}$ . Thus, the grater  $M_2$  becomes, the grater  $f_{m2}$  becomes, too, and the smaller  $\lambda_{m2}$  becomes. But the smaller  $\lambda_{m2}$  is, the more the oscillation can approach the zero-area and this is after all the area with  $A \rightarrow \infty$ . To avoid the oscillation coming to close to the area with  $A \rightarrow \infty$ , the zero-area gets larger.

So, the first question - how big is the zero-area - is answered.

The second question was: how much energy can space absorb?

We recognize in equation (3.10) that the energy for a  $\Delta v_m$  is proportional to the square of  $M_1$ . And we know that  $M_1 \propto f_{m1}$ .

From this I conclude generalizing that the energy (E), which can be absorbed by a space-volume (V), is:

$$\frac{E}{V} \propto f^2 \quad (3.11). \text{ This is in principle nothing else but a rearrangement of the equation (3.10).}$$

So, the energy, which can be absorbed by a space-volume, is directly proportional to the square of the frequency, with which this space-volume is excited to oscillate (in this context, the vacuum energy [12, 13])



may be of interest).

In the case of  $M_2$ , the zero-area of  $M_2$  is excited to oscillate by the  $f_{m1}$  of the field of  $M_1$ . At this,  $M_2$  continues to absorb energy until the volume is saturated. Then, this energy is emitted by producing one  $\Delta v_m$ .

But we know, though, that the energy always depends on the amplitude (A), too. Here, too, a square-relation is valid. Thus, the correct proportionality is:  $\frac{E}{V} \propto f^2 \cdot A^2$ .

For the excitation of the tiny small volume of the zero-area by an external frequency the amplitude seems to have no great importance. But, however, the amplitude could have meaning if it is all about to calculate the complete energy of a mass. To do so, it also has to be taken into account that the amplitude is proportional to  $r^{-2}$ , while the wave of the mass is extending into infinity, of course. Perhaps there is a connection between the magnitude of the zero-area and the maximum amplitude which the oscillation can reach near the edge of the zero-area. This then must be taken into account at the calculation of the total energy of the mass.

However, the meaning of the amplitude is still not quite clear. But, unfortunately, I cannot clear this here yet.

### 3.5 Wave - particle / The centre, and also the quarks

So, we have seen that the energy for a  $\Delta v_m$  is collected in the zero-area of a mass, therefore in the centre of a mass. As soon as the zero-area is saturated energetically, this energy is changed into the kinetic energy of the mass, therefore into the  $\Delta v_m$  of the mass.

But not only the energy is collected in the centre, the  $\Delta v_m$  is also produced in the zero-area, therefore in the centre of the mass.

This happens by the energy of the  $f_{ex}$  (this is the frequency of the external wave) changing the  $\lambda_m^+$  and  $\lambda_m^-$  of the  $f_m^+$  and  $f_m^-$  of a mass symmetrically - this shall mean that  $\Delta \lambda_m^+ = -\Delta \lambda_m^-$ . Due to this change of the wavelength beat arises - as described already. This beat spreads with the speed of light from the centre of the mass.

Here, a coherent picture arises: although the mass is a wave (whose amplitude decreases with  $r^{-2}$  into infinity), its centre still has special meaning. So, e.g., as just described, the  $\Delta v_m$ 's of the mass are produced in the centre. And, the by far greatest part of the energy of a mass also is located near the centre, since there the amplitude is at its greatest.

The centre still has another meaning.

Because, of course, masses cannot only interact by their fields but also by a direct collision. At a collision, the exchange of energy between the masses is very intensive. The more the centres of the masses approach, the more intensive the exchange of energy becomes - according to the fast increase of the amplitudes. And, of course, at the collision, the exchange of energy also leads to changes of  $\lambda_m^+$  and  $\lambda_m^-$ . But, however, at a collision the interaction has obviously particle character. And this is primarily due to the special nature of the centre of the mass.

So, although a mass is a wave, it nevertheless also has particle character, because of its centre.

Here perhaps, the atom shell may be also interesting. If we consider the velocities, which are assigned to the electrons in the atom shells, then we notice that the deBroglie wavelengths of these electrons are a little greater than the diameter of the atom shell. However, there aren't any clear calculation bases for the velocities of the electrons in the atom shell, either. Therefore, it is perhaps better to imagine that the beat-waves of the electrons form the atom shell. Here, as it is easy to understand, many various superposition patterns will result. And the centres of the electrons move according to these superposition patterns. I don't know how far it makes sense, here, still to assign velocities to the electrons.

Here now, I have to say something about the quarks [14]. Of course it is known that elementary particles consist of quarks. This *doesn't* contradict that elementary particles are waves. It is not for sure that the wave, which is an elementary particle (that is an electric charge with mass), is a pure sinusoidal wave. The wave pattern of a particle can absolutely be more complicated. This then is as if this particle had sub-structures, which could correspond to the quarks.

Except all this, I would like to mention, that quarks are only observed at particle collisions. It isn't clear in which way they exist before the collision. It is definitely conceivable that they come into being only due to the collision. When the centres of the waves of two particles come into an intensive interaction, completely new structures can arise. This can be completely new particles with their own wave and centre, and this can

also be only temporarily existing superposition patterns. - There also remains the question what happens to the zero-areas at such collisions. In any case, it is clear that, even when the particles are defined as waves, there must be laws for the collisions. And these laws then yield what we know as quarks.

### 3.6 The acceleration

So, we have seen how a  $\Delta v_m$  results. A  $\Delta v_m$  is a velocity-*change*. A velocity-change corresponds to an acceleration. The magnitude of the acceleration results from the time-period ( $\Delta t$ ) which is needed for the velocity-change. So, how grate is  $\Delta t$  for a  $\Delta v_m$ ?

Well, this is actually quite simple: the  $\Delta t$ , which is needed for a  $\Delta v_m$ , results from the energy-quantity, which is transferred per time to the zero-area.

The energy, which is transferred to the zero-area, can be from arbitrarily many masses at the same time. Thus, the more masses transfer energy to the zero-area, all the smaller the  $\Delta t$  for a  $\Delta v_m$  gets. In this way, arbitrarily grate accelerations can be reached.

But, though, in part 2 of this work, at the description of gravitation, I have explained that the field and the anti-field can never act at the same time but always only after each other. So, on what does the magnitude and the direction of  $\Delta v_m$  depends on, if the energy for one  $\Delta v_m$  can be transferred by arbitrarily many masses at the same time?

Well, the magnitude of  $\Delta v_m$  corresponds, of course, to the  $f_m$  of the (external) field, which produces  $\Delta v_m$ . And it seems as if always only *one* wave stamps (characterizes strongly) the frequency for *one*  $\Delta v_m$  in the zero-area, while the other waves are contributing only their energy. As soon as a  $\Delta v_m$  has been completed, another, new wave stamps the frequency in the zero-area. And here it is that after an anti-field always the corresponding field stamps the frequency in the zero-area, before the wave of another mass (I remind: it always is all about electric charges with mass) can stamp the frequency in the zero-area. I conclude these connections very simply and directly from the considerations on gravitation of part 2.

About the exact processes, which are the reason that only one wave always stamps the frequency in the zero-area while the other waves still can contribute their energy, I only can speculate. I can assume that there is some sort of resonance behaviour. Perhaps the zero-area adopts a certain frequency, e.g., from the wave which excites it at first at the moment, in which its energy is low, that is after the creation of a  $\Delta v_m$ , and then it transfers all the energy, that it absorbs from other waves, to this frequency. This could be founded on the fact that, on the one hand, the zero-area always can oscillate only with one frequency, while, on the other hand, it must absorb the energy of every wave of every mass.

Even if this explanation is still quite inaccurate, I believe that it is definitely plausible and acceptable.

### 3.7 The velocity-dependence of the electric force

To show that magnetism and gravitation are electric effects, I stated that the electric force shall be velocity dependent.

Here now, it turns out, that the velocity-dependence of the electric force arises automatically if - as done here - the mass is defined as a wave.

The energy of a space-wave (that a mass is, of course), is stored in the space of this wave, therefore in the volume (quite analogous to the energy of a spherical light source).

So, the energy-quantity, which is transferred from a field to a mass, is proportional to the absorption-area (S) of the mass multiplied by a length L, so that a volume results. The length L results from the relative velocity ( $v_r$ ) between the mass, to which the field transfers its energy, and the field, which transfers the energy. Of course, the field moves with the speed of light.

Thus, to transfer a certain energy-quantity from the field to the mass, time ( $\Delta t$ ) is needed. The energy, transferred to the mass, produces a  $\Delta v_m$ . And the acceleration (a), which corresponds to this  $\Delta v_m$ , is there-

fore  $a = \frac{\Delta v_m}{\Delta t}$ .

For a motionless mass the relative velocity  $v_r$  between the mass and the field is  $v_r = c$ . The time, which is needed to transfer a certain energy-quantity, is the time, which is needed for the absorption of a certain

volume. Thus, for a given absorption-area S this time is:  $\Delta t = \frac{L}{c}$ . And the acceleration  $a_0$  for this  $\Delta v_m$  (which results by  $v_r = c$ ) is  $a_0 = \frac{\Delta v_m}{L} \cdot c$ .

If the mass already moves with  $\Delta v_m$ , then the time for the transfer of *the same* energy-quantity through the same absorption-area is:  $\Delta t = \frac{L}{c \pm \Delta v_m}$ . And the acceleration (a) is therefore:

$$a = \frac{\frac{\Delta v_m}{L}}{\frac{L}{c \pm \Delta v_m}} = \frac{\Delta v_m \cdot c}{L} \pm \frac{\Delta v_m \cdot \Delta v_m \cdot c}{L \cdot c} = a_0 \pm a_0 \cdot \frac{\Delta v_m}{c}.$$

This corresponds exactly to the velocity-dependence of the electric force, stated in part 2:

$$\vec{F}_E = F_c \cdot (\vec{c} \pm \Delta \vec{v}_m), \text{ with } F_c = \frac{q_1 \cdot q_2}{r^2 \cdot \epsilon_0 \cdot |\vec{c}|}, \text{ so that: } \vec{F}_E = \frac{q_1 \cdot q_2}{r^2 \cdot \epsilon_0} \cdot \frac{\vec{c}}{|\vec{c}|} \pm \frac{q_1 \cdot q_2}{r^2 \cdot \epsilon_0} \cdot \frac{\Delta \vec{v}_m}{|\vec{c}|}.$$

Here now, a little difficulty arises: We know that the energy-quantity, which is transferred from a force-field to a mass in a particular period of time  $\Delta t$ , depends on the initial velocity  $v_0$  of this mass (in accordance with  $E = m_0 \cdot c^2 \cdot (\sqrt{1 - v_0^2 \cdot c^{-2}})^{-2}$ ).

So we briefly calculate the energy-quantity which is transferred to a mass by the field and by the anti-field due to a volume, if an initial velocity  $v_0$  is given. The absorption-area S shall be given. So, if we have for the field:  $L^+ = (c + v_0) \cdot \Delta t$ , then we have for the anti-field:  $L^- = (c - v_0) \cdot \Delta t$ . Thus, the sum is

$L^+ + L^- = c \cdot 2 \cdot \Delta t$ . Field and anti field act after each other, for this reason the time has doubled. What do we see? The initial velocity  $v_0$  cancels out. Therefore, the energy-quantity, which is transferred in the time-period  $\Delta t$ , would be independent of  $v_0$ , which, of course, would be wrong.

This problem is solved very simply: It is necessary to take the size of the absorption-area S into account! Due to the initial velocity  $v_0$ , the mass, which absorbs the energy, increases (becomes grater). And we know that the radius  $r_N$  of the volume ( $V_N$ ) of the zero-area, to which the energy is transferred, is directly proportional to the mass ( $r_N \propto m$ ). Therefore, we get for the absorption-area S:  $S = \pi \cdot r_N^2$ .

Said briefly: Due to the initial velocity  $v_0$ , the absorption-area S increases, so that correspondingly more energy is transferred in the given period of time  $\Delta t$ . And the absorption-area increases by  $v_0$  exactly as it corresponds to the additional energy, since the mass changes according to  $m_0 \cdot (\sqrt{1 - v_0^2 \cdot c^{-2}})^{-2}$ .

As far as it concerns the velocities, the statements about the energy-transfer just made are correct (particularly regarding  $v_0$ ). But we also must take into account the mass  $m_0$ . And we see that the energy-quantity, which is needed for a velocity-change ( $\Delta v$ ), is *directly* proportional to the mass  $m_0$ . On the other hand, for the area S we have:  $S = \pi \cdot r_N^2 \propto \pi \cdot m_0^2$ . (The area S increases more than the needed energy-quantity.)

We recognize here that the energy-quantity, which can be transferred due to S, cannot *only* be proportional to S. There still must be another quantity which must be taken into account at the energy-transfer. This quantity is the frequency  $f_m$  of the mass  $m_0$ . We get correct results if the energy-quantity, which can be transferred due to the area S (of the volume  $V_N$  of the zero-area) from the field, or anti-field to the mass, is inverse proportional to the frequency  $f_m$  of the mass  $m_0$ . So the correct relation for the energy-quantity, which is transferred to the mass  $m_0$  by the field, or anti-field in the time-period  $\Delta t$  is:  $E \propto \frac{S}{f_m} \cdot L$ , with

$$L = (c \pm v_0) \cdot \Delta t.$$

So we see that the energy, which is needed for a change of the velocity (thus, also for a  $\Delta v_m$ ), is transferred by the field, or anti-field to the mass  $m_0$  via the volume  $V_N$  of the zero-area.

I would like to go a little more into detail here: first, a certain energy-quantity is transferred to a mass, then this energy-quantity is released, so that  $\Delta v_m$  results. In part 2, where I describe gravitation as an electric effect, the anti-field, which always acts first, immediately produces a  $\Delta v_m$ , without the need of collecting energy previously. The result is here as there the same since the gravitation results from the difference of the velocities which the mass has relatively to the field and to the anti-field, and this is here as there  $1 \cdot \Delta v_m$ . But, we still see something else: in my descriptions up to now, *first*, the energy is transferred, and only *then*

$\Delta v_m$  results. But, taken exactly, I have never defined, in which way  $\Delta v_m$  is being created. In classical theory, that is on shell, the velocity changes continuously. This means that in classical theory the change of the velocity corresponds simultaneously to an energy-transfer. An energy-transfer *without* a simultaneous velocity-change cannot exist on shell.

This is, in principle, also possible for the emergence of a  $\Delta v_m$ . A  $\Delta v_m$  can also arise continuously, therefore it can be termed on shell. This changes nothing at the validity of the previous statements. The only difference would be, that some numerical values would change by the factor  $\frac{1}{2}$ . But, though, I don't know the course of the emergence of  $\Delta v_m$  yet. There easily could be a more complicated, not linear acceleration process. So, I choose the simplest variant at first and let arise  $\Delta v_m$  without any acceleration process. Some further considerations are necessary here. Perhaps the actual acceleration process can be found out even only experimentally.

The idea that  $\Delta v_m$  results from a continuous change of the velocity is definitely compatible with the statement that the energy for  $\Delta v_m$  is transferred in quanta. At the quantization of the energy-transfer it is primarily all about, that the energy is transferred alternately by the field and by the anti-field, and that the energy comes alternately from different sources (charges). Taken exactly, it is even only all about, that always only the frequency of one source stamps the oscillation of the volume  $V_N$  of the zero-area. I described that the volume  $V_N$  of the zero-area must be first filled with energy, before a  $\Delta v_m$  can arise. We can interpret this also in the meaning that it only is all about, that a certain energy-quantity must be transferred to the volume  $V_N$  of the zero-area, before another source can stamp the volume  $V_N$  of the zero-area with its frequency. And this *doesn't* mean that the energy, which is transferred for an energy-quantum of a  $\Delta v_m$ , can not be changed into  $\Delta v_m$  during the transfer. To know what exactly happens, we would need to know more about the oscillation-behaviour of the space of the volume  $V_N$  of the zero-area, and about the interactions between the zero-areas and the waves of the masses (or the oscillations of the fields and the anti-fields of the masses).

So it is all about that only the frequency of *one* source can stamp (be dominant in) the zero-area. And the energy-quantity, which is stamped by this frequency, corresponds to the volume  $V_N$  of the zero-area, and to the square of the frequency of the source.

In this chapter it was all about the effects of a (initial-) velocity ( $v_0$ ) of a mass on the energy-transfer of a field to this mass.

But, of course, due to the velocity  $v_0$  of a mass the magnitude of this mass changes. In addition, the frequency of the external field, which transfers the energy to the mass, also changes due to  $v_0$  for this mass. These changes of the frequency can change the magnitude of  $\Delta v_m$ . And this means that the energy-quantity, which is needed for  $\Delta v_m$ , can also change. But, at the same time, the corresponding time-period  $\Delta t$  changes, too.

Short and good: there can be effects on the gravitation here. I don't know yet which ones these are. However, I show an example in the next chapter.

Actually, the change of the frequency ( $f_{ex}$ ) of the field, which transfers the energy to the mass, due to  $v_0$  is an important factor. In part 2, in the chapter "On the magnitude of  $\Delta v_m$ ", I show that a  $\Delta v_m$ , with which a mass (that is a receiver) accelerates, changes due to an already existing, constant  $v_E$ . This  $v_E$  corresponds to  $v_0$ , used in this chapter here.

If  $v_E$ , or  $v_0$  is parallel to  $\vec{c}^\pm$  then  $f_{ex}$  changes, and therefore  $\Delta v_m$  changes also correspondingly. And this change of  $\Delta v_m$  due to  $f_{ex}$  corresponds exactly to the change of  $\Delta v_m$  due to  $v_E$  from part 2. Due to  $v_E$ , or  $v_0$  the time-period, which is needed to produce that part of  $\Delta v_m$  which was given for  $v_E=v_0=0$ , changes, of course, since the time-period for the absorption of the corresponding volume changes.

If  $v_E$ , or  $v_0$  is perpendicular to  $\vec{c}^\pm$  then  $f_{ex}$  doesn't change, of course. Due to the motion perpendicularly to  $\vec{c}^\pm$ , additional volume, therefore additional energy is absorbed in the direction of this motion. This additional energy produces an additional  $\Delta v$  in this direction, just as described in part 2.

When the source of the field (or anti-field) moves with a velocity  $v_S$ , then, of course,  $f_{ex}$  changes due to this velocity, too. In addition, the energy-density of the field, which the source causes, also changes due to

$v_s$ . This arises by the fact that the source always causes the same energy-quantity in all directions in the field, or anti-field (which move with the speed of light). And due to  $v_s$ , the volume, in which this energy-quantity is produced, changes.

Something important was said here now: The source causes the energy of the field. At the same time, of course, it causes the energy of the anti-field, too. And the change of the energy-quantity of the field and the anti-field due to  $v_s$  corresponds to the relativistic change of mass.

We recognize here that due to  $v_s$  the forces of the field and the anti-field change, and that  $\Delta v_m$  changes. Both changes (of the force and of  $\Delta v_m$ ) correspond exactly to the conditions, I describe in part 2 in the chapter "On the magnitude of  $\Delta v_m$  : The  $v_s$ ".

Before I come to the effects on gravitation, I still would like to say something about the amplitude here briefly.

I said, at the definition of the mass as a wave, that the amplitude (A) is inverse proportional to the square of the distance r to the centre ( $A \propto r^{-2}$ ). In addition, we know that the intensity of a wave (this is the energy per time ( $\Delta t$ ) and area (S)) is proportional to the square of the amplitude. Thus, the energy per time is proportional to  $\left(\frac{1}{r^2}\right)^2$ , that is  $\frac{1}{r^4}$ .

The same connection applies to the kinetic energy which a mass gets per time by the force of a  $\frac{1}{r^2}$ -force-field. So we see that it makes sense to assume that the amplitude of the wave of a mass is proportional to  $r^{-2}$ .

### 3.8 Effects on gravitation

When a mass moves with a velocity  $v \neq 0$ , then its frequency, or the frequency of its field changes. In addition, the frequencies, with which the fields of other masses have an effect on this mass, change. Since the frequency corresponds to the magnitude of a mass, it is obvious that changes of the frequencies can have effects on gravitation. Of course we are interested in knowing which consequences these are. But, though, there are still quite some open questions, so that here I can treat only some simple aspects.

Well, we know, that the total frequency from field and anti-field of the wave of a mass gets greater due to a velocity along the motion-direction of this velocity, in accordance with  $f = f_0 \cdot (\sqrt{1 - v^2 \cdot c^{-2}})^{-1}$ , where  $f_0$  is the frequency for  $v=0$ .

Therefore, this mass represents, at its interactions with other masses, a greater mass in motion-direction of this velocity, which means, that its gravitation is correspondingly greater. So, due to the velocity of the mass, not only its inert mass ( $m_i$ ) but also its gravitational mass ( $m_g$ ) increases in a similar manner in motion-direction of this velocity.

But, how is it with the direction perpendicular to the motion-direction of the mass, how does the frequency of the wave of the mass changes there?

Well, perpendicular to the motion-direction of the mass the frequencies of the field and the anti-field change exactly identically, therefore there isn't any beat. The frequencies of the field and the anti-field change due to

the time-dilatation and become  $f_m^+ = f_m^- = f_{m0}^\pm \cdot \sqrt{1 - \frac{v^2}{c^2}}$ , where  $v$  is the velocity of the mass, of course, and

$f_{m0}^\pm$  represents the frequencies of the field and the anti-field for  $v=0$ .

So, perpendicular to the motion-direction the total frequency gets *smaller*. And this would mean that the gravitational force of this mass also gets smaller in this direction.

But, perpendicular to the motion-direction the magnetic part of the gravitation also has to be taken into account.

Normally (therefore at electrically neutral mass), the magnetic part of gravitation cancels out, as I have shown in part 2 of this work on gravitation. But I still don't know exactly whether this also is valid for the velocity-depending frequency-changes. There still could be effects on gravitation [15].

If the velocity-depending frequency-changes actually influence gravitation, then this should manifest itself at the planetary orbits. The anomalous perihelion precession of mercury is a well known problem [16]. It could be solved (almost) completely by GR. I can very well imagine that the problem can be solved in a similar

way if the velocity-dependent frequency-changes of a mass are taken into account. Mercury has the greatest orbital velocity of all planets (because he is most close to the sun). Therefore, the velocity-dependent frequency-changes manifest themselves at mercury at most, and his trajectory deviates at most from the classical Newtonian trajectory. I haven't carried out the calculations to this yet (and I will not do that soon). However, if the results would match, this would be a beautiful confirmation for the ideas introduced here. In a similar way the rotation of the planets (round their axes) also could have influence on gravitation.

If, due to the velocity of a mass, not only its frequency changes (in dependence of the direction relative to the direction of the velocity) but also in an analogous way its  $\Delta v_m$ , then the weight of this mass also changes in a corresponding way, within a gravitational field. Thus, a disk, or plate rotating horizontally in the gravitational field of the earth would get lighter due to the rotation. But, though, the reduction of the weight would be inconceivably small: even if it would be possible to assign an average rotational velocity of 10000 m/s to the mass of the plate, the mass of the plate would change only by the factor  $\approx 5 \cdot 10^{-10}$ . At a mass of 10 kg, this would be approximately  $5 \mu g$ . I think that this wouldn't be measurable under the given test conditions.

But what's about the spins of the nuclei? If the spins of the nuclei of all atoms of a mass could be oriented horizontally, then the weight could be reduced perhaps even measurably. This would be easier, perhaps, at very low temperatures, because then the motions due to the temperature are smaller.

I have read about rotating, superconductive plates. Perhaps the superconductivity causes resonances regarding the frequencies ( $f_m$ ) of some of the elementary masses, these plates consist of. This seems conceivable, since here the thermal motions are very small. Due to these resonances the volumes ( $V_N$ ) of the zero-areas of the masses could change. But that's not all. In a certain way, the (elementary) masses situated in resonance would behave together as one single mass. And the centres of the (elementary) masses, which are in resonance, could move freely within the resonance-area. Let us remember here, how a Faraday cage functions: the electric fields, that influence the cage (from outside), are compensated by the motions of the electrons inside the material of the cage. Perhaps in a similar way, the (elementary) masses, which are in resonance, could develop a similar shielding effect due to the mobility of their centres, by superimposing the waves of other (outside) masses destructively, so that they are extinguished - at least partial. This could have an effect on gravitation. But all this is still this very hypothetically.

Regarding the rotation of the superconductive plates, I can only venture assumptions. Perhaps the magnetic effects, which arise due to the rotation, have influence on the resonances of the frequencies of the masses, perhaps even only in interaction with the environment.

In any case, all this is still very speculative indeed.

### 3.9 Equivalence of gravitational and inertial mass

Till now, I have very often used the term "mass" without always saying whether it is gravitational or inertial mass. The reason for that simply is that I have automatically presupposed an equivalence between gravitational and inertial mass. Till now, *all* experiments have always shown an equivalence of gravitational and inertial mass in very high precision.

We remember: the acceleration of a mass  $m$  in a gravitational field is:  $a = \frac{F}{m}$  (where  $F$  is the force of the gravitational field on the mass  $m$ , and  $a$  is the acceleration of this mass). Since  $F \propto m$ , the acceleration is independent of  $m$ . And, actually, the definitions of the quantities, which I use here for the derivation of gravitation, yield, too, that the acceleration is independent of  $m$ : The magnitude of the gravitational force is proportional to  $\Delta v_m$ ; the magnitude of  $\Delta v_m$  is proportional to the energy, which can be transferred to the volume  $V_N$  of the zero-area, and the radius of the volume  $V_N$  of the zero-area is proportional to the mass. The magnitude of the acceleration is proportional to the time-period  $\Delta t$ , which is needed for the transfer of this energy-quantity, and this time-period  $\Delta t$  is proportional to the absorption area  $S$  of the volume  $V_N$  of the zero-area divided by the frequency of the mass. Short and good: the acceleration due to the gravitational force is independent of the magnitude of the mass which is accelerated.

The question is now: Is this always that way? Well, theoretically it must not always be so. If the volume of the zero-area wouldn't be exactly proportional to the mass, or if the energy-quantity, which is transferred, wouldn't correspond exactly to the definitions, then the gravitational mass could differ from the inertial mass. Are there circumstances under which such deviations are possible? I don't know. However, here the possib-

ility of manipulating gravitation would arise. But, these manipulations of the gravitation don't have to be mistaken for the ones who arise from relativistic considerations.

### 3.10 Velocity-change of a macroscopic object

The wavelengths of the field and the anti-field of a mass, which moves with the velocity  $v_m (\neq 0)$ , are:

$\lambda^\pm = \frac{\lambda_0}{c \cdot \sqrt{1 - v_m^2 \cdot c^{-2}}} \cdot (c \pm v_m)$ . (We recognize here the symmetry of  $\Delta \lambda$  of the field and of the anti-field in relation to  $\lambda_0$ , where  $\lambda_0$  is the wavelength for  $v_m = 0$ .) And - as already shown - the superposition of the

field and the anti-field yields a wave with the carrier wavelength:  $\lambda = \lambda_0 \cdot \sqrt{1 - \frac{v_m^2}{c^2}}$ .

We immediately recognize here, of course, that the change of the wavelength of the wave of the superposition (interference), which results due to  $v_m$ , corresponds exactly to the length-change (or length-contraction), which results from SR. SR says that the length  $L$  of an object changes according to its velocity

$v_m$  ( $L = L_0 \cdot \sqrt{1 - \frac{v_m^2}{c^2}}$ ,  $L_0$  is the length if  $v_m = 0$ ). Now we see that the wavelength of the wave of the super-

position of the field and the anti-field of a mass changes in exactly the same way. Thus, we recognize exact concurrence.

So, the question which arises now is: How does the length of a macroscopic object changes if its velocity changes?

With "a macroscopic object" I mean an object which consists of many small masses, in which every mass always belongs to an unit charge, in principle (therefore I talk about atoms, or about objects which consist of many atoms).

Let us consider *two* elementary masses, which *both* move with the velocity  $v_m$ . The number of waves between them results from the distance  $L$  between them and from the wavelength  $\lambda$  of the respective mass. From the point of view of one of the two masses, which, of course, rests relatively to the other mass, the

number of wavelengths between the two masses shall be  $Z_0 = \frac{L_0}{\lambda_0}$ . From the point of view of an observer,

relatively to whom the two masses move with  $v_m$ , the number of wavelengths must be the same. This means, that the distance ( $L$ ) between the two masses must differ (in dependence of  $v_m$ ) in the same way

from  $L_0$ , as  $\lambda$ , so that  $Z = \frac{L}{\lambda} = \frac{L_0 \cdot \sqrt{1 - v_m^2 \cdot c^{-2}}}{\lambda_0 \cdot \sqrt{1 - v_m^2 \cdot c^{-2}}} = Z_0$ . And, actually, this coincides exactly with SR.

Thus, the observations of different observers coincide.

However, the question we are interested in is: What happens if the velocities of the two masses change? My first idea was that the velocities of the two masses change in dependence of each other, in such a way, that the distance between the two masses changes according to SR (this is  $L = L_0 \cdot \sqrt{1 - v_m^2 \cdot c^{-2}}$ ). In that case there should also be - according to SR - a time difference between the two masses. Motion-processes which provide such results are actually conceivable. But here, the course of time of these motion-processes change in dependence of the distance between the two masses (this, of course, is also valid for more than two masses). At the same time, however, any interaction is missing, which would justify such motion-processes - at least I could find none. My conclusion from all this is that every elementary mass can independently of other masses change its velocity only for itself. Dependences between the velocity-changes of elementary masses result only due to the forces, with which elementary masses interact (e.g. the electric, or electromagnetic forces). We don't get motion-processes at the velocity-changes of elementary masses that depend on relativistic changes of space-time.

But, of course, for different observers (who move with different velocities) the motion-processes will appear to be different.

Let us consider the example of the two masses once again. Both masses can change their velocities independently of each other. Therefore, from the point of view of a certain observer, they can also change their velocities at the same time and by the same amount. In that case, the distance between these two masses *doesn't* change for this certain observer. But, from the point of view of the masses, the distance between them

will get *bigger*, since more waves are between them now, while the wavelength  $\lambda$  *hasn't* changed from their point of view.

At real, macroscopic objects, which consist of many elementary masses, the elementary masses are connected to each other with forces. Usually, these forces preserve the form of such objects (unless that other forces prevent this). After an acceleration process, during which elastic deformations can appear, an object takes its original form again (as far as possible). This means that the distances between the elementary masses *haven't* changed from the point of view of the object. But from the point of view of an observer, relative to whom the object was accelerated, the distances have changed in motion-direction according to SR. Short and good: at first, every elementary mass changes its velocity independently of all other elementary masses, in which the  $\lambda$  of the wave of the superposition changes in accordance with SR. Then, at macroscopic objects, merely the forces between the elementary masses have to be taken into account.

I have already thought about the relativistic changes of space-time in the past. There, too, the changes of the length were in the foreground. Finally, I developed a concept, which is just as basic as daring, and which I call "Theory of Objects of Space" [37]. I explain there, quite generally, the emergence of the field like interaction, without referring to special fields. The "objects of space" are nothing else but time-dependent, three-dimensional space, but they can interact in astonishing ways. By their interactions they form matter and its interactions (fields). In a certain degree, this work here, on magnetism and gravitation, specifies the "Theory of Objects of Space". But, though, in this work here I regard the electric force as given, while I can provide at least a general explanation on the emergence of the electric force in the "Theory of Objects of Space". If somebody should decide to want to read the "Theory of Objects of Space" now, then he may be warned: it quite certainly isn't as he imagines this here now perhaps.

### 3.11 Magnetism

I have described in part 1 of this work that the magnetic force results from the angle  $\varphi$  which results between the direction in which the electric field propagates and the direction in which its force actually acts, when the electric charge is in motion.

So, how does the magnetic force appear if the electric charge is understood as a space-time wave?

Well, I won't be into detail here but it is clear of the principle: The space-time wave of the charge is a change of the density of space, spreading with the speed of light. If the charge moves, then the frequency of the space-time wave changes in the direction of the motion. Perpendicular to the direction of the motion the frequency doesn't change, but the direction changes in which the density of space changes due to the space-time wave.

Said differently: the change of the density of space of the space-time wave gets the angle  $\varphi$ , when the charge moves. If I can assume that the force of the electric field results from the changes of the density of space, then, due to the angle  $\varphi$  of the changes of the density, the direction of the electric force will also change by the angle  $\varphi$ . Exactly as defined in part 1.

### 3.12 Electromagnetic waves (EMW)

EMW [17-20] have particle character since they transfer their energy only in quanta. The energy of these quanta corresponds to a mass. In addition, EMW are influenced by gravitational fields. So it is sense-full to consider the EMW in the context of this work here.

EMW are created when electric charges oscillate. Due to this oscillation a wave is created which spreads, or propagates with the speed of light. Of course, the electric fields of the electric charges, whose oscillations cause the EMW, oscillate with their own mass-frequencies, the  $f_m$ 's. The EMW superimposes this  $f_m$ 's of the electric fields. In a way the EMW is an envelop wave. In this sense, the EMW resembles the beat-wave of a moving electric charge.

The waves of the electric fields (with  $f_m$ ) are longitudinal waves. This means that the EMW consist of longitudinal waves. But, the overall effect of the electric fields, an EMW consists of, is transversal.

The energy of the EMW corresponds to a mass. In an analogous way the frequency of the EMW also corresponds to a mass-frequency (therefore to a  $f_m$ ). So, if an EMW interacts with a mass ( $m$ ), then this is for the mass as if it would interact with a mass, which has the frequency of the EMW. The EMW interacts, in



principle, with the mass as if the EMW were also a mass with the mass-frequency of the EMW, and which moves with the speed of light. Therefore, at an EMW it is as if a rest mass ( $m_0$ ) would move with the speed of light. (Therefore, for the kinetic energy of a *quantum* of an EMW, that acts, it is valid:  $m_0 \cdot c^2 = h \cdot f$ . The factor  $\frac{1}{2}$  is missing, since, at an EMW, there wasn't any acceleration for gaining the speed of light.) This idea seems plausible if we consider that masses are also only oscillations.

We know that the EMW transfers its energy in quanta. The magnitude of these quanta results from the frequency of the EMW (which corresponds to a mass-frequency) and the speed of light. But, the wave isn't subdivided in quanta. The quantization arises only in the interaction of the wave with a mass. This idea, that the wave isn't quantized but that it transfers its energy in quanta, seems primarily plausible at long-wave EMW, such as the radio waves. A radio wave is actually a pure, not quantized, uniform wave, but which transfers its energy in quanta. At this, for the magnitude of the quanta, it doesn't matter to whom the EMW transfers its energy. The magnitude of the quanta always corresponds to the mass to which the (frequency of the) wave corresponds, and to the speed of light.

But, nevertheless, there is a special aspect regarding the quantization of the energy transfer of the EMW, which primarily manifests itself at short-wave EMW, such as the visible light. It seems as if EMW were spatially limited, and this spatial limitation seems to remain unchanged at very far distances. How else could we explain that, e.g., lasers can produce single photons, therefore that they can produce EMW which have exactly the energy of one quantum? Or, how else could we explain that single light quanta from suns, that are billions of light years away, can reach us?

A simple explanation for all this could be that space always absorbs (can contain) only a certain energy-quantity, which depends on the frequency.

At the creation of an EMW the energy then can always be transferred to space only in such a way, that it always contains the right energy-quantity. In this way also the so-called photons then arise: The energy, which, e.g., an atom emits if an electron drops to a lower energy level, suffices only for one quantum of the corresponding frequency, and the space, into which this energy is stored, is exactly determined, therefore limited.

Of course, masses aren't limited spatially. This was described well enough in the previous chapters. Masses have a centre, from which the amplitude decreases with  $r^{-2}$ , and the volume of the zero-area  $V_N$  is in the centre. Photons and quite generally EMW probably don't have any centre. I rather assume that their entire space consists of many, many zero-areas ( $V_N$ 's), which all move together with the speed of light. At a mass, the zero-area cannot be accelerated to the speed of light, since the carrier frequency would become infinite, and an infinite amount of energy would be required. While at the EMW the zero-areas already move with the speed of light at their creation. And the magnitudes of thier zero-areas depend on the frequencies of the EMW. Exactly as in the case of the masses.

So, that's, for now, all about the creation and the energy of an EMW.

Much more interesting is, here, the behaviour of an EMW in the gravitational field.

We can, in principle, say that EMW fall, within a gravitational field, in a Newtonian way, exactly as other masses; but, at falling, the energy of an EMW doesn't change by a change of its velocity, but by a change of its mass. It is as if, at falling, a part of its mass would be converted into energy to compensate the change of the velocity.

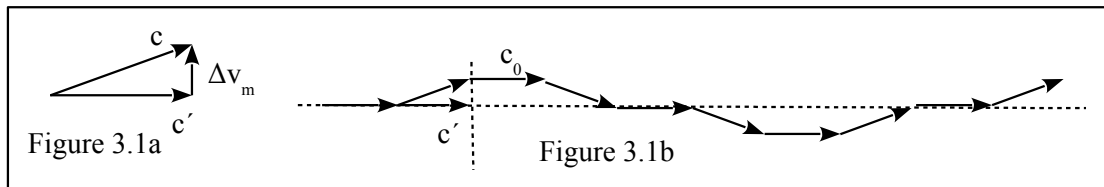
The mass of an EMW corresponds to its frequency. This means that the frequency of an EMW changes, when it is falling. I have described gravitation as an electric effect in this work here. If EMW also fall within the gravitational field, then this fall must be based on the same electric effect, too. This means that EMW have to be equivalent to electric charges, whose masses determine the magnitude of the  $\Delta v_m$ 's. And the masses of the EMW are moved by the  $\Delta v_m$ 's, just as the masses of the electric charges. But, though, the EMW are electrically neutral. As, e.g., also the neutrons are. There were two possibilities at the neutrons: On the one hand, neutrons can consist of two equally grate electric charges, which are connected, but which nevertheless experience gravitation each for itself, or, on the other hand, neutrons can be constructions which are able to alternately have the qualities of positive and negative electric charges, in the course of time. The same applies to the interactions of the EMW in principle. We can recognize that EMW actually unite electrically positive and electrically negative qualities, if, e.g., we sent photons through a magnetic field. It then can happen that a photon is changed into a virtual electron-positron couple. Corresponding experiments are known [21, 22].

Of course, the magnitudes of the  $\Delta v_m$ 's of the zero-areas of an EMW corresponds to the frequency of this EMW.

So, if, now, an EMW moves horizontally - therefore vertically to the gravitational field - then positive and negative  $\Delta v_m$ 's act alternating on this EMW in a vertical direction, therefore perpendicular to the EMW. Since the EMW shall maintain the speed of light,  $\Delta v_m$  changes the direction of the EMW (see Figure 3.1a). The velocity of the EMW in a horizontal direction is then only  $c' = \sqrt{c_0^2 - \Delta v_m^2}$  (where  $c_0$  is the speed of light in the vacuum far away from any mass).

Thus, the EMW doesn't move on a straight line any more. Its motion rather deviates alternately up and below from the straight line. The average velocity ( $c'_{average}$ ) in a horizontal direction, as Figure 3.1b shows clearly,

$$\text{is } c'_{average} = \frac{c' + c_0}{2}.$$



So, an EMW, which moves horizontally within a gravitational field, is slower. The magnitude of the deviation depends on its frequency, because from the frequency the magnitude of the mass results, to which the EMW is equivalent. And the bigger the mass is, all the bigger  $\Delta v_m$  is, too. Thus, blue light is slower than red light.

An EMW falls - I had stated - within a gravitational field in a Newtonian way. At this, the EMW intakes energy on its way downwards or it loses energy on its way upwards. But, here, it is the frequency of the EMW that changes and not its velocity. Thus, the nearer the EMW is to the centre of the gravitational field all the grater the frequency is, too. But, the grater the frequency of the EMW is, all the greater the mass is, to which the EMW corresponds, and therefore all the grater  $\Delta v_m$  is, too. And the greater  $\Delta v_m$  is, all the the slower the EMW is in a horizontal direction.

Said briefly: the more an EMW approaches the centre of the gravitational field, all the slower it is.

What is it like, if the EMW moves vertically - therefore parallel to the gravitational field?

In a vertical direction, the frequency of the EMW changes according to its change of energy, which results from the Newtonian fall. However, the question is: In which way could the frequency of a wave change?

Well, in the end, the wave must be stretched or compressed, so that the distances, e.g., between the wave maxima change. How can this take place? Well, that is easy: The velocity of the wave has to be smaller at the bottom than at the top. In that case, the wave automatically contracts on its way downwards and stretches on its way upwards.

Short and good: here, too, the speed of light is as smaller as nearer the wave is to the centre of the gravitational field.

An EMW is deflected by a sufficiently grate mass due to gravity. On the one hand, this happens by an EMW falling in a Newtonian way, and, on the other hand, due to the slow-down of the speed of light. The correction of the deflection which results due to the slow-down of the speed of light compared with the pure Newtonian fall is decisively important, here. Because it is exactly this correction that Einstein had carried out within his GR of 1916.

My aim is, to show that gravitation can be described as an electric effect, and that this description is equal to GR, that, therefore, it coincides with GR. And I believe that I have succeeded, here again, in confirming a forecast of GR in a plausible way: the slow-down of the speed of light due to which the correct deflection of the EMW by (great) masses can be calculated.

Einstein had observed that the slow-down of the speed of light is only globally and not locally valid. He came to this conclusion by also applying the length-contraction (1916) to the gravitational field besides the time-dilatation (as he did in 1911).

Whether or not and in which way the relativistic time-dilatation and length-contraction are to be taken into account at my derivation of the slow-down of the speed of light I cannot say here yet. For that reason, the corresponding calculations are still missing.

If, nevertheless, somebody wanted already to carry out any calculations, I want to mention here an important

point: The mass of the quantum of an EMW will also always interact only with the mass of an electric charge, that is, e.g., with the mass of an electron or with that of a proton (it has already been said enough about the neutron). For the calculation of the change of the frequency of the EMW on its way through a gravitational field the mass, which produces the gravitational field, can be taken as a whole. In this way, one could try to calculate the Shapiro delay (I haven't finished that yet).

It also is assumed that strong magnetic fields can influence the speed of light. Perhaps, the reason for that is the angle  $\varphi$  of  $\Delta v_m$ . I can't tell more here yet, but I have read about interesting experiments in this context [23].

### 3.13 The electric force as quantum-mechanical effect / The entanglement

It was *not* the aim of this work to find an explanation about the origin of the electric force. The electric force simply is regarded as given.

Nevertheless, it is very enticing to want to explain the electric force quantum-mechanically, because it seems obvious: the duality, which results from the existence of the field and the anti-field, seems to be mirrored in the duality of the electric charge (positive and negative).

So, let us assume that a charge (a receiver) is accelerated by a field, or anti-field. Due to the acceleration the frequencies of the field and the anti-field of this receiver change, so that beat arises. We *always* get repulsion if the frequency of the *field* of the receiver which is on the side of the source gets smaller, and the frequency of the *anti-field* (on the same side) gets larger. Conversely, if (on the same side) it is the other way around (the field gets larger and the anti-field gets smaller), we *always* get attraction.

So the question is: how do the field and the anti-field of the source influence the frequencies of the field and the anti-field of the receiver so that either repulsion or attraction arises?

Or said differently: The frequencies of the field and the anti-field of the receiver change exactly oppositely at opposite charges of the source. How does that happen?

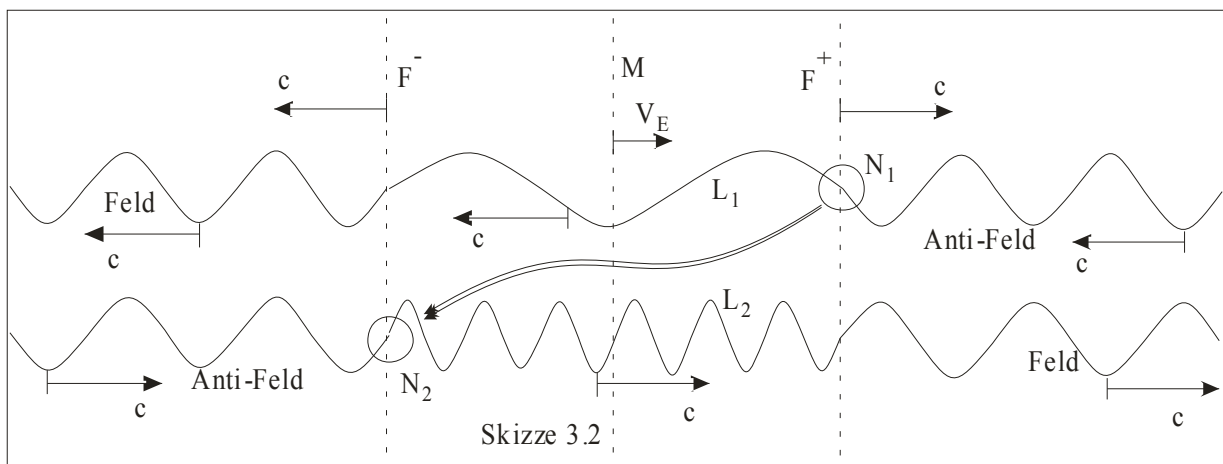
The simplest statement, which I can make here, is that frequency is transferred between the field and the anti-field of the receiver due to the effect of the field and the anti-field of the source.

The idea is here, that the velocity  $v_R$  of the receiver is *not* considered as the *cause* of the changes of the frequencies of the field and the anti-field of the receiver but that the changes of the frequencies of the receiver are caused by the field and the anti-field of the source, what then corresponds to the  $v_R$  of the receiver. So, the velocity of a charge *is* the frequency-shift between its field and its anti-field.

So we see that the frequencies of the field and the anti-field of the receiver change oppositely.

I had already described that we can imagine that the anti-field on the one side of the centre becomes the field on the other side, even if it is hard to imagine this three-dimensionally. And, of course, the amplitude increases towards the centre, since space is somehow compressed towards the centre.

We now want to find out, how the changes of the frequencies of the field and the anti-field, which result due to  $v_R$ , spread. The changes of the frequencies arise in the centre and spread from there with the speed of light. But, of course, the field and the anti-field also propagate with the speed of light. The anti-field always moves towards the centre. The change of the frequency spreads (moves away) from the centre with the speed of light. So we can say that the changes of the frequencies always take place *only* at the anti-field. I represent



that at Figure 3.2 symbolically, so that we can recognize well, how it is meant (in which I *don't* represent the change of the amplitude with  $r^{-2}$ , to not overload the Figure).

The line M at Figure 3.2 represents the centre of the charge, or mass. At the left and at the right of M are the field and the anti-field. The lines  $F^+$  and  $F^-$  show, how far the changes of the frequencies have already spread. And  $v_R$  is the velocity of the charge.

At the locations  $N_1$  and  $N_2$ , the changes of the frequencies take place, which means, that the new waves are made at  $N_1$  and  $N_2$ .

We know that the wavelengths of the field and the anti-field change symmetrically. So, if the wavelength of the wave  $L_1$  increases at  $N_1$ , then the wavelength of the wave  $L_2$  decreases at  $N_2$  by the same amount. So we can assume that an exchange takes place between  $N_1$  and  $N_2$ . With other words:  $N_1$  and  $N_2$  are *entangled* (with each other)! Of course, this statement is a little venturing. But if the entanglement of photons [24, 25] actually exists, I then think that the entanglement of  $N_1$  and  $N_2$  could represent the basis for the entanglement of photons. Photons always arise, when the velocities of charges change. From this, the entangled changes of the frequencies result. Under suitable circumstances, these entangled changes of the frequencies are mirrored in the photons - particularly since photons arise from the fields and anti-fields of electric charges.

The question is now: What exactly is exchanged between  $N_1$  and  $N_2$ ? Is energy also exchanged? But the most important question still is: from what does either repulsion or attraction arises?

Let us assume that the source, whose field and anti-field change the velocity of the receiver, is on the left side in Figure 3.2. Then, the *field* of the source will change the wave  $L_1$  of the receiver at  $N_1$ , and the *anti-field* of the source changes  $L_2$  at  $N_2$ . In this case (of Figure 3.2), the wavelength of  $L_1$  will increase and the one of  $L_2$  decreases, which means that we have repulsion.

If, now, the sign of the charge of the source is converted, then repulsion turns into attraction, which means that the wavelength of  $L_1$  decreases and the one of  $L_2$  increases. Thus, the qualities of the field and the anti-field of the source were swapped. If the sign of the charge of the receiver is converted, then the same happens: the qualities of the field and of the anti-field of the receiver are swapped.

Here, a simple conclusion arises: Positive and negative electric charges differ by the fact that the qualities of the field and the anti field at positive and negative charges are exactly swapped. This also is then the only difference between particles and anti-particles: the qualities of the field and of the anti-field are swapped. Here, we shall not forget: it is always only the anti-field of the receiver which changes at  $N_1$  and  $N_2$ . So, the field and the anti-field of the source will always change *only* the anti-field of the receiver. In this way, the described duality results.

But which quality that is, that causes in the one case a stretching and in the other case a compression of the wavelength, I don't know yet.

Since mass is proportional to frequency, and since mass is equal to energy, we can assume that the changes of the frequencies of the field and the anti-field of the receiver correspond to a change of the energy. This means that energy is exchanged between  $N_1$  and  $N_2$  (in Figure 3.2 the energy flows from  $N_1$  to  $N_2$ ). We can say that, in the case of repulsion (at the interaction between same charges), the energy always flows from the field of the source to the anti-field of the source, and vice versa at attraction (at the interaction between opposite charges). I would like to mention here that the energy increases with an increasing  $v_R$ , since the mass of the receiver increases with an increasing  $v_R$  - as I have already explained well enough.

Now, it is known that no energy transfer takes place at entangled photons. Instead, e.g., the polarizations of the entangled photons correlate. This can be explained by the fact that the photons arise perpendicular to the direction in which the the electric charges, which produce the photons, oscillate, and the frequencies of the field and of the anti-field *don't* change perpendicular to the direction in which the charges move - instead, the angle  $\varphi$  results between the direction in which the field (or anti-field) propagates, and the direction in which the force of the field (or anti-field) acts.

It isn't clear yet, if energy is actually exchanged between  $N_1$  and  $N_2$ . The exchange of energy could take place also between the anti-field of the receiver and the field, or anti-field of the source, although this would mean that the velocity-change of the receiver would change the field and the anti-field of the source, which would be also problematic. But even if energy is exchanged between  $N_1$  and  $N_2$ , it is not clear, in which extend this exchange of energy can be influenced.

Unfortunately, I cannot answer the most important question of this chapter yet: How does either repulsion

or attraction arises? I think, that I still lack an important piece of the jigsaw puzzle to answer this question.

### 3.14 Experiments

Of course, I have tried to find really feasible laboratory experiments which would support the ideas introduced here. This should best be experiments which weren't carried out yet and which are based on the ideas introduced here.

And, of course, I always try to find experiments which may have practical use soon.

The most important insight which I have introduced here is that gravitation is an electric effect. So, the question is: Can gravitation be produced or influenced electrically?

Actually, I have carried out experiments of this type already earlier, but I couldn't achieve any satisfying results. There always simply are too many influences and disturbances, particularly since the results to be expected are anyway usually very, very small.

I assume good chances for some experimental proofs in the magnetic gravitation, therefore in the magnetic part of gravitation which is perpendicular to the electric part of gravitation. (The electric part of gravitation is usually the "normal" gravitation.)

Here, rotating disks or circular plates are very popular. They can have grate masses and grate speeds under controlled conditions in the laboratory.

Very strong magnetic fields can perhaps also provide some possibilities [26-31].

Grate currents of electrons doesn't move much mass since the electrons are very light. To have grate currents *and* much mass moving, one could use very fast rotating disks which are strongly positively charged.

The problems are obvious: it seems as if there are almost innumerable phenomena of all sorts that all want to be taken into account. And, if we have a result, we can never be sure... that it is really the magnetic part of gravitation.

Unfortunately, I cannot make concrete proposals for experiments here yet. There still are too many open questions. But I have read about rotating, frozen, perhaps superconductive plates again and again. Perhaps there already are results which could match?

Quite some time ago, I have read about an experiment in Austria [33-36], in which a connection between magnetism and gravitation was assumed, but, though, I don't have knowledge of the details of this experiment. However, I read about connections between magnetism and gravitation again and again. Perhaps, based on this work here, the search can be done more concrete in the future?

### 3.15 Summary of part 3

In this part 3 I have described the mass as a wave. By the concept of the anti-field beat results. This beat corresponds to the matter waves. Furthermore the relativistic change of a mass results due to the anti-field. These are very convincing arguments which speak for the existence of the anti-field. The velocity-dependence of the electric force can be explained by the way in which the energy-transfer takes place. And the quantization of the energy-transfer of the electric field (that is the magnitude of  $\Delta v_m$ ) can be derived in a very good way through the volume of the zero-area.

Short and good: all three postulates could be represented quantum-mechanically.

### General closing remark

I could show - very convincingly, as I hope - that magnetism and gravitation aren't forces of their own (therefore that they don't have fields of their own) but that they are electric effects which result due to the qualities of the electric field.

The magnetic force results from the angle  $\varphi$  between the direction, in which the electric field propagates, and the direction, in which the electric force actually acts. Gravitation results by the fact that the field and the anti-field of an electric charge doesn't act simultaneous but after each other. Since gravitation is an electric effect, it has not only an electric but also a magnetic component. But, the magnetic components of gravitation cancel each other out mutually at electrically neutral matter - nevertheless, I have great hope that the magnetic component of gravitation can be proven experimentally.

At the quantum-mechanical considerations, the mass is defined as a wave - and to be more precise, as a wave of the electric field. The magnitude of the mass determines the frequency with which the electric field oscil-

lates. Since not only the field but, of course, also the anti-field oscillates, beat arises here. The wavelength of this beat is exactly the same as the wavelength which is found for matter waves. This represents a grate confirmation for the existence of the anti-field.

The definition of mass as a wave in combination with the three postulates for the qualities of the electric field permits deep insights into the connections between magnetism, gravitation and the electric force, or the electric field. There are still quite some open questions here, but I believe that the answers to this questions will be certainly interesting, and I am sure that some very interesting experiments will arise, too.

I haven't worked out a proper mathematical representation in this work here yet. This still must follow. My intention in this work was primarily to find out the physical connections, and to present them understandably and plausible.

I believe that I have well succeeded in fulfilling this intention. I hope very much that the physical meaning of this work will not be ignored, only because the mathematical representation does not comply with the common standards yet.

After all, I have managed to answer important questions physically correctly and a new, a little curious field has entered the stage of physics: the anti-field.

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