Theory of gravitation

Leptons as an electromagnetic wave in a gravitational field

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Abstract
Gravitation is described in the macroscopic area by the general theory of relativity. The ART is an effective theory. The reason for the curvature of space is the sum of all masses of all elementary particles. The exact functional principle of the curvature of space by masses is not explained. A crucial question in physics is whether the theory of Maxwell's equations is also an effective theory. The reason for electromagnetic waves is the moving elementary particles with charges. The question is if electromagnetic waves can also be the reason for elementary particles with mass. The problem is to find an electromagnetic model of the elementary particles that explains gravity.
An electromagnetic wave model of the leptons is used for this.
The energy of the leptons is only in an electromagnetic wave that moves in a "circle". There are no particles in this model. It is shown how the Poynting vector of the electromagnetic wave changes in the gravitational field. This model explains the gravitational acceleration of elementary particles in a gravitational field very clearly. The gravitational force and the time change due to gravity are calculated. The generation of the gravitational potential by the electromagnetic wave is explained.

Content

1. The electromagnetic model

An electromagnetic wave can be described by an electric vector field and an magnetic vector field. These fields move with the speed of light c. The direction of energy transport is described by the Poynting vector. In each point of space, these three vectors are perpendicular to each other.

From the perspective of an observer, the directions of the electric and magnetic field changes. See figure 1.

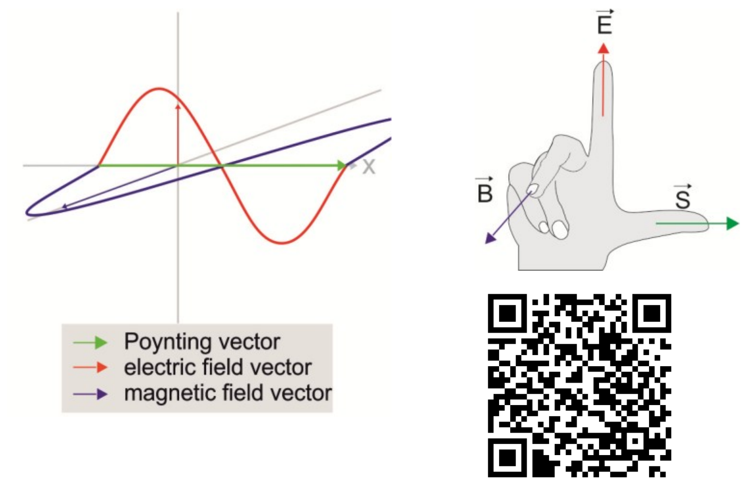


Figure 1: Electromagnetic wave and right hand rule

The electric field of an electron at rest consists of a static electric field. The electric field of an electromagnetic wave is a dynamic field. The electron carries a charge e. The electric field lines point to the center of the electron and is a spherically symmetrical field and do not move.

The electron also has a magnetic moment μs and also a magnetic field. What the magnetic field looks like is not known.

It is known, that electrons and positrons can be generated from an electromagnetic wave. We know the wavelength of the electromagnetic wave from the law of conservation of energy. The wavelength is the Compton wavelength of the electron (2.426 * 10-12 m) which is much larger than the radius from the particle model of an electron (10-13-10-15 m). This electromagnetic wave must be “captured” in the area in which the electron is created. (The antiparticle is ignored here and will be later examined.) For this “light trap” there are already considerations of other authors:

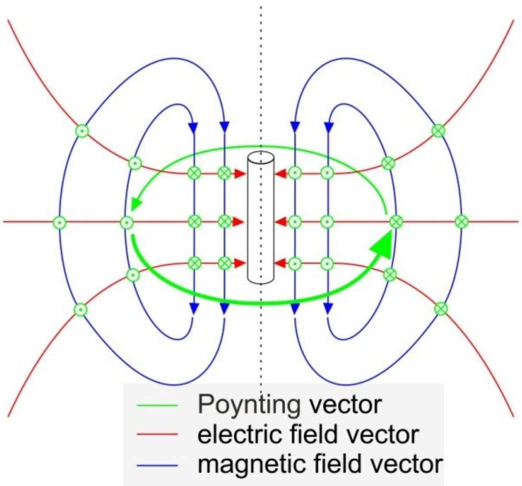
Herbert Weiß describes 1991 this “light trap”, in his book „Wellenmodell eines Teilchens“, as two mirrors. Between the mirrors the light jumps back and forth. Because the lepton forms a light clock in this model, it explains very clearly all the phenomena of the Lorenz transformation and the special theory of relativity.

Christoph Caesar describes the „model of the lepton as rotating photon or electromagnetic knot with internal twist”.

Carl-Friedrich Meyer describes the “light traps” in the same way as Christoph Caesar, with his electromagnetic elementary model for electrons, protons and neutrons.

In both electron models, the light rotates in a circle with an additional phase rotation of 180° at each rotation. Meyer explains very clearly why the magnetic field and the spin changes when the electron is rotated 360 degrees.

In this paper the lepton will be describe as a rotating wave, with internal twist. A cycle in an eight without internal twist is also possible and would bring the same results for the elementary charge and for the gravitation.



Fugure 2: The electromagnetic field of an electron

There are three vector fields in an electromagnetic wave. All this three vectors must be at right angle to each other in each point of the space:

1. The field lines of the Poynting vector point in the direction of energy transport. In this model the Poynting vector moves in a circular motion, with torsion by 180 ° at each half oscillation.
2. The electric field: Due to the torsion by 180 degree with each half oscillation, the electric field lines always point to the center of the axis of rotation.
3. The magnetic field lines are similar to the field of a bar magnet.

The density of energy increases strongly with the concentration of the electric field lines at the axes of rotation. The density of energy becomes so strong that an event horizon forms on the axes of rotation. On the event horizon, the electric field lines will be end and form an elementary charge. It will be shown in the following text that the event horizon does not look like a ball. **The event horizon looks like a string or a cylinder. The diameter is much smaller than the height of the cylinder. The cylinder is referred here as elementary cylinder.**

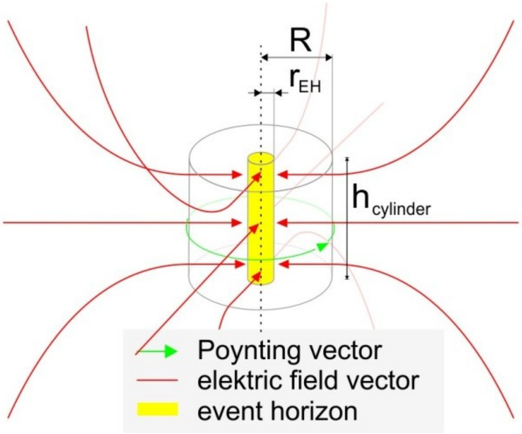


Figure 3: The electric field lines end on the event horizon

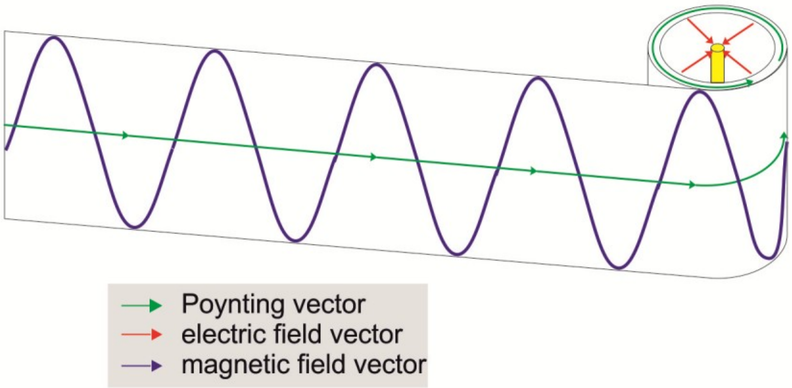
The entire energy of the elementary particle is only stored in the electromagnetic field. The particle consists only of an electromagnetic field.

2. The diameter of the elementary cylinder

This section shows the relationship between energy and the diameter of the elementary cylinder. The diameter of the elementary cylinder becomes larger if the energy of the electromagnetic wave becomes bigger. This relationship is the basis for the gravitational effect on the elementary particle.

2.1. The cylinder height: h cylinder

The height $h_{cylinder}$ of the elementary cylinder is unknown and not measured.
For the determination of the cylinder height hcylinder we investigate the electromagnetic oscillation. We assume a sinusoidal oscillation.
The magnetic oscillation is recorded on a long paper as a wave. This paper is rolled up. This is the "light trap". (The antiparticle is created by rolling it up in the other direction.)



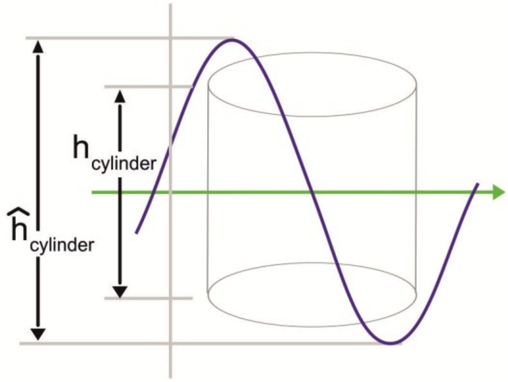


Figure 4: The cylinder height

$$x_{(t)} = \hat{x} * \sin(\omega t) = \frac{\lambda_0}{2 * \pi} * \sin(2\pi f * t)$$

The cylinder is as high as the magnetic oscillation in the positive and negative direction of the cylinder.
The height of the elementary cylinder is proportional to the Compton wavelength λ_0 of the lepton. This means that the lepton with more energy will have a smaller elementary cylinder.

2.2. The event horizon

The event horizon is the limit curvature of space, where the time stand still or the speed of light will be zero for an outside observer. In this case, the electric field lines end at this limit. We have labeled the event horizon r_{EH} in the upper equations. For a better understanding we will first calculate the Schwarzschild radius for a sphere mass m_1 and then we calculate the event horizon for the elementary cylinder in the same way.

2.2.1. Schwarzschild radius for a sphere mass

An event horizon is similar to the beginning of a black hole. The event horizon starts where the light no longer manages to escape, because the space curvature is too high. For the calculation of the Schwarzschild radius we think of light as a particle with the mass m_2, which tries to escape from the gravitational field of mass m_1. The sphere mass m_1 is in the center of coordinates. The light particle m_2 is located on the event horizon at a distance $r_{Schwarzschild}$ from the origin of coordinates. The particle m_2 moves away from the mass m_1 with the speed of light $v=c$. We set the kinetic energy equal to the energy that the particle needs to escape from the gravitational field. The gravitational force $F(r)$ is calculated by using the gravitational constant G of Newton. The energy is equal to power times way. Since the force changes with the distance r, we need the integral of the force F over the distance, from the starting point $r_{Schwarzschild}$ to infinity:

$$E_{Kinetics} = E_{Gravitation}$$

$$\frac{1}{2} * m_2 * v^2 = \int_{r_{Schwarzschild}}^{\infty} F_{(r)} dr = \int_{r_{Schwarzschild}}^{\infty} G * \frac{m_1 * m_2}{r^2} dr$$

$$\frac{1}{2} * m_2 * c^2 = \left[-G * \frac{m_1 * m_2}{r}\right]_{r_{Schwarzschild}}^{\infty} = G * \frac{m_1 * m_2}{r_{Schwarzschild}}$$

$$r_{Schwarzschild} = \frac{2 * G * m_1}{c^2}$$

Light that is closer to the point mass m_1 than the Schwarzschild radius $r_{Schwarzschild}$ can't escape from the gravitational field.

2.2.2. The event horizon for the elementary cylinder

Figure 4 shows a model, how light is captured and how an elementary particle is created. The model is an electromagnetic wave rotating in a cylindrical way. Now the light tries to escape from its own gravitational field. The event horizon for the elementary particle is determined in the same way as the Schwarzschild radius of a point mass was determined. The same formula is used as for a point mass. This can be explained by the fact that the electromagnetic wave consists of a punctiform photon. This photon moves in the direction of the Poynting vector and oscillates with the amplitude $\lambda 0$ through π in the direction of the magnetic field (blue line in Fig. 4). The punctiform photon is somewhere on the surface of the elementary cylinder. The energy of the electromagnetic wave is distributed with the electromagnetic field throughout the room.

$$\frac{1}{2} * m_2 * c^2 = \int_{r_{EH}}^{\infty} G * \frac{m_{1(r)} * m_2}{r^2} dr \qquad (2.1)$$

The mass m_1 is not a point mass, it is cylindrically. We can calculate the mass m_1 from the energy inside an electromagnetic field as a function from the radius r.

$$E_{(r)} = m_{1(r)} * c^2$$

$$m_{1(r)} = \frac{E_{(r)}}{c^2}$$

We are looking for an equation for the energy E(r) in the electromagnetic. The magnetic and electrical field energy is the same size for an electromagnetic wave, because the energy alternates between electrical energy and magnetic energy. They contribute equally to the curvature of space. It is sufficient if only the electrical energy density is examined in the equation and this energy is simply doubled.

The energy density of the electrical field is:

$$\omega_E = \frac{1}{2}\varepsilon_0(\vec{E})^2$$

The energy density of the magnetic field is:

$$\omega_M = \omega_E$$

The energy density of a cylindrical electromagnetic field is:

$$\omega_{EM} = \omega_E + \omega_M = 2 * \omega_E = \varepsilon_0 * (\vec{E})^2 = \varepsilon_0 * \left(\frac{e}{2\pi * r * h_{Zylinder}\, \varepsilon_0}\right)^2$$

The energy of the electromagnetic field is calculated by integrating the energy density over the cylinder volume from the event horizon r_{EH} to the radius r. [1]

$$E_{(r)} = \int_{r_{EH}}^{r} (\omega_{EM} * 2 * \pi * r * h_{Zylinder})\, dr$$

$$E_{(r)} = \int_{r_{EH}}^{r} \left(\frac{e^2}{4\pi^2 r^2 h_{Zylinder}^2 \varepsilon_0} * 2 * \pi * r * h_{Zylinder}\right) dr$$

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[1] The small r stands for the radius inside the elementary particle. The large R stands for the distance to a planetary mass (for example the earth's radius on the earth's surface).

$$E_{(r)} = \int_{r_{EH}}^{r} (\frac{e^2}{2\pi\, h_{Zylinder}\varepsilon_0})\ \frac{1}{r}\ dr$$

$$E_{(r)} = \frac{e^2}{2\pi\, h_{Zylinder}\varepsilon_0} (\ln \frac{r}{r_{EH}})$$

The function $E_{(r)}$ delivers the energy in the cylinder from the event horizon[2] to r. The result for the mass $m_1(r)$ is:

$$m_{1(r)} = \frac{E_{(r)}}{c^2} = \frac{e^2}{2\pi * \varepsilon_0 * c^2 * \ h_{Zylinder}} (\ln \frac{r}{r_{EH}})$$

If you insert the mass $m_1(r)$ in the equation (2.1) and shorten m_2 you get the integral:

$$\frac{1}{2} * c^2 = \frac{G * e^2}{2\pi * \varepsilon_0 * c^2 * \ h_{Zylinder}} \int_{r_{EH}}^{\infty} \frac{\ln \frac{r}{r_{EH}}}{r^2} dr$$

$$\frac{\pi * \varepsilon_0 * c^4 * \ h_{Zylinder}}{G * e^2} = \int_{r_{EH}}^{\infty} \frac{\ln \frac{r}{r_{EH}}}{r^2} dr$$

$$= \int_{r_{EH}}^{\infty} \frac{\ln r}{r^2} dr - \ \ln r_{EH} \int_{r_{EH}}^{\infty} \frac{1}{r^2} dr$$

For the calculation of the integral see appendix calculation B.

$$\frac{\pi * \varepsilon_0 * c^4 * \ h_{Zylinder}}{G * e^2} = \frac{1}{r_{EH}}$$

$$r_{EH} = \frac{G * e^2}{\pi * \varepsilon_0 * c^4 * \ h_{Zylinder}}$$

The cylinder height is proportional to the Compton wavelength λ_0.

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[2] This event horizon cannot capture photons. The wavelength of the photons is much larger than the diameter of the event horizon.

The radius of the elementary cylinder is inversely proportional to the Compton wavelength λ_0 of the elementary particle. This means that the diameter of the elementary particle increases the more energy the particle has.

$$r_{EH} = Konstante * \frac{1}{\lambda_0} \qquad (2.2)$$

2.3 Effects of the gravitational potential on the diameter of the elementary particle

The wavelength of an electromagnetic wave is changed by the gravitational potential. The following relationship applies to a spherically symmetrical gravitational potential as on the earth's surface[3]:

$$\frac{\lambda_2}{\lambda_1} = \sqrt{\frac{1 - \frac{R_s}{R_2}}{1 - \frac{R_s}{R_1}}} \qquad R_s = \frac{2 * G * M}{c^2}$$

M is the mass of the gravitational source (for example the mass of the earth)
R is the distance to the source of gravity
c is the speed of light
G is the gravitational constant

At location 1, which is R_1 from the center of the earth, the wavelength is λ_1. If the electromagnetic wave moves to location 2, where the distance from the center of the earth is R_2, the wavelength becomes λ_2.
If the electromagnetic wave falls down, the wavelength becomes shorter and the wave becomes more energetic. If the electromagnetic wave rises, the wavelength becomes longer and the electromagnetic wave loses energy.
The wavelength in the potential free room, at r_0 towards infinity, the wavelength is λ_0.
The wavelength in a curved space is:

$$\lambda_{(R)} = \lambda_0 * \sqrt{1 - \frac{R_s}{R}} = \lambda_0 * \sqrt{1 - \frac{2 * G * M}{c^2 * R}}$$

The electromagnetic wave that forms an elementary particle is changed by the gravitational field just like any other electromagnetic wave.
The radius of the elementary particle (2.2) is inversely proportional to the

[3] https://de.wikipedia.org/wiki/Rotverschiebung#Gravitative_Rot-_und_Blauverschiebung

wavelength. In the relativistic notation, the result for the radius of the elementary cylinder is:

$$r_{EH0} * \lambda_0 = r_{EH(r)} * \lambda_{(r)} = \text{Konstante}$$

$$r_{EH(r)} = \frac{r_{EH0} * \lambda_0}{\lambda_{(r)}} \qquad (2.3)$$

$$r_{EH\,(r)} = \frac{r_{EH0}}{\sqrt{1 - \frac{2 * G * M}{c^2 * R}}} \qquad (2.4)$$

The radius of the elementary cylinder changes in the gravitational field. For R towards infinity, the root becomes 1. For R against R_S the root becomes zero and r_{EH} becomes infinite.[4]

The radius of the elementary cylinder on the surface of the earth is smaller at the top than at the bottom. The elementary cylinder becomes a cone in the gravitational field. See figure 5.1

3. Gravitational acceleration

The gravitational acceleration *a* will be calculated. If the Poynting vector starts horizontally, it is deflected towards the larger diameter. This explains the "attraction" of the earth. From the point of view of the Poynting vector, it runs in a straight line on the surface of the elementary cylinder.

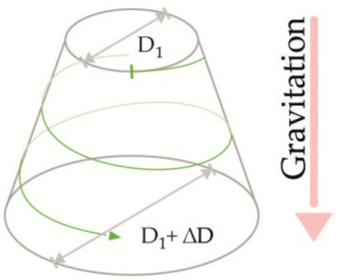

Figure 5.1: elementary cylinder in a gravitational field with the Poynting-vector (green)

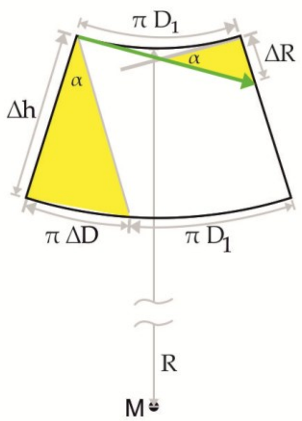

Figure 5.2: surface of the elementary cylinder

[4] This means that matter in a black hole becomes unstable or circles as an electromagnetic wave on the event horizon.

Conceptually, the elementary cylinder (Fig. 5.1) is cut open vertically and placed flat, as can be seen in Figure 5.2. One rotation of the Poynting vector (green) is examined. ΔR is the deflection after one rotation and the distance the elementary particle has fallen in this time.

A constant acceleration is assumed. Then ΔR according to Newton:

$$\Delta\mathrm{R} = \frac{1}{2} * \mathrm{a} * \Delta\mathrm{t}^2$$

$$\mathrm{a} = \frac{2 * \Delta\mathrm{R}}{\Delta\mathrm{t}^2}$$

The two cutting edges Δh of the elementary cylinder are at an angle α to each other. The angle α is much smaller than shown in Figure 5. It almost goes to zero. Matter falls to a depth of about 5 m on the earth's surface in one second. The Poynting vector has wound up around 300 000 km in one second. So the angle is very small α = 0.0000019 °.

We can specify the tan α as follows (see similar yellow triangles in Figure 5.2):

$$\tan\alpha = \frac{\Delta\mathrm{R}}{0{,}5 * \pi * D_1} = \frac{\pi * \Delta\mathrm{D}}{\Delta\mathrm{h}} \tag{4.1}$$

For ΔD divided by Δh we can use the derivative of function D(R) at point R. The equation is converted according to ΔR:

$$\Delta\mathrm{R} = \left(\frac{\pi^2 * \mathrm{D}_1}{2}\right) * \frac{d\mathrm{D}_{(\mathrm{R})}}{dR}$$

The time Δt the Poynting vector takes for one revolution is equal to the diameter divided by the speed of light:

$$\Delta\mathrm{t} = \frac{\pi * \mathrm{D}_1}{\mathrm{c}}$$

Than we get for the acceleration:

$$\mathrm{a} = \frac{2 * \Delta\mathrm{R}}{\Delta\mathrm{t}^2} = \frac{2 * \mathrm{c}^2}{\pi^2 * {\mathrm{D}_1}^2}\left(\frac{\pi^2 * \mathrm{D}_1}{2}\right) * \frac{d\mathrm{D}_{(\mathrm{R})}}{dR}$$

$$\mathrm{a} = \left(\frac{\mathrm{c}^2}{\mathrm{D}_1}\right) * \frac{\mathrm{dD}_{(\mathrm{R})}}{\mathrm{dR}} \tag{4.2}$$

We get the function $D_{(R)}$ by multiplying equation (2.4) by 2π.

$$D_{(R)} = \frac{D_0}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}} \tag{4.3}$$

The derivation of the function $D_{(R)}$, is still missing (see appendix Interim calculation A). This is the change in the diameter of the elementary cylinder in the direction of the gravitational field:

$$\frac{dD_{(R)}}{dR} = \frac{\frac{-D_0 * G * M}{R^2 * c^2}}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}^3} \tag{4.4}$$

The derivative (4.4) and the equation (4.3) are used in equation (4.2).

$$a_{(R)} = \left(\frac{c^2}{D_1}\right) * \frac{dD_{(R)}}{dR}$$

$$= \frac{c^2 * \sqrt{1 - \frac{2 * G * M}{R * c^2}}}{D_0} * \frac{\frac{-D_0 * G * M}{R^2 * c^2}}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}^3}$$

$$a_{(R)} = \frac{-G * M}{R^2 * (1 - \frac{2 * G * M}{R * c^2})} \tag{4.5}$$

Here the acceleration of gravity due to the curvature of space inside an electron was explained very clearly. We only followed the path of the Poynting vector on the elementary cylinder.

The gravitational acceleration is the Newton gravitational acceleration divided by the curvature factor:

$$(1 - \frac{2 * G * M}{R * c^2})$$

On earth, this curvature factor has the value: 0.9999999986078 and is therefore negligible. The factor can take values from 1 to 0.

If the factor is 0 and we change it to R, we get the Schwarzschild radius. In this case, the angle α is no longer very small and the approximation in equation (4.1) used above is not allowed.

Example: For an apple falling from the tree, we can enter the following values:

$G = 6.674 * 10^{-11} \frac{m^3}{kg * s^2}$

$M = 5.9722 * 10^{24}\ kg$

$r = 6\ 371\ 000\ m$

$c = 299\ 792\ 458\ \frac{m}{s}$ The gravitational acceleration a then results in: -9.81986 m / s²

The centrifugal force due to the earth's rotation was not taken into account.

4. Weight force

In order to prevent an apple from falling, a force F must act on the apple that counteracts the acceleration of gravity.

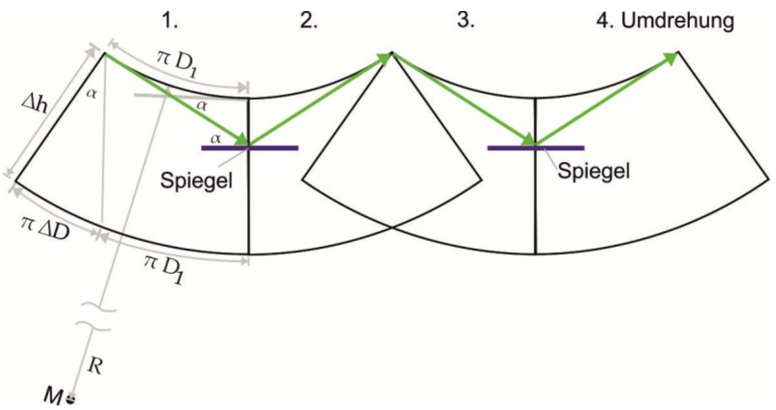

Figure 6: Four rotations of the Poynting vector on the surface of an elementary cylinder

Imagine the effect of this force with the help of an imaginary mirror. The imaginary mirror reflects the Poynting vector after the 1st rotation so that it arrives at the starting point after a 2nd rotation. A force acts on the mirror due to the radiation pressure[5] of the Poynting vector. This force should be calculated.
The angle of incidence on the mirror is
Θ = 90 ° - α. The force from the radiation pressure that the reflected Poynting vector transmits to the mirror is:

$$F = 2 * \cos\theta \frac{h * f}{c} * \frac{dN}{dt}$$

$\frac{dN}{dt}$ is the photon current or how often the Poynting vector hits the mirror per time.

The two in the equation results from the total reflection of the Poynting vector.

h is Planck's quantum of action, f is the frequency of light and c is the speed of light.

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[5] https://de.wikipedia.org/wiki/Strahlungsdruck

The Poynting vector hits the mirror once every second rotation ΔN = 1. Since the Poynting vector rotates at the speed of light around the elementary cylinder with diameter D, the following results for Δt is:

$$\Delta t = \frac{2 * \pi * D}{c}$$

The force is:

$$F = 2 * \cos(90° - \alpha)\,\frac{h * f}{c} * \frac{1 * c}{2 * \pi * D} = \ 2 * \sin\alpha\,\frac{h * f}{2 * \pi * D}$$

$$F = \ 2 * \ \tan\alpha\,\frac{h * f}{2 * \pi * D}$$

For small angles, the sin α is equal to the tan α. We know the tan α from equation (4.1).

$$\tan\alpha = \frac{\Delta R}{0{,}5 * \pi * D_1} = \frac{\pi * \Delta D}{\Delta h} = \frac{\pi * dD}{dR} \qquad (5.1)$$

We know the change in the diameter of the elementary cylinder in the direction of the gravitational field at point R from equation (4.4).

R is the distance to the mass M (R for an apple is the earth's radius).

$$\tan\alpha = \pi * \frac{\frac{-D_0 * G * M}{R^2 * c^2}}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}^{\,3}} \qquad (5.2)$$

The force is:

$$F = \ 2 * \frac{\frac{-D_0 * G * M}{R^2 * c^2}}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}^{\,3}}\,\frac{h * f}{2 * D} = \frac{D_0}{D} * \frac{-G * M * \ h * f}{R^2 * c^2 * \sqrt{1 - \frac{2 * G * M}{R * c^2}}^{\,3}}$$

We know the ratio of the diameter of the elementary cylinder D_0 in the non-curved space to the diameter D in the curved space from equation (4.3).

$$\left(\frac{D_0}{D}\right) = \sqrt{1 - \frac{2 * G * M}{R * c^2}} \qquad (5.3)$$

The force is:

$$F = \sqrt{1 - \frac{2 * G * M}{R * c^2}} * \frac{-G * M * \mathrm{h} * \mathrm{f}}{R^2 * c^2 * \sqrt{1 - \frac{2 * G * M}{R * c^2}}^3}$$

$$= \frac{-G * M * \mathrm{h} * \mathrm{f}}{R^2 * c^2 * (1 - \frac{2 * G * M}{R * c^2})}$$

We can replace the frequency of the electromagnetic wave f by the speed of light c divided by the wavelength λ:

$$F = \frac{-G * M * \mathrm{h}}{R^2 * c * \lambda * (1 - \frac{2 * G * M}{R * c^2})}$$

Example proton:
For a proton on the earth's surface with the Compton wavelength of
$\lambda = 1.321 * 10^{-15}$ m the force is: $F = 1.643 * 10^{-26}$ N

Let's interpret this equation:
The weight can be explained by the radiation pressure of the Poynting vector. The mirrors are of course the other elementary particles on which this force acts.

The transported energy of the Poynting vector is given by Planck's quantum of action h and the frequency: $E = h * f = h * c / \lambda$. The relationship between energy and mass is known from Einstein's formula $E = m * c^2$. The mass is $m_0 = E_0 / c^2 = h / (c * \lambda_0)$.

If you write the equation for the force only with the masses, you get:

$$F = \frac{-G * M * \mathrm{m_0}}{R^2 * (1 - \frac{2 * G * M}{R * c^2})}$$

This is Newton's law of gravity divided by the curvature factor, which can be neglected on Earth.

Example apple:
Apple mass $m_0 = 0.15$ kg

$G = 6.674 * 10^{-11} \ \frac{m^3}{kg * s^2}$

$M = 5.9722 * 10^{24} \ kg$

$R = 6\ 371\ 000 \ m$

The force with which the apple pulls on the tree is F = 1.473 N.

5. Gravitational time dilation

The elementary particle is considered a light clock. Every revolution of the Poynting vector around the elementary cylinder is like a ticking of the light clock. Since the Poynting vector moves at a constant speed of light, the ticking is influenced by the diameter of the elementary cylinder.

$$D = \frac{D_0}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}} \qquad (5.3)$$

The diameter increases in the curved room, the light clock ticks more slowly.

$$\Delta t = \Delta t_0 * \left(\frac{D_0}{D}\right)$$

$$\Delta t = \Delta t_0 * \sqrt{1 - \frac{2 * G * M}{R * c^2}} \qquad (5.4)$$

Example time delay at space station: time delay on Earth after one year compared to the space station at height H. The speed in both points is assumed to be v = 0:

$G = 6.674 * 10^{-11} \ \frac{m^3}{kg * s^2}$

$M = 5.9722 * 10^{24} \ kg$

$R = 6\ 371\ 000 \ m$

$c = 299\ 792\ 458 \ \frac{m}{s}$

$H = 400\ 000 \ m \ \ => \ \ R_{Raumstation} = R + H = 6\ 771\ 000 \ m$

t_0 in the non-curved space is 1 year = 365 * 24 * 60 * 60 s = 31536000 s.

Inserting these values into equation (5.4) gives Δt = 31535999.9793 s for the time in the space station. For the past time on the earth's surface Δt = 31535999.9780 s

1.3 milliseconds more time has been passed on the space station than on the earth's surface.

And 22 ms less time has passed on the surface of the earth than in the non-curved space. This is because the elementary cylinders on the surface of the earth are larger due to the curvature of the space and the Poynting vector takes longer for one rotation. The clock is ticking more slowly.

6. The gravitational field

To explain the gravitational potential, the masses are to be replaced by the electromagnetic fields of the elementary particles. In the first moment, this intention seems wrong and impossible. The electric field lines start with the positive charge (proton) and end with the negative charge (electron). The field lines do not leave the atom and have no influence on the gravitation, which is noticeable in the complete solar system. The gravitational field consists only of sources. Antigravity is not known. The electrical potential field is very different to the gravitational field.

The magnetic field lines of the magnetic spin also run in very small loops around the elementary particles and do not spread out into space.
There is a simple solution. Just look at the amounts of the electrical potential and assume that the positive and negative electric fields overlap. The potentials of the positive and negative charges are present in each point in space, and the sum is the electrical potential. Mass consists of electrons, protons and neutrons or electrons, up and down quarks. In a first approximation, the ratio of the numbers (A_i) of all elementary charges contained in a mass (M_i) to the mass (M_i) is constant. It is not easy to say whether the elementary charges or the masses are the reason for the gravitational potential.

$$\frac{A_i}{M_i} = Konstante \tag{5.1}$$

The static gravitational potential, at any point 1, generated from N point masses Mi in the distance Ri, is calculated as follows:

$$\phi_{\text{Punkt 1}} = \sum_{i=1}^{N} -\frac{G * M_i}{R_i} \tag{5.2}$$

N is the number of masses
M_i are the masses, they can only be positive
R_i is the distance to the mass M_i

The static electrical potential, at any point 1, generated from N point charges Q_i in the distance R_i, is calculated as follows:

$$\varphi_{\text{Punkt 1}} = \sum_{i=1}^{N} \frac{Q_i}{4 * \pi * \varepsilon_0 * R_i} \tag{5.3}$$

N is the number of charges
Q_i are the charges, they can be positive or negative
R_i is the distance to the charge Q_i

Only the amounts of the elementary loads and not the sign should be taken into account. This only represents the energy that each elementary particle emits in the form of its electrical field. The field energy is as high for a positive elementary particle with the same charge and at the same distance as for a negative elementary particle.
The amounts of all elementary charges $|Q_i|$ are replaced by the number of elementary charges A_i multiplied by the elementary charge e.

$$\sum_{i=1}^{N} \frac{|Q_i|}{4 * \pi * \varepsilon_0 * R_i} = \sum_{i=1}^{N} \frac{A_i * e}{4 * \pi * \varepsilon_0 * R_i} = \sum_{i=1}^{N} \frac{Konstante * e * M_i}{4 * \pi * \varepsilon_0 * R_i} \tag{5.4}$$

This equation is fundamentally different to the electrical potential (5.3) but it is proportional to the gravitational potential (5.2). If you can calculate the electrical potential at one point, you should also be able to calculate the gravitational potential. This procedure makes sense mathematically, but the question is if it makes physical sense to replace the masses with the charges for the gravitational calculation.
It could be that the energy in a point in space is the reason of gravitation. A single charged particle has a spherical electric field that is identical in shape to its gravitational field. The question is if these electrical fields are overlap.

7. Conclusion and outlook

The wavelength of electromagnetic waves in a space point depends on the total energy in this point. An electromagnetic wave moving towards a mass gets more energy (blue shift). In the electromagnetic model proposed here, the event horizon r_{EH} of an elementary particle with a stronger gravitational field becomes larger. This turns the event horizon into a cone in the gravitational field. The acceleration of gravity can be calculated using the course of the Poynting vector on the surface of the cone. The gravitational force can be determined with the course of the Poynting vector and the radiation pressure of the Poynting vector. If you consider the elementary particle as a light clock, the time change due to gravity can be calculated very clearly. The total energy at a point in space is generated by superimposing the field energies of all electromagnetic fields.

Outlook:

If we consider the electron exclusively as an electromagnetic wave, almost all of its physical quantities can be clearly explained.

The fine structure constant α is the ratio of the energies behind the event horizon (energy density at the event horizon multiplied by the volume of the elementary cylinder) to the energy before the event horizon (total energy of the particle).[6]

The elementary charge is created from the fact that the electric field lines find a beginning and an end on the event horizon. The elementary charge can be calculated with this model.[7]

[6] Gößling, Manuel; Physik – Rechnen mit dem Elementarzylinder
Das Elektron als elektromagnetische Welle; 2. Auflage 2018; ISBN 978-3-9819366-1-2

[7] http://manuel.goessling.info/Elementarladung%20Manuel%20Goessling.pdf

8. Appendix

8.1. Calculation A

$$\mathrm{D}_{(\mathrm{R})} = \frac{D_0}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}}$$

$$D_{(R)} = \frac{u}{v} \qquad D'_{(R)} = \frac{u' * v - v' * u}{v^2}$$

$$u = D_0 \qquad u' = 0$$

$$\mathrm{v} = \sqrt{1 - \frac{2 * G * M}{R * c^2}} = z^{\frac{1}{2}} \qquad \mathrm{v}' = f'_{(z)} * z'_{(R)}$$

$$f_{(z)} = z^{\frac{1}{2}} \qquad f'_{(z)} = \frac{1}{2} z^{-\frac{1}{2}}$$

$$z_{(R)} = (1 - \frac{2 * G * M}{R * c^2}) \qquad z'_{(R)} = \frac{2 * G * M}{c^2 * R^2}$$

$$\mathrm{v}' = f'_{(z)} * z'_{(R)} = \frac{1}{\sqrt{(1 - \frac{2 * G * M}{R * c^2})}} * \frac{G * M}{c^2 * R^2}$$

$$D'_{(R)} = \frac{\mathrm{dD}_{(\mathrm{R})}}{\mathrm{dR}} = \frac{\frac{-D_0 * G * M}{R^2 * c^2}}{\sqrt{1 - \frac{2 * G * M}{R * c^2}}^3}$$

8.2. Calculation B

$$F_{(r)} = \int_{r_{EH}}^{\infty} \frac{\ln r}{r^2} dr - \ln r_{EH} \int_{r_{EH}}^{\infty} \frac{1}{r^2} dr$$

$$\int f_{(r)} * g'_{(r)} \, dr = f_{(r)} * g_{(r)} - \int f'_{(r)} * g_{(r)} \, dr$$

$$f_{(r)} = \ln r \qquad g'_{(r)} = \frac{1}{r^2}$$

$$f'_{(r)} = \frac{1}{r} \qquad g_{(r)} = \frac{-1}{r}$$

$$F_{(r)} = \left[\ln r * \frac{-1}{r}\right]_{r_{EH}}^{\infty} - \int_{r_{EH}}^{\infty} \frac{1}{r} * \frac{-1}{r} * dr - \ln r_{EH} \int_{r_{EH}}^{\infty} \frac{1}{r^2} dr$$

$$= \left[-\frac{\ln r}{r}\right]_{r_{EH}}^{\infty} - \left[\frac{1}{r}\right]_{r_{EH}}^{\infty} - \ln r_{EH} * \left[\frac{-1}{r}\right]_{r_{EH}}^{\infty}$$

$$= \frac{\ln r_{EH}}{r_{EH}} - \left(0 - \frac{1}{r_{EH}}\right) - \ln r_{EH} * \left(-0 + \frac{1}{r_{EH}}\right)$$

$$= \frac{1}{r_{EH}}$$

8.3. Constants

Bohrsches Magneton

$\mu_B = 9.274096 * 10^{-24}$ $A * m^2$

Magnetisches Moment Elektron

$\mu_s = 9.28476462*10^{-24}$ $A * m^2$

Elektrische Feldkonstante

$\varepsilon_0 = 8.854185 * 10^{-12}$ $\frac{A*s}{V*m}$

Elektrische Elementarladung

$e = 1.6021917 * 10^{-19}$ C

Gravitationskonstante

$G = 6.6732 * 10^{-11}$ $\frac{m^3}{kg*s^2}$

Lichtgeschwindigkeit im Vakuum

$c = 299\ 792\ 458$ $\frac{m}{s}$

Magnetische Feldkonstante

$\mu_0 = 4 * \pi * 10^{-7}$ $\frac{V*s}{A*m}$

Plancksches Wirkungsquantum

$h = 6.62607004 * 10^{-34}$ Js

reduziertes Plancksches W.-q.

$\hbar = \frac{h}{2*\pi}$ Js

Ruhemasse des Elektrons oder des Positrons

$m_e = 9.109558 * 10^{-31}$ kg

Compton-Wellenlänge des Elektrons oder des Positrons

$\lambda_0 = 2.42631023 * 10^{-12}$ m

Feinstrukturkonstante

$$\alpha = \frac{1}{137{,}035999046} = \frac{e^2}{2 * \varepsilon_0 * h * c}$$

8.4. General formulas

Mass - energy

$$E = m * c^2 = h * f = \frac{h * c}{\lambda}$$

Speed of light

$$c = \lambda * f = \frac{1}{\sqrt{\varepsilon_0 * \mu_0}}$$

Fine structure constant:

$$\alpha = \frac{1}{137{,}035999046} = \frac{e^2}{2 * \varepsilon_0 * h * c}$$

Radiation pressure full reflection:

$$F = 2 * \cos\theta \frac{h * f}{c} * \frac{dN}{dt}$$

Kinetic energy:

$$E = \frac{1}{2} * m * v^2$$

Electric field of a cylinder in vacuum:

$$\vec{E} = \frac{Q}{2 * \pi * \varepsilon_0 * l} * \frac{1}{r} * \vec{e}_r$$

Electric field of a sphere charge in vacuum:

$$\vec{E} = \frac{Q}{4 * \pi * \varepsilon_0} * \frac{1}{r^2} * \vec{e}_r$$

Energy density of electromagnetic fields in vacuum:

$$\omega_{EB} = \omega_E + \omega_B = \frac{1}{2} * \varepsilon_0 * \overrightarrow{|E|}^2 + \frac{1}{2} * \frac{1}{\mu_0} * \overrightarrow{|B|}^2$$

$$= \varepsilon_0 * \overrightarrow{|E|}^2 = \frac{1}{\mu_0} * \overrightarrow{|B|}^2$$

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