The Gravitation As An Electric Effect

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Abstract: The electric forces are immensely great in comparison with the gravitational forces. There have already been many attempts to explain the gravitation by the immense electric forces. Thanks to the quantization of the electrical energy I have succeeded in it here now. And this in conformity with general relativity.
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Preface
The electric forces [1-3] are immensely great in comparison with the gravitational forces. There have already been many attempts to explain the gravitation by the immense electric forces. Thanks to the quantization of the electrical energy I have succeeded in it here now. And this in conformity with general relativity [4-6].
In the first part (of this work) I show that the gravitation is an electric effect. Thereby I describe the quanta of the electrical energy. In the second part I try to describe in which way the quanta of the electrical energy are created.

Part 1 The gravitation as an electric effect

1. 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 grater 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:

$$\frac{\frac{q_{p+}q_{e-}}{4\pi\varepsilon_0 r^2}}{\frac{m_p m_e G}{r^2}} = \frac{q_{p+}q_{e-}}{4\pi\varepsilon_0 m_p m_e G} = \frac{1.6\cdot 10^{-19}\cdot 1.6\cdot 10^{-19}}{4\cdot 3.14\cdot 8.8\cdot 10^{-12}\cdot 9.1\cdot 10^{-31}\cdot 1.6\cdot 10^{-27}\cdot 6.6\cdot 10^{-11}} \approx 2.41\cdot 10^{39},$$

where q_{p+}, q_{e-}, m_p, m_e are the charges and masses of the electron and the proton, ε_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 $\approx 6 \cdot 10^{24} kg$ exerts a force of 10N on a test mass of 1 kg, which is on her surface, therefore in the distance of $\approx 6.3 \cdot 10^{6} m$ 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: $\frac{q_1 q_2}{4\pi\varepsilon_0 r^2} = 10N$. If, to begin with, we assume that the two charges are equally grate ($q_1 = q_2 = q$), we get: $q \approx \sqrt{10 \cdot 4\pi\varepsilon_0 \left(6 \cdot 10^6\right)^2} C \approx 200C$ (C = Coulomb).
And, how many unit charges does one need for such a charge quantity? Well, this is also easy: The unit charge is $\approx 1.6 \cdot 10^{-19} C$, 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 $\approx 2 \cdot 1.6 \cdot 10^{-27} kg$.
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: $\frac{1.25}{2} \cdot 10^{21} \cdot 2 \cdot 1.6 \cdot 10^{-27} \approx 2 \cdot 10^{-6} kg$. So, a mass of $\approx 2 \cdot 10^{-6} kg = 2mg$ 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 $\approx 2mg$ in a distance of $\approx 6.3 \cdot 10^{6} m = 6300 km$ 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 $\approx 2mg$ 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 $\approx 500t$ (t = metric ton). For the force of 10N one then needs a charge quantity which is in a mass of only $\approx 8.35 \cdot 10^{-19} kg = 0.000835\, pg$. In this, the ratio of the quantities is preserved: the $\approx 500t$ correspond to the mass of the earth and the $\approx 8.35 \cdot 10^{-19} kg$ correspond to the 1kg test mass. Said casually: we could replace the whole earth by a rock ball of only $\approx 18m$ 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 $\approx 4m$. 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. Quanta

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 the 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. 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) [7]. 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.
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.

3. 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 one would have as a result an attraction, which could correspond to the gravitation.
But what can weaken the repulsion and strengthen the attraction? This also is simple: at the repulsion the charge, on which the field has an effect, moves in the same direction as the field (the field, of course, moves or propagates with the speed of light). Thus, the charge moves away from the field. This motion away from the field weakens the effect of the field. For the attraction it is exactly the other way round: the charge moves due to the force of the field in the opposite direction to the field, so it moves towards the field, which strengthens the effect of the field.
This is essentially the basic idea, and it works! This, of course, doesn't suffice yet, though. I will show in the following how the basic idea can be carried out and I will settle the open questions.

4. Relative velocity

The basic idea says in principle that the effect of the electric field depends on the velocity with which the charge, on which the field has an effect, moves (related to a fixed frame of reference, e.g. the laboratory).
This means that the force on a *motionless* charge is the normal electric force, given by Coulombs law. And this means that the normal electric force can be equated with the velocity of the electric field, which is the speed of light $\vec{c}$. As said already, according to Coulomb's law the electric force is:

$$F_E = \frac{q_1 q_2}{4\pi\varepsilon_0 r^2} .$$

The force shall now dependent on the velocity with which the charge, on which the field has an effect, moves. So, for a motionless charge we can write: $\vec{F}_E = \frac{q_1 q_2}{4\pi\varepsilon_0 r^2} \cdot \frac{1}{c}\vec{c} \quad \Rightarrow \quad \vec{F}_E = F_C \cdot \vec{c}$, where

$$F_C = \frac{q_1 q_2}{4\pi\varepsilon_0 r^2} \cdot \frac{1}{c} .$$

If the charge (on which the field has an effect) moves with the velocity $\vec{v}$, then the electric force (F_E) changes by the corresponding amount. However, for the considerations which are made here, though, only the component of $\vec{v}$ which is parallel to $\vec{c}$ is relevant, this is $\vec{v}_{//}$. Therefore we have:
$\vec{F}_E = F_C \cdot (\vec{c} - \vec{v}_{//})$. It is necessary to use $-\vec{v}_{//}$ (instead of $+\vec{v}_{//}$) since the force increases when the charge moves towards the field.
I strongly recommend my work on magnetism [8] here. There I have introduced this principle for the first time, therefore there I describe it in greater detail.

But, of course, it is clear that the electric force can *not* dependent on the velocity ($\vec{v}$) of a charge (magnetic forces are a completely different topic).
The problem can be solved easily if one assumes that there is an anti-field.

5. The anti-field

What is the anti-field? The anti-field is a field which always arises when a field has an effect on an object. Normally this is if an electric field has an effect on a charge. One can understand the anti-field as a kind of reflection. The anti-field acts in the same direction as the field and it has the same strength as the field. The important difference is that it moves exactly in the opposite direction to the field. Since the anti-field has exactly the same effect as the field, this means that the overall-effect arises exactly half from the field and half from the anti-field (for a motionless charge). This also means that the energy or the momentum, which is transferred, comes half from the field and half from the anti-field.

So the force of the field on a motionless charge is $\vec{F}_E = \frac{1}{2} F_C \cdot \vec{c}$. The anti-field moves (propagates) in the opposite direction ($\vec{c}\,' = -\vec{c}$) but at the same time it acts in the same direction as the field. Thus the force of the anti-field on a motionless charge is: $\vec{F}_E' = \frac{1}{2}(-F_C) \cdot (-\vec{c}) = \frac{1}{2} F_C \cdot \vec{c}$, so that the sum of $\vec{F}_E$ and $\vec{F}_E'$ is: $F_C \cdot \vec{c}$.

In which extend the anti-field can actually be regarded as a reflection, isn't clear yet. The relations could be quite complicated and must be treated in another place. In a first-order approximation the anti-field can certainly be used as it is described above. By doing so, the relations work out well in very good conformity. I have already very successfully applied the concept of the anti-field to the magnetism in an earlier work [8].
The relations between the anti-field and the anti-particle or anti-matter [9] aren't clear either.

The important meaning of the anti-field is: the effect of a constant velocity-component ($v_{//}$) of a charge parallel to the field (which acts on the charge) cancels out, therefore it is zero. The reason for that is clear: since the anti-field moves with the speed of light ($\vec{c}\,'$) exactly in the opposite direction to the field ($\vec{c}\,' = -\vec{c}$), a $v_{//}$ of a charge will change the effect of the anti-field in exactly the opposite way to the field. So if e.g. the effect of the field increases by $v_{//}$, then the effect of the anti-field will decrease in the same amount. The force of the field on the charge is $\vec{F}_E = \frac{1}{2} F_C \cdot (\vec{c} - \vec{v}_{//})$, and the force of the anti-field on the charge is $\vec{F}_E' = -\frac{1}{2} F_C \cdot ((-\vec{c}) - \vec{v}_{//}) = +\frac{1}{2} F_C \cdot (\vec{c} + \vec{v}_{//})$. So the overall-effect is: $\frac{1}{2} F_C \cdot (\vec{c} - \vec{v}_{//}) + \frac{1}{2} F_C \cdot (\vec{c} + \vec{v}_{//}) = F_C \cdot \vec{c}$; this is exactly the overall-effect of the field and the anti-field on a motionless charge.
To relief the notation I set the sum of the forces from the field and the anti-field to be $2 \cdot F_C \cdot \vec{c}$. In this way I do not need to always write $\frac{1}{2}$, regarding the field and the anti-field. This doesn't effect the meaning of the relations.

6. Momentum and energy transfer by quanta

So, the anti-field cancels the effect of a velocity $v_{//}$ of a charge. On the other hand, however, according to the basic idea, exact such velocities ($v_{//}$) of the charges shall strengthen the attraction and weaken the repulsion so that the gravitation occurs. I will explain in the following, how this comes out.
We have seen that the every day masses surrounding us contain very, very much 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 charge (whose effects cancel out, of course). At the same time I have stated that the electric fields act only quantized, thus they transfer energy and momentum 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 a momentum ΔP to the charge which causes a velocity-change Δv. The momenta 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 Δv caused by ΔP exists. The Δv´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.

7. Arbitrarily many ΔP´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 grate. The number of the quanta which have an effect on a charge which is on the earth's surface is appropriately gigantically grate. But still, always only *one* quantum acts at the time. The number of the quanta which can act per time-unit is arbitrarily grate. Thus the *period* (or time-*interval*) of effectiveness of a quantum can be arbitrarily small. It is only important that the quantum transfers its momentum, and for this a time-*period* going against zero (but which never becomes zero!) suffices. The sum of the quanta per time-unit finally yields the acceleration.
So the Δv produced by ΔP exists for a time-period Δt. Actually, the magnitude of Δt 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 Δv at the time.

8. Field and anti-field with Δv

So, a quantum transfers a ΔP which produces a Δv.
In which way the Δv is created, if, e.g., there is an acceleration process, I cannot say yet. I assume, for the simplicity, that the Δv arises spontaneously as soon as a quantum has had an effect on a charge (in part 2 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 an apostrophe (´). So every quantum produces a Δv and every anti-quantum a $\Delta v'$.
The Δv 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. At the Δv or $\Delta v'$ produced by the quanta or anti-quanta it isn't necessary to mention the parallel component extra since the Δv or $\Delta v'$ is always parallel to the velocity of the field or anti-field anyway.
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 $v_{//}$ of a charge doesn't has any effect because the effects which $v_{//}$ 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 $v_{//}$ is equally for both the field and the anti-field. But, the quantum produces a Δv and this Δv 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 Δv and $\Delta v + \Delta v' = 2 \cdot \Delta v$.
Due to the effects of Δv 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.

9. Gravitation by Δv

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 charge (on which the field has an effect).
For a motionless charge, it is $\vec{v}_r = \vec{c}$, therefore $\vec{F}_E = F_C \cdot \vec{c}$.
Due to the effect of a quantum a Δv 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: $F_C \cdot (c \mp (\Delta v + \Delta v')) = F_C \cdot (c \mp 2\Delta v)$. 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 Δv of the quantum then the effect of the anti-field is weakened by $\Delta v + \Delta v' = 2\Delta v$ (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 $\Delta v = \Delta v' = 0$).
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 and repulsive.
We actually know that the electric attraction and repulsion cancel out at electrically neutral objects. What is with the $\pm \Delta v$? If the $\pm \Delta v$ shall correspond to the 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 Δv which points in the same direction as the c of the field. This corresponds to a weakening of the effect (the Δv moves away from the field). Then the anti-quantum acts, it produces a $\Delta v' = \Delta v$ which is added to the Δv of the quantum ($\Delta v' + \Delta v = 2\Delta v$). 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 Δv).
But the 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 Δv (per quantum-couple).
For the attraction (e.g. between an electron and a proton) it is analogous: at attraction, the Δv points in the opposite direction to the c of the field and in the same direction to the c' of the anti-field. If the quantum acts first and the anti-quantum second then a strengthening arises by Δv and a weakening by

$2\Delta v$. Since the attraction is strengthened by the gravitation, the anti-quantum must act fist and the quantum second here, too. Then, a strengthening of the attraction arises per quantum-couple by Δv. So we recognize: to get gravitation the anti-quantum is fist 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 Δv 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: $F_C \cdot \Delta v = F_G \quad \Rightarrow \quad \Delta v = \frac{F_G}{F_E}$

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, ε_0 = electric permittivity of free space and c = speed of light.
For two protons we get a Δv_{PP}:

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

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 $\Delta v \approx 2.2\cdot 10^{-28} ms^{-1}$. 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) a momentum ΔP which corresponds to a velocity-change Δv. From the time (Δt) per Δv, the acceleration ($a = \Delta v \cdot \Delta t^{-1}$) results, which arises due to the electric force. Due to the Δv the electric force changes by the amount of the gravitational force. The time Δt per Δv corresponds to the resultant force of the electric and the gravitational force. The Δv 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 Δv is, thus all the bigger the quanta are (they transfer more momentum and energy).
I label the Δv of the gravitation of the masses from now on always with Δv_m.

10. Many elementary particles act (also neutrons)

The magnitude of Δv_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 Δv_m at ordinary matter: $\Delta v_{mPP} \approx 2.2\cdot 10^{-28}$, $\Delta v_{mPe} \approx 1.2\cdot 10^{-31}$ 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 Δv_m´s have to be calculated correspondingly.
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 superpose). 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 one 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. There is the problem now to assign the right mass to the positive and negative elementary charge unit of the neutron respectively. From the correct assignment of the masses the corresponding Δv_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 Δv_m´s are calculated correctly.

Part 2 Explanation attempt for the creation of the electrical quanta

11. Explanation attempt for the Δv_m

So we have seen that the gravitation can be calculated by the Δv_m as an electric effect.
In principle, this could be it. We are ready and we could leave here.
But, though, there still is a point that astonishes me, but which is characteristic for the gravitation: the dependence of the Δv_m on the product of the masses (of the interacting charges), $\Delta v_m \propto m_1 \cdot m_2$.
The Δv_m is equally in magnitude for the two charges no matter how different their masses may be. How does this happens?
In addition: how does the mass of the charge, on which the field has an effect, know, how big the other mass (that is the mass of the field producing charge) is?
I will try to settle these questions in the following. But I can provide only a hypothetical approach, though. That works very well, is plausible and doesn't cause any contradictions. But, though, I cannot prove it yet.

The basic idea is, as always, very simple: The electric field must contain some information which tells about the mass of the field producing charge. This information shall be a frequency. The electric field shall vibrate or oscillate with a frequency which is proportional to the mass of the field producing charge. The vibrating field, for its part, excites the mass of the charge, on which the field has an effect, to vibrate or oscillate, too. The greater the mass is, which is excited to vibrate, the more energy is necessary. As soon as the mass, which is excited to vibrate, exceeds a certain point the energy stored in the oscillation until then is released and is conversed into a translatory movement, which is Δv_m. This means: the Δv_m is proportional to the two masses, as it shall be. That's the basic idea, but, of course, there is much more to be done. So, I will put this basic idea in concrete terms in the following.

We know that mass represents a form of energy, it is: $E = mc^2$. So, the mass of an elementary particle corresponds to an energy. This also applies particularly to charged particles.
In addition, we know that the energy of electromagnetic waves is quantized. It is: $E = h \cdot f$, where h = Planck constant, f = frequency of the wave. Electromagnetic waves are electromagnetic fields which vibrate in space and which propagate with the speed of light. In the end, we don't really know what electric and magnetic fields are. But as I have pointed in an earlier work [8], magnetic fields aren't fields of their own. The magnetic field is rather a changed electric field. This change arises if the electric charge, which produces the electric field, moves with a velocity (v). Than, an angle φ (which is proportional to v) is made between the propagation direction of the electric field and the effect-

direction (the direction of the force) of the electric field. That's how magnetism arises. The magnetic field is so to speak an angled electric field. Without going into further details, the important statement is here: the magnetic field isn't a field of its own but it is a changed electric field.
And what's about the gravitational field? Well, that is exactly what this work here is all about. I show, quite convincingly as I hope, that the gravitation is nothing else but an additional effect of the electric force. Thus there isn't a gravitational field of its own. Of course it very often makes sense to define a gravitational field. In the context of such a definition a gravitational field then exists. But one then knows, however, that this gravitational field is just a resultant field which arises from the electric fields. The same also applies to the curvature of spacetime of general relativity (GR): it is a resultant field (I will say more about that later).
But what is that what vibrates there?
Well, since there is nothing else besides, I think that it is the space itself that vibrates. This seems sensible since all these fields have, as said, the same origin. It is always only the space that vibrates. The time dependent three-dimensional space, of course.
Space isn't just as space. In special relativity (SR) [10] we learn that the length of a space depends on its speed. Time changes as well. GR defines curved spacetime and gravitational waves, which are waves in spacetime in the end, and which contain energy.
Electric fields, magnetic fields and gravitational fields are therefore nothing else but vibrating space. Electric fields are created by electric charges and these charges usually have inertial masses. But what is this inertial mass? We know that a mass corresponds to an energy. The same also applies to the photons of the electromagnetic waves, they represent an energy. And as we just noticed, the photons are vibrating space. I now do the next generalization step and put forward the hypothesis: Mass is vibrating space. The photons are the energy quanta of the electromagnetic waves. In an analogous way one can imagine the mass of an elementary particle as a motionless energy quantum. And just as to the photon a frequency can be assigned to the mass-energy quantum, too. It is:

$$mc^2 = hf_m \quad \Rightarrow \quad f_m = \frac{mc^2}{h}.$$

The f_m is the frequency of an energy quantum of the mass m.
How does this frequency (f_m) has to be understood? Well, one can imagine, as said, that, in the end, mass is nothing else but vibrating space. One can imagine (simplified) a sphere whose radius changes, thus the radius oscillates or vibrates. This sphere only consists of pure space. The radial vibration or oscillation means that the space of the sphere is compressed and stretched (it contracts and expands). The compression and stretching of space contains energy, as, e.g., we know from gravitational waves. Thus the conversion of energy into mass means nothing else than the conversion of energy into the radial vibration of a space area. And vice versa, the conversion of mass into energy means nothing else than the release of the vibrational energy of the space. Usually this results in the translatory movement (therefore in the velocity-change) of a mass, which usually is the same object but with less mass due to the mass loss.
The frequencies which arise here are very grate indeed. For a proton e.g. this is:

$$f_m \approx \frac{1.6 \cdot 10^{-27} \cdot \left(3 \cdot 10^8\right)^2}{6.6 \cdot 10^{-34}} s^{-1} \approx 2.2 \cdot 10^{23}\ s^{-1}.$$

This is due to the enormous energy amount mass contains.

To avoid any misunderstandings, I must say something about the quarks [11] here briefly.
Of course it is known that elementary particles consist of quarks. This is in no contradiction to mass being vibrating space. The vibrations of the space of a mass absolutely can contain sub-structures. These sub-structures can very well be quite complicated. In addition, there will be rules or laws which determine the type of the formation of the vibrational structures of the space of a mass. These sub-structures then would correspond to the quarks.
After all I would like to mention here that the quarks always occur only at the particle collisions. It isn't clear in which form the quarks exist before the collision. But, however, there must be clear laws according to which the quarks arise, of course. And these laws should actually be related also with the vibration behaviour of the space of a mass. In any way, there are no contradictions here.

Now, that this is clarified, I can go on.

The next assumption is that not only the mass vibrates with f_m but that the electric field of this mass also vibrates with the same frequency. Thus the first part of the basic idea is clarified: the information about the mass of the field producing charge is the frequency f_m.

The second part of the basic idea concerns the mass of the charge on which the field acts on. How does the vibration of the field creates the Δv_m of the mass of the charge on which the field acts on, and how does it happens that this Δv_m is proportional to the product of the two masses?

The frequency of the field (f_m) excites the space of the charge, on which it has an effect, to oscillate or vibrate. Due to this energy is transferred from the field into the charge or into the mass of the charge, that is the vibrating space of the charge. As soon as a certain point is exceeded, the energy stored until then in the charge is released again. The released energy produces a translatory movement, that is a Δv_m of the mass of the charge from which the energy was released. Said briefly: The vibration of the charge is conversed into the Δv_m of the charge.

The point which must be exceeded so that the vibrational energy is released could be, e.g., a resonance between the vibration of the mass of the charge and the field which excites the charge. This resonance, though, isn't the only possibility. There are more. Maybe the orbit quantization or the spin quantization of particles [12] provides some ideas.

The energy amount per time which is transferred from the field to the charge is of course nearly independent of the frequency f_m of the field since the acceleration depends essentially on the electric forces of the charges and not on their masses. At least this applies to motionless charges. I will describe later how it behaves if the charges move.

So, if, e.g., the frequency f_m of the field increases, then the energy amount transferred per time doesn't increase. But increasing f_m also means that the (field producing) mass of the charge increases, too. This means that Δv_m must also increase appropriately. But at a greater frequency there also is in principle more energy in the energy quanta. This means that more energy also must be transferred to the mass, which is excited by the field, until the point is reached at which the energy is released again (therefore until e.g. the resonance is reached).

In this sense, a ,e.g., doubling of the mass m_1 of the charge, which produces the field, (from m_1 to $2m_1$) also means a doubling of the frequency (f_{m1}) of the field (from f_{m1} to $2f_{m1}$). The doubling of f_{m1} means that the mass, on which the field has an effect, must absorb the double amount of energy before the resonance is reached, and this means that the double amount of energy is released, too, and that produces a double as big velocity (from Δv_m to $2\Delta v_m$); this corresponds exactly to the gravitation law.

Here now I have to say something about the time-interval which is needed for the formation of a quantum. As said already: The energy amount, which is transferred from the field to the charge per time-unit, is independent of the frequency f_m since the strength of the electric field is independent of f_m. But, the grater the frequency is, all the grater the energy amount of a quantum is, too. This means that, with a growing frequency, the time-interval which is needed for the formation of a quantum grows, too. This time-interval of the formation of a quantum may not be mistaken for the time-period (or periodic time or oscillatory period) of the frequency f_m, because the time-period of the frequency decreases with a growing frequency, of course.

There is another possibility for mistakes. On the one hand, there is the time-interval just described which is necessary to collect the energy for a quantum. And on the other hand, there also is the time-interval at which this quantum actually acts, that is, so to speak, the action-time of the quantum. A quantum acts by the Δv_m which is produced by the quantum. The time-interval for a Δv_m depends on the magnitude of the acceleration. The acceleration depends on the strength of the field. And the strength of the field depends on the number of the charges which form the field. The stronger the field that is, all the smaller the time-interval is per Δv_m.

The time-interval which is necessary to collect the energy for a quantum is completely independent of the time-interval per Δv_m.

Said differently: A charge can *collect* the energy for arbitrarily many quanta *at the same time* but there always can act only *one* quantum at the time through a Δv_m. This distinction is very important. So much about this.

So we have seen what happens when the mass of the charge changes which produces the field which acts on a charge. Thus we have seen what happens when the f_m of the field changes.

How is it now, if it is not the frequency (f_m) of the field that changes but if the magnitude of the mass (m_2) of the charge on which the field has an effect changes? Then the Δv_m must change correspondingly, of course. And here now it gets a little more complicated.

The kinetic energy of a mass (m_2) is $E = \frac{1}{2} m_2 \cdot v^2$. If ,e.g., we double the mass, then the energy doubles, too, at the same speed. But we know that a doubling the mass also causes a doubling the Δv_m. This means that the energy becomes **8** times as big.

Let us remember what mass actually is: Mass is a radial vibration or oscillation of space. Thus we can assume that a change of the mass also changes the radius. But in which way? One could, e.g., assume that the mass is proportional to the volume. Thus, e.g., doubling the mass would mean doubling the volume.

But, though, the space of the mass vibrates radially. So one could assume that the mass is proportional to the *radius*. Thus, e.g., doubling the mass would mean doubling the radius. And the volume becomes 8 times as big.

And, subsequently, one could assume that the energy of the mass is proportional to the volume which vibrates.

In the case which we consider here, the frequency (f_m) of the field, which excites the vibration of the mass m_2, shall, as said, not change. Instead the mass m_2 changes. Therefore the volume changes with r^3. Consequently the energy which must be transferred by the field into the mass also changes by E^3 - at a constant field-frequency. At least until resonance is reached again. Then the energy stored in the oscillation until this point is converted into Δv_m. An example: Doubling the mass (on which the field acts) (from m_2 to $2m_2$) means doubling the Δv_m (from Δv_m to $2\Delta v_m$) and this means that 8 times the energy is required. And this 8 times bigger energy arises from the 8 times bigger volume, which arises from doubling the radius (from r to $2r$, thus, from r^3 to $(2r)^3 = 8r^3$), because it requires 8 times the energy to excite the vibration (until resonance) of an 8 times bigger volume.

Now immediately the following problem arises: We know from $E = mc^2$ that mass and energy are only directly proportional to each other (thus for the mass it is *not* m^3). The explanation to this is as follows: At the creation of a mass the space itself provides the necessary energy. Every space-volume contains or represents a certain energy amount by itself. So, if, e.g., the mass is doubled, then r is doubled, too, and the volume is 8 times as big. Thus the 8 times of the energy, which is required for doubling the mass, comes directly from the 8 times of the space. Now, by doubling the mass the frequency of the mass (f_m) doubles, too. Doubling the frequency means doubling the energy, as we have already seen. Thus, doubling the energy at doubling the mass, because of $E = mc^2$, arises exclusively by doubling the frequency.

The idea that a space-volume also represents an energy amount doesn't seem too daring if one considers that mass is defined as vibrating space. I already mentioned the gravitational waves. However, there still are other experiments, such as the ones about the vacuum energy [13, 13b], who indicate that space doesn't only contain energy but that it also is energy; that space itself is energy.

Here I would like to mention my work about the objects of space. There I derive an extreme, dynamic structuring of the space, which perhaps could explain the energy of the space assumed here.

I also treat the creation of the electric field there. I don't do this in this work here. Here I simply take the electric charges and the electric field as given. Though: If mass is radially vibrating space, then the electric charge could be vibrating space, too. The vibration of the charge is transferred to the space around it and spreads. Depending on the way in which the expansions and contractions of the vibrations of the space take place, when the field has an effect on a charge, the result can be either attraction or repulsion. Somehow like this one could imagine this. But all this still is immature. It is another story.

What was it about once again? It was all about the second part of the basic idea: how does the f_m produces a $\Delta v_m \propto m_1 \cdot m_2$.

Well, I think that this is clarified now.

Of course there still are many open questions.

In this chapter it mainly was all about to show that it is possible to derive a Δv_m which meets all requirements, to show that it is definitely possible to represent the gravitation in the described way as an electric effect. It was all about searching for possibilities. In this sense the frequency f_m, as it was derived here, is only a interim hypothesis. Much more exact and more extensive considerations are still necessary. We will see whether a frequency finally can actually be derived for the mass, and if which one.

12. Frequency changes (of f_m)

There is an interesting and important question regarding the frequency f_m: Is the frequency f_m velocity dependent?

The frequency of an electromagnetic wave is velocity dependent. It could be similar for the frequency f_m.

Let us assume it is so.

The frequency f_m is transmitted from the vibrating mass to the electric field. So we can distinguish two areas: the frequency of the mass and the frequency of the field.

Let us look at the frequency of the field. There are two possibilities: 1. The source moves with the velocity v_Q and 2. The mass on which the field acts, this is the receiver, moves with the velocity v_E.

We start with the simplest case: the source rests ($v_Q = 0$) and the receiver moves with v_E ($\neq 0$).

As we have seen in the first part of this work, there is not only the field but always also the necessary anti-field. If the source is motionless, then the field and the anti-field have the same frequency f_m.

Field and anti-field move or propagate, as said, in exactly opposite directions. So, if the receiver moves with the velocity v_E, then the frequencies of the field f_m and the anti-field f_m' (I put an apostrophe on the frequency of the anti field (')) change in exactly opposite ways. Therefore, if the one frequency increases, then the other frequency decreases by exactly the same amount. Thus the *sum* of the two frequencies is independent of v_E.

The frequency f_m corresponds to the gravitational force of a mass. The gravitational force of a mass consists of the gravitational force of the field plus the gravitational force of the anti-field, so it is the sum of the gravitational forces of the field and the anti-field. Since the sum of the frequencies f_m and f_m' doesn't change by v_E, the gravitational force *doesn't* change by v_E either.

I think this is simple and clear.

It is a little less as simple if the source moves, with $v_Q \neq 0$.

At first we notice: The frequency of the field becomes due to v_Q in the direction of v_Q:

$$f_m^{\,+} = f_{m0} \frac{c}{c - v_Q}.$$

The $f_m^{\,+}$ is greater than the f_{m0} (f_{m0} is the frequency if $v_Q = 0$). I have taken only the amounts for c and v_Q since the directions are known here.

In the opposite direction to v_Q the frequency of the field becomes: $f_m^{\,-} = f_{m0} \dfrac{c}{c + v_Q}$.

The $f_m^{\,-}$ is smaller than the f_{m0}.

This is so far trivial.

But what's about the anti-field?
The anti-field always appears just when the field acts on an electric charge. However, taken exactly the existence of the field can also be proven only when it is in interaction with a charge. The field is assumed to always exist principally. I am making the same assumption for the anti-field here now. The anti-field shall be always existed, too. This idea isn't to easy because the anti-field always moves towards its source (an electric charge). On the other hand the anti-field always exists only in combination with the field. Furthermore, this assumption leads to correct results.
A small remark: I wonder, whether there is a connection between the anti-field and the phenomenon of entanglement. I have found indications in this direction but unfortunately still nothing definite. I mention this here primarily to show that there still are stranger things than the anti-field. In addition, it would be a beautiful confirmation for the existence of the anti-field if with its help the entanglement could be explained.

If the anti-field always exists, then its frequency changes due to v_Q. So we can calculate the sum of the frequencies (f_{sum}) of the field plus the anti-field if the source moves with v_Q:

$$f_{sum} = f_{m0}\frac{c}{c+v_Q} + f_{m0}\frac{c}{c-v_Q} \quad \Rightarrow \quad f_{sum} = f_{m0}\frac{1}{\left(1-\frac{v_Q{}^2}{c^2}\right)}.$$

It now gets interesting if we calculate relativistically. Because of the time-dilation the time of the mass passes the more slowly the bigger v_Q is. This means that the time-period (T) of the frequency f_{m0} gets greater. It is: $T = T_0\frac{1}{\sqrt{1-\frac{v_Q{}^2}{c^2}}}$ (T_0 is the time-period when $v_Q = 0$). Through this the frequency f_{sum} becomes: $f_{sum} = \frac{1}{T_0\frac{1}{\sqrt{1-\frac{v_Q{}^2}{c^2}}}}\cdot\frac{1}{\left(1-\frac{v_Q{}^2}{c^2}\right)} \quad \Rightarrow \quad f_{sum} = f_0\frac{1}{\sqrt{1-\frac{v_Q{}^2}{c^2}}}$.

This is thrilling: The frequency f_{sum} changes with v_Q in the same way as the inertial mass ($m = m_0\frac{1}{\sqrt{1-\frac{v_Q{}^2}{c^2}}}$).

The frequency f_{sum} is proportional to the gravitational force therefore to the gravitational mass. This means: increasing v_Q increases not only the inertial mass (m_t) but also the gravitational mass (m_s). But it has to be taken into account, though, that the frequency f_{sum} and therefore also the gravitational mass changes only in the direction of v_Q (here, with the direction of v_Q I mean the path of v_Q). Later, I still will say more about the equivalence of gravitational and inertial mass.

The increase of the gravitational mass with v_Q can be checked only with difficulty in the laboratory. However, instead we have our solar system with its planets and their trajectories (orbits). The anomalous perihelion precession of mercury [14] is a known problem. It could be solved (almost) completely by GR. I can very well imagine that the problem can be solved in a similar way if one simply takes into account the dependence of the frequency f_{sum} of the gravitational mass on v_Q. Mercury has the greatest speed of all planets (since he is most close to the sun). Therefore the change of the gravitational mass with v_Q manifests at mercury the most. This means that mercury's trajectory will deviate from a classical Newtonian trajectory the most. I haven't carried out the calculations to this yet (I must admit that I must learn this first) but if the results would match that would be a beautiful confirmation for the ideas introduced here.

So we have seen how it is if the receiver moves with v_E while $v_Q = 0$, and how it is if the source moves with v_Q while $v_E = 0$.
How is it now if both the receiver and the source move? Due to the v_Q of the source the frequencies of the field and the anti-field are no longer equally great. Does this have effects on the motion of the receiver? If the frequencies of the field and the anti-field are equally grate, then the frequency-*changes* which arise due to v_E cancel out exactly. A short calculation has shown that, even when the frequencies of the field and the anti-field are different, the frequency-changes cancel out exactly, too. With other words: A motion (with v_E) of the receiver doesn't have influence on the gravitational force here either.

13. Frequency-changes of the quanta and the anti-quanta

If a quantum acts, then a Δv_m arises. In the first part of this work I assume that this Δv_m appears at once. On the other hand one could argue that the quantum must act first *before* the Δv_m can result. Well, it doesn't matter principally how one takes it. In both cases a Δv_m results for every quantum-couple because if one says that the Δv_m results only after the quantum has acted, then the Δv_m of the previous quantum has to be taken into account for this quantum-couple.
To be in conformity with the first part of this work, the Δv_m shall appear at once when a quantum acts here, too.
We have seen that the anti-quantum acts first. A $\Delta v_m^{\prime}$ arises. This $\Delta v_m^{\prime}$ is a motion of the receiver thus the $\Delta v_m^{\prime}$ corresponds to a v_E.
Due to this v_E $(= \Delta v_m^{\prime})$ the frequency f_m of the charge on which the anti-field has an effect changes. Then, subsequently, the quantum produces a (further) Δv_m which is added to the $\Delta v_m^{\prime}$ of the anti-quantum. The frequency f_m changes also here. Though: the field of the quantum moves or propagates in the opposite direction to the field of the anti-quantum. The frequency f_m changes at the quantum in an opposite way to the anti-quantum. But this *doesn't* cancel out mutually since the speed relative to the field of the quantum is twice as grate as the speed relative to the anti-field of the anti-quantum (that is $\Delta v_m + \Delta v_m^{\prime} = 2 \cdot \Delta v_m$).
Regarding the frequencies f_m we have here exactly the same conditions as in the first part of this work regarding the velocities. In the first part of this work we have seen that the Δv_m strengthens ($c + \Delta v_m$) or weakens ($c - \Delta v_m$) the electrical force so that gravitation arises. The frequency-changes which arise by Δv_m correspond exactly to that.
I will explain this now.
The frequency f_m produces a certain Δv. This Δv corresponds actually only to the acceleration of the electrical force, therefore I label it Δv_e. Due to this Δv_e the frequency f_m changes. This change of the frequency f_m corresponds exactly to the gravitational force. But this changed frequency can't have produced the Δv_e since the Δv_e only represents the electrical force. Thus there must have been created anyway some other *resultant* Δv, which I call Δv_r, which corresponds to the sum of the electrical force and the gravitational force. And this Δv_r must then correspond exactly to frequency which arises when the receiver moves just with this Δv_r. This Δv_r corresponds exactly to the Δv_m which was calculated in the first part of this work.
The frequency at the receiver is: $f_m = f_{m0} \dfrac{c \pm \Delta v_r}{c}$.
I label the gravitational part of Δv_r with Δv_g.
The f_{m0} produces the Δv_e which corresponds to the electrical force.

The $f_{m0} \frac{c \pm \Delta v_r}{c}$ produces the $\Delta v_e + \Delta v_g$ which corresponds to the sum of the electrical force and the gravitational force.

We can relate both and get the ratio: $\frac{f_{m0}}{f_{m0} \frac{c \pm \Delta v_r}{c}} = \frac{\Delta v_e}{\Delta v_e \pm \Delta v_g} \quad \Rightarrow \quad \Delta v_r = c \frac{\Delta v_e}{\Delta v_g}$.

By dividing the Δv_e and Δv_g through the same time-interval Δt, one gets the accelerations which correspond to the electrical force F_E and the gravitational force F_G. Therefore:

$$\Delta v_r = c \frac{\Delta v_e}{\Delta v_g} \equiv c \frac{F_G}{F_E} = \Delta v_m .$$

Said shortly: At first the frequency f_m corresponds just to Δv_e. But due to the effect of f_m on the receiver the Δv_r results which corresponds to the Δv_m.

Thus the frequency f_m describes the emergence of the gravitation correctly.

14. The equivalence of gravitational and inertial mass

In all my considerations up to now I simply have presupposed that the gravitational and the inertial mass are the same, therefore that there is only one type of mass.

The mass with which the Δv_m is calculated is principally the gravitational mass. I have always equated this mass (with which Δv_m is calculated) with the inertial mass automatically. But who knows? Perhaps there is a possibility of increasing the gravitational force without increasing the inertia by the same amount. I don't believe this, though. At least there hasn't been any experiment yet which has yielded an inequality of gravitational and inertial mass.

There also is a theoretical argument. I have defined the mass as vibrating space. The mass is proportional to the radius and the energy is proportional to the volume. If this is correct, then gravitational and inertial mass must be equal: Let us consider the mass m of an electric charge on which an electric field has an effect. If we double this mass (to $2 \cdot m$), then Δv_m doubles, too (to $2 \cdot \Delta v_m$). If together with the inertia the mass also has doubled then the required energy amount must have become 8 times as big because the mass in $E = \frac{1}{2} m v^2$ is an inertial mass. This corresponds exactly to the 8 times bigger volume of the vibrating mass.

Of course, by developing this relations I have presupposed that gravitational and inertial mass are equal, and for that reason I may have not considered alternative possibilities as much. But if it would be possible to prove that the vibrational energy of the space of a mass is proportional to the volume, then this would also be a proof or at least a strong indication for the equality of gravitational and inertial mass.

To understand the relations better we can calculate the time-interval Δt for which Δv_m exists:

$$m_t \frac{\Delta v_{ms}}{\Delta t} = F_E \pm F_G \quad \Rightarrow \quad \Delta t = \frac{m_t \cdot \Delta v_{ms}}{F_E \pm F_G} .$$

For the acceleration, it is the inertial mass m_t. For the gravitation, it is the gravitational mass m_s therefore I have written Δv_{ms} instead of Δv_m. Here the F_G can be neglected compared with the F_E.

Some examples:

- If m_t doubles and m_s doesn't then Δt doubles (and vice versa).
- If $m_t = m_s$, then m_s doubles automatically with m_t, too, so that Δt quadruples.
- If the charge of the mass on which the field has an effect is doubled, then F_E doubles and Δv_{ms} halves, therefore the Δt becomes a quarter as big ($\frac{\Delta t}{4}$). But that is obvious: if the electric force

doubles (at the same mass) and the Δv_{ms} halves then only one quarterly (¼) of the time-interval remains for every Δv_{ms}, to obtain the double acceleration.

Here, by calculating the Δt, we recognize that the equivalence of gravitational and inertial mass can not be deduced automatically by the Δv_m (as I hoped for a short time).

15. Translatory movement by oscillation / inertial mass

We know from SR that the inertial mass is speed dependent. It is: $m = \frac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$, where m_0 is the rest mass and v is the velocity with which this mass moves.
What does this relativistic mass increase mean for the frequency f_m? After all, the frequency f_m shall be proportional to the mass. Does the frequency f_m also increases with the relativistic mass increase? I don't think so.
The frequency f_m even decreases with the speed (v_Q) because of the time dilation.
How can the mass increase then be explained? Well, I will show this now.
I have defined mass as vibrating space. The translatory movement of such a mass could also be a space vibration or oscillation which moves forward. That's the way this could happen: due to the oscillation the space of the mass expands and contracts alternately. This oscillation usually is radially, thus it is centre orientated. This radial oscillation happens furthermore, so that the form remains a sphere. But: at the contraction the outside of the sphere sticks at a point just like on a wall, this is the rest-point. In this way the centre of the sphere moves by the Δr of the oscillation, due to the contraction, towards the imaginary wall (that is the rest-point). At the following expansion, exactly the same happens, but this time the rest-point is exactly on the opposite side of the sphere. In this way the centre will move by Δr in the same direction as before at the contraction. In this way a translatory movement is created. The average velocity v_t of this translatory movement is: $v_t = 2 \cdot \Delta r \cdot f_m$.
In some way the space moves as a caterpillar: he draws forwards and shoves from behind alternately.
A little remark: if the contraction and the expansion take place with a continuous motion and not, as usually at an oscillation, sinusoidally, then v_t is constant.

Now, though, it makes little sense to use the frequency f_m since f_m has a fixed relation to the mass. I assume that the space of the mass can execute different vibrations or oscillations at the same time. Therefore, for the translatory movement, a translatory frequency, f_t, is defined. So it is:
$v_t = 2 \cdot \Delta r \cdot f_t$.
Something similar already happens when the space of the mass is excited by the field of an other electric charge to oscillate in the frequency of the field.
What could that frequency f_t be?
The frequency f_t could be a modulation of the frequency f_m. The frequency f_t is considerably smaller than the frequency f_m - that will be obvious later. Only at the speed of light it is: $f_t = f_m$.
The f_t could be a kind of amplitude modulation of the f_m. An amplitude modulation in the way, that the rest-point of the radial oscillation changes according to the modulation, so that the centre of the radial oscillation carries out the translatory movement. In the end, while considering the f_t, it is quite fundamentally all about the behaviour of the rest-point.
I can't tell more yet. What we notice is: a part of the frequency f_m results in the translatory movement of the mass, in the mentioned way. For that, of course, energy is required.
One can very well imagine that the energy, which is stored in the radial oscillation (f_m), which was transferred from the field to the space of the mass, is converted into the frequency (f_t) of the translatory movement once a certain point is reached. This means that the frequency f_t gets greater (thus there is a Δf_t), which corresponds to a Δv_t. And this Δv_t corresponds to the Δv_m here.

We know from SR that the length (L) of an object is speed dependent: $L' = L_0 \sqrt{1 - \frac{v^2}{c^2}}$, where L_0 is the rest-length. So, the length decreases with growing speed.
The vibrating space of the mass has the radius r and it vibrates with Δr . Now we have to assume that r and Δr also decrease by v_t , compared with the rest-radius (r_0): $r = r_0 \sqrt{1 - \frac{v_t^2}{c^2}}$.

So the velocity v_t becomes: $v_t = 2\Delta r_0 \sqrt{1 - \frac{v_t^2}{c^2}} \cdot f_t$.

This means: the speed (v_t) increases less due to the length contraction of r or Δr . To compensate that, the frequency f_t must be increased in the same way. So it is: $f_t' = \frac{f_t}{\sqrt{1 - \frac{v_t^2}{c^2}}}$.

This increase of the frequency corresponds exactly to the increase of the mass (with $m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}}$).

It is remarkable: The additional energy which must be absorbed (by f_t) due to the length contraction corresponds exactly to the energy which results due to the relativistic mass increase of the inertial mass.
At the relativistic mass increase it is: the grater the speed already is, the more energy is required for a speed-change. The same is valid for the frequency f_t . The bigger f_t becomes, all the more inert the mass gets. Does this apply to all directions?
If the frequency f_t oscillates only in motion direction, then the inertia also increases only in motion direction. If the frequency f_t is a radial oscillation, then the inertia increases in all directions. Which of the two is valid? I cannot tell yet.
There is a further open question: Does the frequency f_t influences the gravitational force [15]?
Well, I don't know yet. What can be said is that the f_t of the mass can be transferred also on the field (of the charge). But, though, the f_t is for the field (exactly as for the space of the mass) only a modulation of the f_m .
There are for certain further open questions.
On the other hand there may be answers to open questions. As that to the wave-particle duality, as I will show now.

16. Matter waves

Double split experiments have shown that particles also have wave properties. According to deBroglie mass-particles have the wavelength: $\lambda_{dB} = \frac{h}{mv}$, where λ_{dB} is the deBroglie wavelength, m is the relativistic mass of the particle, and v is the velocity of the particle.

In an analogous way the particles also have a frequency f_{dB} : $f_{dB} = mv\frac{c}{h}$.

I have wondered whether the deBroglie frequency f_{dB} could be identical with the translatory frequency f_t of the inertial mass.
It seems quite reasonable. The oscillation like translatory movement of the inertial mass, as described in the previous chapter, corresponds exactly to the wave-particle duality. The space of an inertial mass moves forwards by oscillating. This space has the radius r and it oscillates with Δr . Due to this oscillation the velocity $v_t = 2 \cdot \Delta r \cdot f_t$ results. If $f_{dB} = f_t$ is actually valid, then the Δr can be

calculated here. The v_t is the velocity with which the mass-particle moves. Therefore the v_t can be used for the calculation of the f_{dB}. So it is: $f_{dB} = f_t \quad \Rightarrow \quad m \cdot v_t \frac{c}{h} = \frac{v_t}{2\Delta r} \quad \Rightarrow \quad \Delta r = \frac{h}{2mc}$.

So, if we insert, e.g., the mass of the proton ($m_{p+} \approx 1.6 \cdot 10^{-27}\,kg$), we get: $\Delta r_{p+} \approx 7 \cdot 10^{-16}\,m$ (m = meter).

If, now, we know the radius of the mass of the proton, then we can deduced the magnitude of the contraction and the expansion of the mass of the proton due to the translatory movement (but only related to the rest-points, though).

Of course, the problem is to find out the radius of the mass of the proton correctly.

First of all, one cannot assume that the proton has a sharp surface. Perhaps it may not be a sphere at all. Then, one must distinguish between the radius (surface area) of effectiveness and the actual radius (whatsoever that may be). This is especially valid if one considers that the proton is characterised by its electric charge. It is not at all for sure that the radius of the electric charge of the proton matches the radius of the inertial mass of the proton. Particularly not the radius of effectiveness. In the end the particle size of the proton depends on the characteristic that we look at.

At least the calculation of the Δr_{p+} delivers a value in the right range, however. This can be regarded as a confirmation for the idea which I assert here.

Usually the radius of the proton (r_{p+}) is set approximately $r_{p+} \approx 10^{-14}\,m$. The translatory oscillation of the proton (Δr_{p+}) is considerably smaller ($\Delta r_{p+} \approx 7 \cdot 10^{-16}\,m$). This is approximately 1%. Thus the contractions and expansions needed for the translatory movement are very small. This is due to the very high deBroglie frequency of the proton which is proportional to the mass of the proton.

A more light particle than the proton, as the electron, has a considerably smaller deBroglie frequency. Therefore the Δr_{e-} of the electron is considerably greater because at a smaller frequency the steps must be larger for the same speed.

It is: $\Delta r_{e-} \approx 1.2 \cdot 10^{-12}\,m$.

The radius which is assumed for the electron is, in any case, much smaller than $1.2 \cdot 10^{-12}\,m$. So, what does that $1.2 \cdot 10^{-12}\,m$ means? Well, it is the distance of the steps with which the electrons move. This then explains why it is so hard to localize an electron. When it moves (and usually it always moves), it is compressed and stretched strongly (due to the contractions and the expansions).

It is generally difficult to exactly localize mass particles which move because they move due to the contractions and expansions (the oscillations) of the space of which they consist of. Thus they never are actually at a concrete place, when they move. This, however, reminds a little of the uncertainty principle, although I cannot derive a clear connection yet.

However, we still notice something else: The $1.2 \cdot 10^{-12}\,m$ is approximately 1% of the diameter of the atom shell which is approximately $10^{-10}\,m$. The electrons are in the atom shell. The space of each interval with which the electrons move is quite big in relation to the diameter of the atom shell. Actually, because of the Δr_{e-}, the electrons jump around in the atom shell with large steps. And through this now the strange behaviour of the electrons in the atom shell is explained. On the one hand they jump with relatively large steps around, on the other hand they also repel mutually. From this then the forms of the orbitals or the probability clouds of the electrons in the atom shell result. Here it should certainly be possible to create computer simulations. I cannot do this, though.

In any case, it is nice to see that here good conformity with phenomena of quantum mechanics can be archived if one assumes that the inertial mass is vibrating space.

Here, perhaps, it seems right to say something about the collision. If masses are vibrating space, then what is a collision between two such masses? Well, this is actually simple, too. If two vibrating spaces (masses) get very close to each other, then the oscillations of their spaces influence each other mutually. In this way they exchange oscillational energy. This exchange of energy leads to changes of the f_t and therefore to changes of the velocities.

17. Photons

We have seen that the Δr_{e-} of the electron is considerably grater than the radius of the mass of the electron. The Δr_{e-} corresponds to an oscillation of the space which creates a translatory movement. The translatory movement of the oscillation arises due to the changes of the rest-points. A Δr_{e-} which is greater than the radius of the mass means that the rest-point is outside the space of the mass. This means that the translatory movement of the mass of the electron influences not only the space of the mass itself, but also the space around the mass. In principle, the rest-point of the oscillation of the translatory movement can be at any place inside or outside the space of the mass.

Neutrinos (n), e.g., have, if at all, a very, very small mass. Their Δr_n is appropriately grate. Their Δr_n could be many kilometres great (!), when the mass is appropriately small. Therefore the sphere of influence of a neutrino is many kilometres in size. And the mass of the neutrino then appears sometime at someplace within this sphere of influence. That's perhaps the reason why neutrinos are so hard to be measured. I don't know more to tell, yet.

And now, on the photons [16-19]. Photons stand out by the fact that the product of wavelength λ and frequency f_{Ph} is always equally grate, namely c, this is the speed of light. It is: $c = \lambda \cdot f_{ph}$. The speed of light is the translatory movement of the photon. Thus the f_{Ph} is the translatory frequency of the photon. Therefore the λ is the space of each interval of the translatory movement, that is $\lambda = \Delta r_{Ph}$.

For a mass the space of each interval (Δr) of the translatory movement is fixed and the velocity of the translatory movement changes due to changes of the translatory frequency (f_t). Photons, on the other hand, have a constant speed so that by changing the frequency the space of each interval changes, too.

We know that the energy of a photon corresponds to a mass. So we can imagine, that photons are exactly like every other mass: Photons are radially vibrating space, just as masses (I will say something about the transversal electromagnetic oscillations in a moment).

Here, in this representation, the frequency f_{Ph} of the photon is identical with frequency f_{mPh} of the mass of the photon.

So, here, in this representation, there is a quite decisive difference between photons and masses: a mass can have arbitrarily many different translatory frequencies, depending on its velocity. At the photon, on the other hand, the translatory frequency is *always* exactly equal to the frequency of the mass of the photon . The translatory frequency of the photon *always* corresponds to the frequency of the mass of the photon.

Here we have perfect conformity: the deBroglie frequency of a mass is: $f_{dB} = mv\frac{c}{h}$. For the speed of light it becomes: $f_{dB} = mc^2\frac{1}{h}$. The energy of a photon corresponds to a mass of $hf = mc^2$. Inserting yields: $f_{dB} = f_{Ph}$.

An exceptional conclusion gets possible here: any mass which carries out a translatory movement due to its own frequency of mass has the speed of light. Thus every mass could in principle become an electromagnetic wave. But, though, with growing speed the Δr decreases against zero, according to SR. If a mass shall have the speed of light at all, it must have the speed of light right at its emergence. If an acceleration is necessary first, the Δr will decrease against zero so that the speed of light cannot be reached. This is therefore, in the end, the meaning of the acceleration: it compresses the space. And this compression (or contraction) corresponds to an energy. And if the space shall be compressed to zero, then infinitely much energy is necessary. With other words: the inertial mass becomes infinitely grate.

And now, on the electromagnetic fields of a photon. We know that photons are influenced by the gravitation, exactly as masses are. I have described the gravitation as an electrical effect and stated that a neutron consists of one positive and one negative electric charge. Well, the alternating electric field of a photon can be understood as positive and negative electric charges. Any charge which moves always also produces a magnetic field. And when the charge moves with the speed of light, then the magnetic field is exactly as grate as the electric field. For that reason, at a photon, the electric and

magnetic fields must be equally grate. Unfortunately, I cannot explain yet why the positive and negative fields (= charges) of the photon have to exist in that alternating, oscillation like way. It in principle is as if the charges are alternately located along the photon. Perhaps here one gets a small insight into the true nature of the electric charge which after all cannot be anything else than vibrating space with certain characteristics, e.g., regarding the rest-points.
On the other hand it is clear why the electromagnetic fields of the photon act only vertically to the motion: since the photon moves with the same speed as the electric field, it already doesn't have any electric field in motion direction at its emergence. Here perhaps we can see what happens to a radial oscillation if a particle moves with the speed of light.
Here perhaps it is interesting that electric charges which move together with the speed of light in the same direction exert no electric forces (neither repulsive nor attractive) on each other.

We have seen that masses and photons move due to the translatory frequency. Here now the picture arises, that a steady velocity, as we know from everyday live, actually does not exist at all. Every translatory movement is in principle just an oscillation of the space, and its magnitude results from the frequency and the rest-points (therefore the Δr).

There is an aspect which I must mention to complete the picture: The translatory movement arises from $v = 2\Delta r \cdot f_t$. Changes of the velocity (Δv) arise at masses due to changes of the frequency (Δf_t). However, it is in principle possible that the Δr of a mass could also change, so that the velocity of the mass changes. But, though, we know from the deBroglie frequency, that it is the frequency that changes and not Δr.
In any case both would be possible regarding the energy: The energy of a charge is proportional to the square of the amplitude (Δr^2) at a constant frequency (f_t), and the energy is proportional to the square of the frequency (f_t^2) at a constant amplitude (Δr). In both cases the energy is proportional to the square of the velocity ($v = \Delta r \cdot f_t$), as it corresponds to the kinetic energy.

Now briefly something on the entanglement [20, 21]: We have seen at the translatory movement that there are alternating rest-points relative to which the translatory oscillation takes place. At the Neutrinos the space area which can be influenced in this way is very large. Now, it is conceivably, only very hypothetically, that there also are rest-points for other qualities (than for the translation). The entanglement of two particles then could mean that the rest-point (for some quality) of the one particle is the other particle and vice versa. Thus, as soon as one influences one of the two particles one influences automatically the rest-point of the other particle whose behaviour would change without time delay (due to the influence on its rest-point). In this way even three (or more) particles could be entangled: the rest-point of the first particle is the second particle, the one of the second is the third, and the one of the third is the first.
But this is all still very, very daring and not very concrete. Theoretically the rest-points can be distributed in every conceivable way or variant. Be careful with the cheese on the mousetrap!

18. Magnetism / gravitational waves

What's about the magnetism? How does the quantization of the transfer of the electrical energy effects the magnetism?
The gravitation (of the masses) is created by the Δv_m. The Δv_m is created by the electrical forces of the electric fields. If the sources of the electric fields move, then magnetic fields are created additionally. When a charge moves through a magnetic field, due to the Δv_m, a magnetic force arises which causes an additional Δv vertically to the Δv_m, which I label $\Delta v_{m\perp}$. This means that the Δv_m used until now is only the electric part of the gravitation. There is in addition the magnetic part of the gravitation, which is expressed by $\Delta v_{m\perp}$.
The magnetic fields which arise if electrically neutral matter moves cancel out (each other). They nevertheless exist. And these magnetic fields also exist for the Δv_m´s which arise by the quanta and anti-quanta of the electric fields.

It may help to understand these relations a little easier if one looks at my work on the magnetism [8]. There I assume that the magnetic field is part of the electric field. I show there that the magnetic force is a result of the angle φ which occurs between the propagation direction of the electric field and its direction of effectiveness, if the source of the field (that is a charge) moves. This means that Δv_m will also have the angle φ in relation to the propagation direction of the electric field (which spreads with the speed of light).
But no matter which consideration we choose, in any case the Δv_m will deviate from the pure electric Δv_m by an angle φ due to the magnetic influence. From now on I will label the electric part of the Δv_m with $\Delta v_{m//}$.
The question is now: If normal, electrically neutral matter moves, do the magnetic parts (positive and negative) of the gravitation then cancel out or not?
To answer this question let us imagine a (theoretically) infinitely long train which moves rectilinear. The protons and electrons (plus the neutrons), which the train ultimately consists of, move together with the same average velocity. Next to the train we place a motionless test charge. For example a proton. Due to the electric field of a proton of the train a $\Delta v_{m//}$ occurs at the test proton, and this $\Delta v_{m//}$ points away from the train (because of the repulsion). In addition, due to the magnetic field, which arises by the velocity of the proton of the train, there is also a $\Delta v_{m\perp}$ rectangular to the $\Delta v_{m//}$.
At next, now, we look at an electron of the train that shall act on the same test charge (the proton). Due to the opposite sign of the electron the test proton will now move with $\Delta v_{m//}$ in the opposite direction (then before due to the proton of the train). So we have the opposite electric field *and* a motion in the opposite direction (by $\Delta v_{m//}$), together this means that the $\Delta v_{m\perp}$ points in the same direction again as before due to the proton of the train.
Short and good: The magnetic part of the gravitation remains.
So, if one places, e.g., a test mass (which consist of many particles) next to the train, then there will be both an electric and a magnetic gravitation between the test mass and the train.
How big is the magnetic gravitation? Well, the ratio of electric to magnetic gravitation corresponds to the ratio of electric to magnetic force, of the charges involved.
The gravitational force is, as known, very small (compared to the electric force). The gravitational force of a train on a test mass is hardly measurable, the magnetic part is appropriately smaller.
Of course, the magnetic forces which arise from a constant velocity still cancel out (each other mutually) at electrically neutral matter. The magnetic gravitation is only about the velocities which result from the quantization of the electric effect (that are the Δv_m´s), exactly as in the case of the electric part of the gravitation.

Now, what is it like with the magnetic gravitation at the rotation of the earth?
Well, magnetism only results due to the relative motions (velocities) of the electric charges. It is, of course, exactly the same for the magnetic gravitation.
Here then it is necessary to calculate relativistically. A force that is magnetic for one observer can be purely electric for another observer. By carrying out the relativistic conversions correctly this becomes quite obvious.
Exactly the same applies to the rotation of the earth: For an observer resting on the earth's surface the charges of the earth don't move. Thus there isn't any magnetic gravitation either. So the orbits of the satellites or the trajectory of the moon can be calculated without taking the effect of a magnetic gravitation into account. Relative to the sky or for an observer at a fixed star the earth rotates, of course. This means that there is a magnetic gravitation from the view of the observer at the fixed star. But this magnetic part of the gravitation would dismiss the satellites or the moon from their trajectories. For that reason it is important to calculate relativistically here. Because then one recognizes that the electric fields also change correspondingly due to the (rotational) velocities. The changes of the electric fields compensate the magnetic gravitation in a way, that the normal trajectories always result for the satellites (and the moon).
I haven't carried out the corresponding calculations yet but as soon as I will have time, I will do so. However, there must be inevitably complete conformity with the calculations which one knows from the SR; such as the calculations on currents flowing through cables.

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 the gravitation in this work here. But I haven't checked this yet, though.

I don't treat 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 one looks more exactly, then one sees 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 the gravitation.

GR describes the effect of the gravitation, this is the acceleration, as a result of the curvature of the space-time. The great advantage of this way of looking at gravity is that here the changes of the spacetime, 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 the gravitation.

In this work here I describe the gravitation as an electric effect. The results or conclusions are the same as in GR, with the difference that here SR is applied directly on the electric and magnetic fields that produce the gravitation. How to apply SR on electric and magnetic fields is well known. This way of calculating gravitational phenomena is a little more direct than the way via the curvature of the spacetime of GR. But, though, I am not sure whether this relativistic way of looking at the gravitation as an electric effect reaches as far as GR does.

19. 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 assumption which I have introduced here is that the gravitation is an electric effect in the end. So the question is: Can gravitation be produced or influenced electrically?

Actually I have carried out experiments of this type already earlier, but, however, 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 the gravitation which is vertically to the electric part of the gravitation. (The electric part of the 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 [22-28].

Having 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 one has a result, then one can never be sure... that it is really the magnetic part of the gravitation.

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

Quite some time ago, I have heard of an experiment in Austria [29-32], in which a connection between magnetism and gravitation was suspected, but I don't have knowledge of the details of this experiment, though. However, one hears of connections between magnetism and gravitation again and again. Perhaps, based on this work here, the search can be done more concrete in the future?

Perhaps the frequencies f_m and f_t offer broader possibilities for experiments. There still are open questions, here too. Maybe there are possibilities of influencing the gravitation hidden in the open questions. I don't have concrete proposals here either yet.

Perhaps particles as heavy as possible with very high speeds could be sent in a vertical direction until collision; and then one looks at the energy balance exactly. If the energy balance isn't correct, this then could be due to a deviation in the gravitation. (Although the chances seem superior for faults here.)
Before the end, I still would like to say something about the energy briefly.

20. Energy balance

I have defined mass as vibrating space. The energy is both in the oscillation and in the space itself. It is clear that the energy of the *oscillation* (of the space) must flow into the energy balance.
But what's about the energy of the space itself? If the energy of the space exists, then it also must flow into the energy balance. On the other hand it is very well possible that the energy balance is always neutral, for the energy of the space itself. This shall mean that the energy of the space is perhaps never converted into oscillational energy or into motion (kinetic) energy. In this case one almost could ignore the energy of the space.
On the other hand it could be that the energy of the space isn't neutral anyway. One then could use, e.g., the energy of an oscillation to produce space. Or formulated a little differently: there could be, e.g., oscillational processes at which space is created while, at the same time, the oscillational energy is being reduced. And conversely, space could be destroyed while, at the same time, energy is released, which then could, e.g., be measured through an increase of a velocity. But what shall that mean, space is destroyed? This could mean that, e.g., particles move (for instance they change their position or maybe even their velocity) *without* an outer force being exerted on them.
Nevertheless, of course there must be some kind of influence which causes space to convert into energy (or energy into space). I don't know yet, whether and if which processes actually lead to the conversion between space and energy. But if this conversions between space and energy really exists, then the energy of the space should be taken into account in the energy balance at the corresponding processes, because otherwise the results will be wrong.

21. Closing remark

I think that I could show that the gravitation of the masses can be understood as an electric effect. Most important for the derivation is the quantization of the energy transfer of the electric field. Furthermore the anti-field or the anti-quantum was introduced. And, thirdly, it was stated that the force of the electric field depends on the relative velocity of the charge to the field (in combination with the anti-field the laws of electromagnetism [33] maintain, of course).
The gravitation finally arises completely naturally if the quanta and the anti-quanta act successively.
Since the gravitation is an electric effect, there also is a magnetic part of the gravitation which is vertically to the electric part. Though this, perhaps some possibilities arise for experimental examinations of the ideas introduced here.
In the second part of this work I try to explain *how* the quanta of the electrical energy are created. I make some assumptions here which are still quite hypothetical, but which provide very good results, in conformity with observations.
I can show how the proportionality between the quanta of the electrical energy and the masses of the gravitation arises. The basis for this relation is the definition of the mass as vibrating space.
Apart from the gravitation even further phenomena can be interpreted here: it can be shown, how the relativistic speed dependence of the inertial mass arises, and a possible cause for the wave-particle duality can be shown.
Of course there are still many questions unanswered, but that's how it always is...
On the other hand, I think that important questions could be answered convincingly.

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