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# The cause of gravity

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**Abstract**
An overwhelming number of the scientists assume today that the general relativity theory describes the gravity correctly. Here, another description of gravitation is presented. This new description is based on three pillars: 1. an extended mechanical view based on Newton's equations, 2. an electromagnetic view based on Maxwell's equations, 3. a quantum physical view describing gravity as a radiation phenomenon.

**Keywords:** gravitation, interaction particles of gravitation, magnetic monopoles

## 1. Introduction

While Newton described the laws of gravitation correctly and they are applied successfully for many decades, the general theory of relativity ART remains controversial among critical scientists. This is mainly due to the fact that a unification with the proven quantum mechanics does not succeed. Another reason is that neither Newton nor Einstein described the interaction of gravitation via exchange quanta, which should exist according to the basic physical understanding of interacting masses. A third reason not to be underestimated is the difficult handling of the ART, with which it is not even possible to determine in a simple way the orbital curves and final velocities of two celestial bodies which fall on each other from rest. All investigations, which are made in the present publication, refer for simplicity primarily to two-mass systems. Comprehensible calculation results are given by the example of earth and moon falling on each other from assumed rest and from their mean distance. Both celestial bodies are considered here as non-rotating isotropic spheres.

## 2. The mechanical description of gravitation

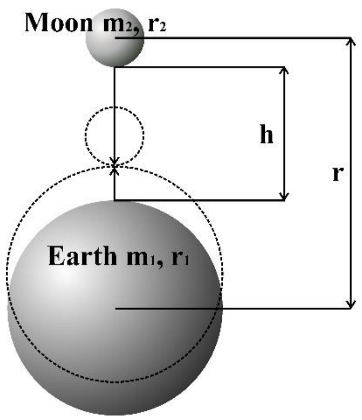


**Figure 1:** Model of free fall of moon and earth on each other

This description involves the principle of constant effects on each mass under their mutual gravitational influence and time dilation.

From the Newtonian gravitational force follows for a two-mass system the gravitational work under the assumption that two spherical masses $m_1$ and $m_2$ with their radii $r_1$ and $r_2$ from rest and their center distance $r$ fall on each other until their surfaces touch:

$$E_{grav} = \int_{r_1+r_2}^{r} F_{grav} ds = -\int_{r_1+r_2}^{r} \gamma \frac{m_1 m_2}{s^2} ds = \gamma \frac{m_1 m_2}{s} \Big|_{r_1+r_2}^{r} \quad (01)$$

$$r_b = r(r-h)/h \qquad \text{with the height} \qquad h = r - r_1 - r_2 \quad (02)$$

$$E_{grav} = \gamma m_1 m_2 \left(\frac{1}{r} - \frac{1}{r_1+r_2}\right) = -\gamma m_1 m_2 \frac{h}{r(r-h)} = -\gamma \frac{m_1 m_2}{r_b} \quad (03)$$

For the example earth and moon, which from assumed rest and their center distance $r$ fall on each other, the earth mass $m_1$ and the earth radius $r_1$ and the lunar mass $m_2$ and the moon radius $r_2$ a gravitational energy $\boldsymbol{E_{grav} = -3.54\ 10^{30}\ Ws}$. The value $r_b$ according to (02) is 8.29 $10^6\ m$.

It could be proved that on every mass under gravitational influence the principle of constant effect is valid [1.].

Thus for each mass is valid: $m_0\ t_0 c^2 = m_b\ t_b c^2 = N\hbar = const.$ (04)

The product of mass and a period of time that passes on it remains constant and corresponds to a certain number of $N$ of effects $\hbar$. The mass at rest is smaller than in the moving state and the time span at rest is larger in the moving state. Time passes more slowly on the moving object.

In equation (04) we can subtract from both sides the term $m_0 t_b$ can be subtracted from both sides. From this follows:

$$m_0 t_0 - m_0 t_b = m_b t_b - m_0 t_b \qquad \text{or} \qquad -\Delta t\ m_0 = \Delta m t_b \quad (05)$$

Thereby applies $\Delta m = m_b - m_0$ and $\Delta t = t_b - t_0$. The conversion of equation (05) leads to the specific time dilation $\Delta \mathrm{t}/t_b$ on each mass.

$$\frac{\Delta m_1}{m_1} = -\frac{\Delta t_1}{t_{1b}} \qquad \frac{\Delta m_2}{m_2} = -\frac{\Delta t_2}{t_{2b}} \quad (06)$$

The notation of gravitational energy by means of specific time dilation was last shown in [2.]

$$E_{grav} = -\Delta m_1 c^2 - \Delta m_2 c^2 = \frac{\Delta t_1}{t_{1b}} m_1\ c^2 + \frac{\Delta t_2}{t_{2b}} m_2\ c^2 \quad (07)$$

The specific time dilation is obtained for both masses as follows [3.]:

$$\frac{\Delta t_1}{t_{1b}} = -\frac{\gamma\ {m_2}^2}{c^2\ r_b\ (m_1+m_2)} = -8.00\ 10^{-14} \qquad \frac{\Delta t_2}{t_{2b}} = -\frac{\gamma\ {m_1}^2}{c^2\ r_b\ (m_1+m_2)} = -5.29\ 10^{-10} \quad (08)$$

To prove this, the specific time dilations from (08) are substituted into equation (07):

$$E_{grav} = -\frac{\gamma\ {m_2}^2}{c^2\ r_b\ (m_1+m_2)}\ m_1 \mathrm{c}^2 - \frac{\gamma\ {m_1}^2}{c^2\ r_b\ (m_1+m_2)}\ m_2 c^2 = -\gamma \frac{m_1 m_2}{r_b}$$

With equation (07) the sum convention for the free fall of the involved masses from rest and respective distance onto the center of gravity is valid for a many-mass system:

$$E_{grav} = -\sum_{n=1}^{n} E_{kin\ n} = -c^2 \sum_{n=1}^{n} \Delta m_{\mathrm{n}} = c^2 \sum_{n=1}^{n} \frac{\Delta t_{\mathrm{n}}}{t_{\mathrm{n}b}} m_{\mathrm{n}} \quad (09)$$

Newton had not recognized the change of the time flow on an object in consequence of movement or gravitation. However, as could be shown, this change does not contradict his law of gravitation. It is to be noted that there is nevertheless a universal time which is equally valid for all places in the universe, namely the age of the space. In relation to this there is a universal simultaneity.

The gravitational energy obtained in (03) can be equated to the negative sum of the known kinetic energy of both masses upon collision:

$$E_{grav} = -\gamma \frac{m_1 m_2}{r_b} = -\left(\frac{m_1 c^2}{\sqrt{1-\frac{v_1^2}{c^2}}} - m_1 c^2\right) - \left(\frac{m_2 c^2}{\sqrt{1-\frac{v_2^2}{c^2}}} - m_2 c^2\right) \approx -\frac{m_1}{2} v_1^2 - \frac{m_2}{2} v_2^2 \quad (10)$$

With (10) and the conservation of momentum $m_1 v_1 + m_2 v_2 = 0$ applies to the velocities [4.]:

$$v_1 = c\sqrt{1 - \frac{1}{\left[\frac{\gamma\, m_2^2}{c^2\, r_b\, (m_1+m_2)} + 1\right]^2}} \qquad v_2 = c\sqrt{1 - \frac{1}{\left[\frac{\gamma\, m_1^2}{c^2\, r_b\, (m_1+m_2)} + 1\right]^2}} \quad (11)$$

For earth and moon the following velocities result from the collision:

$$v_1 = 120\, m/s \qquad v_2 = 9{,}750\, m/s$$

Where does the energy come from, which leads to the velocities of the masses? Of course from the gravitational field. It was supplied with positive energy to the field when the masses were separated from each other in the space.

In this chapter, Newton's gravity was described including the principle of constant action (04) and time dilation (07). The principle of constant action prevents the compatibility of the general relativity theory with the quantum mechanics. The ART is valid for a so-called smooth space-time. It is known that quantum fluctuations take place on smallest space scales in vacuum. These are the stronger, the smaller the observation space is chosen [5.]. Virtual particles and antiparticles with energy "borrowed" from space can be created and annihilated in a very short time. Their possible existence is linked to the condition that the energy is returned within a time span which must be so small that the product of energy and the time span of the created quantum is smaller than the Planck's quantum of action $\hbar$. This can be interpreted as a quantization condition. Equation (04), which was applied here in the calculation, describes exactly the necessary quantization of the product from energy and time with the gravity, because $\hbar$ is indivisible. The equivalence principle of the ART is valid only if one restricts his consideration to a very small space region, because the gravitational field strength is location dependent. However, the principle presupposes a uniform gravitational field. So it can work only for smallest space regions, where it can be assumed that in these regions the uniformity of the field strength is given. The resulting virtual particles (quantum foam), which may well have high energies in extremely short times, prevent a uniform gravitational field strength. This known contradiction cannot be solved with the ART.

## 3. The electromagnetic description of gravitation

Analogous to the force between two electric charges, which can be calculated with Coulomb's law, the force between two magnetic charges follows. As is well known, Coulomb's law can be derived from Maxwell's equations.

The gravitational force in space is a magnetic force. The magnetic charges show up in the mass effect. It is astonishing that masses with the same polarity attract each other and do not repel each other as observation teaches us. The magnetic force can be calculated with the following formula:

$$F_{grav} = -\frac{N_{p1} N_{p1} p^2}{4\pi\mu_0 r^2} = -\gamma \frac{m_1 m_2}{r^2} \qquad N_{p10} = \frac{m_1}{p}\sqrt{4\pi\mu_0\gamma} \quad N_{p20} = \frac{m_2}{p}\sqrt{4\pi\mu_0\gamma} \quad (12)$$

Thereby $p$ is the elementary magnetic charge. It can be calculated as follows [6.]:

$$p = \sqrt{4\pi\mu_0 \alpha_{em} c\hbar} = 6.036\ 10^{-17}\ Vs \quad (13)$$

The supposed number $N_{p10}$ and $N_{p20}$ of magnetic monopole charges $p$ is for earth and moon: $N_{p10} = 3.215\ 10^{33}$ $N_{p20} = 3.954\ 10^{31}$

Although the magnetic force between two magnetic elementary charges in space would be as large as the electric force between two electric elementary charges, we can detect the magnetic force only very weakened. We observe the force effect of the magnetic monopoles in space. Since they are in time, as will be shown, their magnetic effect is reduced by a factor of $\alpha_{grav}/\alpha_{em} = F_{grav}/F_{em}$ [7.]. Therefore the real number of magnetic monopoles must be higher by this factor. This can be made clear also with the gravitational force between proton and electron. It is valid:

$$F_{grav} = F_e \frac{\alpha_{grav}}{\alpha_{em}} = \gamma \frac{m_e m_p}{r^2} = \frac{e^2}{4\pi\varepsilon_0 r^2} \frac{\alpha_{grav}}{\alpha_{em}} \qquad (14)$$

For the force between two magnetic monopoles of equal weight $m_{mono}$ as charges of gravitation can be written:

$$F_{grav} = F_m \frac{\alpha_{grav}}{\alpha_{em}} = \gamma \frac{m_e m_p}{r^2} = \gamma \frac{{m_{mono}}^2}{r^2} = \frac{p^2}{4\pi\mu_0 r^2} \frac{\alpha_{grav}}{\alpha_{em}} \qquad (15)$$

The actual number $N_p$ of the magnetic monopoles is shown by equation (16). Since for the determination of the gravitational force in the two-mass system both masses must be multiplied with each other, the ratio occurs $\alpha_{grav}/\alpha_{em}$ occurs in the square root:

$$N_{p1} = N_{p10}\sqrt{\frac{\alpha_{em}}{\alpha_{grav}}} \qquad N_{p2} = N_{p20}\sqrt{\frac{\alpha_{em}}{\alpha_{grav}}} \qquad (16)$$

It is remarkable that the interaction constant $\alpha_{grav}$ can be written as the ratio of the proton radius to the diameter of the universe:

$$\alpha_{grav} = \frac{\gamma m_e m_p}{\hbar c} = \frac{r_p}{2r_{uni}} = \frac{r_p}{2ct_{uni}} \qquad (17)$$

$$F_{grav} = -\frac{N_{p1}N_{p2}\, p^2}{4\pi\mu_0 r^2}\frac{\alpha_{grav}}{\alpha_{em}} = -\frac{N_{p1}N_{p2}\, p^2}{4\pi\mu_0 r^2}\frac{r_p}{2\alpha_{em} r_{uni}} \qquad (18)$$

$$N_{p1} = \frac{m_1}{p}\sqrt{4\pi\mu_0\gamma\frac{\alpha_{em}}{\alpha_{grav}}} \qquad N_{p2} = \frac{m_2}{p}\sqrt{4\pi\mu_0\gamma\frac{\alpha_{em}}{\alpha_{grav}}} \qquad (19)$$

Herewith the number of the monopoles $N_{p\,uni}$ in the universe is to be found.

$$N_{p\,uni} = \frac{m_{uni}}{p}\sqrt{4\pi\mu_0\gamma\frac{\alpha_{em}}{\alpha_{grav}}} \quad {N_{p\,uni}}^2 = \frac{{m_{uni}}^2}{p^2}4\pi\mu_0\gamma\frac{\alpha_{em}}{\alpha_{grav}} \qquad (20)$$

$${N_{p\,uni}}^2 = \frac{{m_{uni}}^2}{4\pi\mu_0 c\alpha_{em}\hbar}4\pi\mu_0\gamma\frac{\alpha_{em}}{\alpha_{grav}} = \frac{{m_{uni}}^2}{c\hbar}\frac{\gamma}{\alpha_{grav}} \qquad (21)$$

$${N_{p\,uni}}^2 = \frac{{m_{uni}}^2}{c\hbar}\frac{\gamma\hbar c}{\gamma m_e m_p} = \frac{{m_{uni}}^2}{m_e m_p} \qquad N_{p\,uni} = \frac{m_{uni}}{\sqrt{m_e m_p}} = 4.5\ 10^{81} \qquad (22)$$

A plausible and beautiful result. As equation (22) impressively shows, the number of magnetic monopoles in the universe corresponds to the number of electric charges. North poles and south poles could be of equal weight. If a monopole could exist in space, it would weigh according to (22) $m_{mono} = \sqrt{m_e m_p}$ weigh. Equation (22) is universally valid. It can be applied to any mass. Thus the number of monopoles follows alternatively from equation (19) or (22):

$$N_{p1} = 1.531\ 10^{53} \qquad N_{p2} = 1.883\ 10^{51}$$

The total number of effects in the universe can now be calculated with several formulas, for example with its mass $m_{uni}$ and its age $t_{uni}$ can be calculated:

$$N_{uni} = \frac{m_{uni}t_{uni}c^2}{\hbar} = \sqrt{2{N_{p\,uni}}^3\sqrt{\frac{m_e}{m_p}}} = \sqrt{\frac{2{m_{uni}}^3}{m_e {m_p}^2}} = 6.5\ 10^{121} \qquad (23)$$

Also equation (23), which is very similar to (22) and was used here for the universe, is generally valid and can be applied to any mass. Thus for the masses of earth and moon during the gravitational time dilatations $\Delta t_1$ and $\Delta t_2$:

$$N_1 = \frac{m_1 \Delta t_1 c^2}{\hbar} = \sqrt{\frac{2{m_1}^3}{m_e {m_p}^2}} = 1.294\ 10^{79} \qquad N_2 = \frac{m_2 \Delta t_2 c^2}{\hbar} = \sqrt{\frac{2{m_2}^3}{m_e {m_p}^2}} = 1.766\ 10^{76}$$

The number of total effects in the universe can be calculated with the number of monopoles. The following correlations were found as by-products:

$$\frac{N_{p1}}{N_{p2}} = \frac{m_1}{m_2} \qquad \frac{N_1}{N_2} = \sqrt{\frac{{m_1}^3}{{m_2}^3}} \tag{24}$$

$$\frac{\Delta m_1}{\Delta m_2} = \frac{{\Delta t_2}^2}{{\Delta t_1}^2} \tag{25}$$

A quite astonishing formula results also with equation (23) and the equation for the space age $t_{uni} = \gamma m_{uni}/c^3$:

$$\gamma = \frac{2\hbar^2}{c\ t_{uni}\ m_e {m_p}^2} \tag{26}$$

This means that the Newtonian gravitational value $\gamma$ must change with the time (the space age)! I have already published this several times [8.].

Based on equation (04), (27) shows the number of effects $N\hbar$which occur as a result of the time dilation $\Delta t$ for the mass.

$$N\hbar = -m\ \Delta t\ c^2 = \Delta m\ t_b c^2 \tag{27}$$

To get from the gravitational force to the gravitational energy, the integration in equations (01) to (03) can be applied to equation (18). From this follows then generally for two isotropic spherical masses which collide at the example earth and moon:

$$E_{grav} = -\frac{N_{p1} N_{p2}\ p^2}{4\pi\mu_0 r_b} \frac{\alpha_{grav}}{\alpha_{em}} \qquad \boldsymbol{E_{grav} = -3.54\ 10^{30}\ Ws} \tag{28}$$

As already shown with equation (27), it is possible to calculate the absolute time dilation of a mass. The absolute time dilation $\Delta t_x$ of an arbitrary mass $m_x$ is independent of the other object masses involved in gravity. This is true neither for the time dilation $t_b$ in the moving state and not even for the time span $t_0$ in the rest state:

$$\Delta t_x = -\frac{N_x \hbar}{m_x c^2} \tag{29}$$

As will be shown later at the gravitational frequency, the time interval $t_b$ in the moved state of the mass has a special meaning!

At the free fall of earth and moon on each other come for the time dilation $\Delta t$ and the mass increase $\Delta m$ the following results are obtained:

$$\Delta t_1 = -2.54\ 10^3 s \qquad \Delta t_2 = -2.82\ 10^2 s$$

$$\Delta m_1 = 4.78\ 10^{11} kg \qquad \Delta m_2 = 3.89\ 10^{13} kg$$

For the time interval $t_b$ in the moving state then applies with equation (06) for the masses:

$$t_{1b} = -\frac{\Delta t_1}{\Delta m_1} m_1 = 3.18\ 10^{16} s \qquad t_{2b} = -\frac{\Delta t_2}{\Delta m_2} m_2 = 5.33\ 10^{11} s$$

The time span $t_0$ As expected, it can hardly be distinguished from the time span $t_b$:

$$t_{10} = t_{1b} - \Delta t_1 = 3.18\ 10^{16} s + 2.54\ 10^3 s \approx 3.18\ 10^{16} s$$

$$t_{20} = t_{2b} - \Delta t_2 = 5.33\ 10^{11} s + 2.82\ 10^2 s \approx 5.33\ 10^{11} s$$

As can be seen, these time spans are $t_0$ and $t_b$ which occur as a result of gravitation, are extremely long. In chapter 5 the connection to the gravitational wave frequency is established.

**4. The quantum physical description of gravity as a radiation phenomenon**

In the following derivation of gravity from quantum physics, the gravitational effect is obtained from a special temperature radiation of one-dimensional radiators.

During the expansion of the universe presumably the ether photons appearing as quanta radiate from the area of monopoles, which are in one-dimensional temporal order. The expansion of the universe is a repulsive process, it decays the neutrinos postulated by Wolfgang Pauli into monopoles and ether photons. These are quanta whose velocity in space is $c_i = ic$ is. They couple to the monopoles and can transfer their magnetic effect instantaneously. Magnetic north and south poles form the time, north poles the future and south poles the past. More monopoles exist in the region of large masses, and here field strength and time formation are greater. The informal structure of the decayed neutrinos becomes a time period, which represents the simplest information system by its order. This is shown by the information-time equivalent [9.].

$$I = \frac{1}{2}\frac{dA}{dt} = \frac{1}{2}\frac{dr^2}{dt} = \frac{1}{2}\frac{dc^2t^2}{dt} = tc^2 \quad ® \qquad (30)$$

Equation (30) shows one half of the time emergence at the structural decay of neutrinos $dA/dt$ for example the emergence of the future from magnetic north poles. At the same time, however, just as much past arises from magnetic south poles.

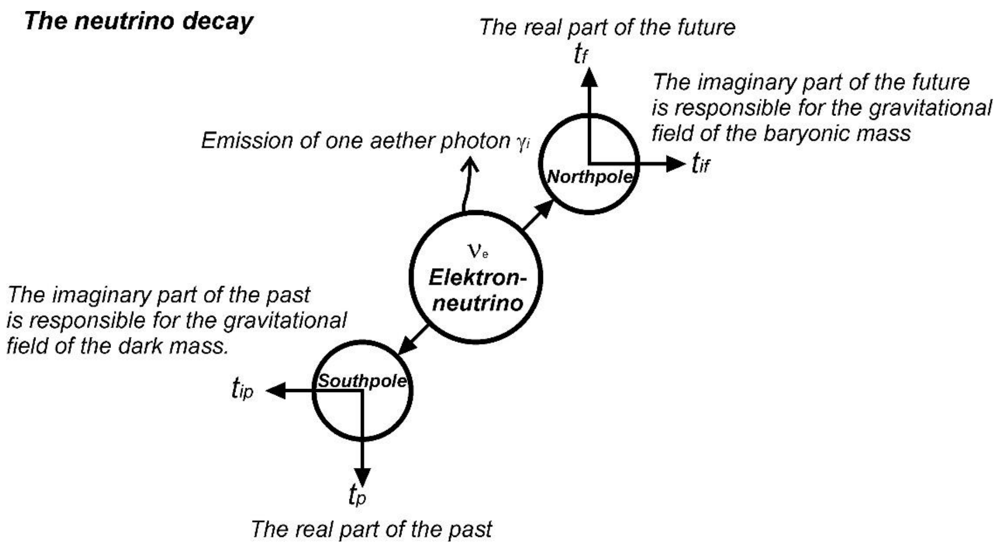


**Figure 2:** Model of neutrino decay into a north pole and a south pole.

With the structure-forming gravity it is exactly the other way round: Magnetic monopoles fuse to neutrinos. Each neutrino consists of a north pole, a south pole and of two ether photons. In this process, the ether photons also mediate the instantaneous attractive gravitational effect between the masses. The source of the radiation are the monopoles of time and therefore their magnetic effect occurs in space only very weakened. A peculiarity is that this process takes place, so to speak, backwards in time, because monopoles are erased from time. Therefore masses with the same polarity are observed as attracting. So it is a repulsion which proceeds backwards in time. With the acceleration of both masses to the common center of gravity, the gravitational time dilation at the surfaces of the masses increasingly becomes a velocity-induced time dilation. While falling objects become richer in energy with the velocity, a structure formation must also begin with the growing mass. This happens in the form of the formation of neutrinos in the objects. Thereby the object masses involved in the gravitation are increased. With the time dilation $\Delta t$ it comes to a length contraction $\Delta s = s_b - s_0$ in the direction of motion with $s_b = s_0\sqrt{1 - v^2/c^2}$. This contraction, which goes hand in hand with the time dilation, affects both the space area of the object and the object itself [10.]. Consequently, space is erased or formed as in the case of mass decay and not "curved".

Why doesn't the entire universe collapse as a result of gravitational effects? The answer is simple. The universe pulsates and is in the expansion cycle of this oscillation. Taken for itself the universe cannot pulsate, because every oscillator needs an oscillation partner. What is meant by the pulsation of the universe is that the masses vibrate in interaction with the space. In pulsation, alternately the masses and the space could act as energy storage.

While the baryonic masses possess a positive energy, their gravitational field in the space possesses a negative gravitational energy. The gravitational field, which is strongest near the masses, could be due to the imaginary time component of the time-forming north poles interacting with ether photons (see Figure 2). The gravitational field of the north poles forming the future couples to the baryonic masses. It is the gravitational field we are familiar with. What happens to the imaginary time part of the south poles, which form the past? It is assumed here that the south poles are repelled by the north poles, but the south poles attract each other and settle in the outer region of the galaxies. There their imaginary time part in interaction with ether photons forms a gravitational field with positive field energy repulsive from baryonic mass. This could be an explanation for the dark mass. This ensures that the baryonic masses of the stars, which rotate in the outer area of galaxies, are repelled by the positive field and are pressed into the inner area of the galaxies.

If masses are separated from each other under supply of positive energy in the space, this energy is stored as negative potential gravitational energy in the space. During the free fall of two masses onto each other, the positive separation energy previously added to the gravitational field is released to the masses in the form of kinetic energy.

As the universe expands, we observe the case of separation of masses. So, positive energy must be supplied to the gravitational field to build up the potential. Where does this positive energy come from? From the masses themselves, they become smaller with the expansion. Consequently, as space ages, the mass energy falls and the negative field energy rises. Its increase means that it becomes less negative. By the mass decay also the positive field energy of the south poles in the outer area of galaxies increases. This field energy, which is considered today as dark mass, could be formed, as already mentioned, with ether photons from the imaginary time part of the south poles. Since south poles attract each other, neighboring galaxies become more and more attractive to each other as their positive field energies increase. Above a certain magnitude of the positive field energy of galaxies, this mutual attraction could lead to the swinging back of the hitherto expanding universe. The neutrino decay would be terminated. A neutrino fusion would have to begin with which time and space would be erased. The universe would contract. In principle also an antineutrino fusion would be conceivable, since the antineutrino could consist exactly like the neutrino of a magnetic north and a magnetic south pole. With this structure, the neutrino could also be its own antiparticle.

The informal aspect of the decay of baryonic mass in the expansion of the universe is that time must emerge from the mass structure.

The mechanism of gravitation is now to be captured formulaically. For this the energy density is calculated for the one-dimensional radiator [11.]. The energy within the radiator is stored in electromagnetic natural oscillations (in the form of standing waves), the modes. The occupation probability of a mode with bosons $f(\nu)$ is given by the Bose-Einstein distribution function:

$$f(\nu) = \frac{1}{e^{h\nu/kT} - 1} \quad (31)$$

For the quantum mechanical energy per mode $\epsilon_{qm}$ holds (32) with the energy $h\nu$ of a boson with integer spin. This should be valid for ether photons as exchange particles.

Thereby are $h$ the Planck quantum of action, $\nu$ the frequency, $k$ the Boltzmann constant and $\mathcal{T}$ the radiation temperature of the one-dimensional radiator:

$$\epsilon_{qm} = h\nu\, f(\nu) = \frac{h\nu}{e^{h\nu/k\mathcal{T}}-1} \tag{32}$$

In each case neutrinos are created from a magnetic north pole and a magnetic south pole. It is a time extinction process. While at the expansion of the universe mass decays and time is created from its structure, at the gravity in the masses structure is created and time is erased for it. This shows the time dilation. The unification of the monopoles in the objects to neutrinos is a consequence of the gravitational radiation. With the spectral mode density $g(\nu) = 2L/c$ and the length of the radiator $L$ follows the spectral energy density $u(\nu)$ of the one-dimensional radiation law:

$$u(\nu) = \frac{g(\nu)\,\epsilon_{qm}}{L} = \frac{2}{c}\frac{h\nu}{e^{h\nu/k\mathcal{T}}-1} \tag{33}$$

The reciprocal of the mode spectral density is the lowest possible frequnez of the mode.

The total energy density $u$ of the one-dimensional blackbody radiator is obtained by integrating the spectral energy density over the entire frequency range:

$$u = \int_0^\infty u(\nu)\,d\nu = \frac{2}{c}\int_0^\infty \frac{h\nu}{e^{h\nu/k\mathcal{T}}-1}d\nu \tag{34}$$

With the substitutions $x = \frac{h\nu}{k\mathcal{T}}$ and $d\nu = \frac{k\mathcal{T}}{h}dx$ it follows for the total energy density $u$:

$$u = \frac{2}{c}\frac{k^2\mathcal{T}^2}{h}\int_0^\infty \frac{x}{e^x-1}dx = \frac{2}{c}\frac{k^2\mathcal{T}^2}{h}\frac{\pi^2}{6} = \frac{k^2\mathcal{T}^2}{c\,h}\frac{\pi^2}{3} \tag{35}$$

The law according to (35) is well known and is called one-dimensional Stefan-Boltzmann law. For the internal energy $U$ of the one-dimensional radiator is valid with the total energy density $u = a_{1d}\mathcal{T}^2$ and its length $L$ [12.]:

$$U = uL = a_{1d}L\mathcal{T}^2 \tag{36}$$

Here is $a_{1d}$ is the one-dimensional radiation constant. For this it results from equations (35) and (36):

$$a_{1d} = \frac{u}{\mathcal{T}^2} = \frac{k^2}{c\,h}\frac{\pi^2}{3} = \frac{k^2}{c\,\hbar}\frac{\pi}{6} \tag{37}$$

How to calculate the one-dimensional radiation constant $\sigma_{1d} = xa_{1d}$ which is directly comparable with the Stefan-Boltzmann constant $\sigma_{3d}$ and which can be calculated without further coefficients in the power $P_{1d}$ according to equation (38) for the one-dimensional radiator? The SI units of $a_{1d}$ and $\sigma_{1d}$ must be in agreement (see also the well-known derivation for the three-dimensional radiation case).

$$P_{1d} = \sigma_{1d}\mathcal{T}^2 = xa_{1d}\mathcal{T}^2 \tag{38}$$

$$x = \frac{6c}{\pi} \tag{39}$$

Equation (39) is initially an assumption which serves to make all further coefficients in the radiation constant $\sigma_{1d}$ to disappear:

$$\sigma_{1d} = xa_{1d} = \frac{6c}{\pi}\frac{k^2}{c\,\hbar}\frac{\pi}{6} = \frac{k^2}{\hbar} \tag{40}$$

The calculation of the radiation constant $\sigma_{1d}$ according to equation (40) is verified below. For the radiant power $P_{1d}$ of the one-dimensional radiator follows:

$$P_{1d} = \sigma_{1d}\,\mathcal{T}^2 = \frac{k^2}{\hbar}\mathcal{T}^2 \tag{41}$$

The number $N$ of effects corresponds to the number of one-dimensional radiation modes. With the one-dimensional Stefan-Boltzmann constant consequently applies:

$$P_{1d\;ges} = N\;\sigma_{1d}\mathcal{T}^2 = N\;\frac{k^2}{\hbar}\mathcal{T}^2 \tag{42}$$

Two masses differ in number $N_1$ and $N_2$ their radiation effects with their respective beam temperature $\mathcal{T}_1$ and $\mathcal{T}_2$.

$$P_{grav} = N_1\frac{k^2}{\hbar}\mathcal{T}_1{}^2 + N_2\frac{k^2}{\hbar}\mathcal{T}_2{}^2 \tag{43}$$

The radiant energy $\epsilon$ for each individual mode corresponds to the energy of two monopoles with beam temperature $\mathcal{T}$. The beam temperatures are extremely low. At the free fall of earth and moon on each other the temperatures result $\mathcal{T}_1 = 2.40\;10^{-28}\;K$ and $\mathcal{T}_2 = 1.43\;10^{-23}\;K$. From statistical physics it is known that in thermal equilibrium the average energy per mode and degree of freedom is $k\mathcal{T}/2$ is. Each mode is composed of a north and a south pole, both of which can move in one time direction each. Consequently, each mode has two degrees of freedom:

$$\epsilon = 2\frac{k\mathcal{T}}{2} = k\mathcal{T} \tag{44}$$

Every electromagnetic wave can absorb energy only in quantized portions. $h\nu$ absorbed. The photon energy stored in each mode is $nh\nu$ with $n$ as the number of photons. For each mode, one photon exists in the form of a special ether photon (figure 2):

$$\epsilon = h\nu \tag{45}$$

Consequently, it can be written with equations (44) and (45):

$$k\mathcal{T} = h\nu = \frac{h}{T} = \frac{\hbar}{t} \tag{46}$$

What is the reduced period $t$ of the one-dimensional radiation from equation (46)? Here I could make the following surprising discovery: The size of the period $t$ corresponds exactly to the reduced period $t_b$ on each moving mass at the collision due to gravity.

$$t = t_b = \frac{\hbar}{k\mathcal{T}} \tag{47}$$

For the time periods $t_{1b}$ and $t_{2b}$ on both masses then applies with the two different beam temperatures $\mathcal{T}_1$ and $\mathcal{T}_2$.

$$t_{1b} = \frac{\hbar}{k\mathcal{T}_1} \qquad\qquad t_{2b} = \frac{\hbar}{k\mathcal{T}_2} \tag{48}$$

Since the masses become heavier from their distance in the rest position until their collision, probably fusions of magnetic monopoles from time to neutrinos take place in them, as explained above. The idea is unusual, however, the source of radiation is in the time whose density is greatest at the location of the center of gravity of both masses. This is the place where in the moved state $b$ the masses meet and at which the time interval $t_b$ exists.

If equation (48) is inserted into (43), the gravitational power is obtained $P_{grav}$ between two masses in the moving state $b$ [13.]:

$$P_{grav} = N_1\frac{\hbar}{t_{1b}{}^2} + N_2\frac{\hbar}{t_{2b}{}^2} \tag{49}$$

For $N$ monopole effects of any mass can be written with time dilation $\Delta t$ can be written (see equation (27)):

$$N_1\hbar = -m_1\Delta t_1 c^2 \qquad N_2\hbar = -m_2\Delta t_2 c^2 \tag{50}$$

Since the time dilation $\Delta t = t_b - t_0$ is less than zero in the case of attraction of masses, a positive total effect in equation (50) results in the negative sign. This means that the time interval $t_0$ is greater than the time interval $t_b$. For (49) can be written with (50):

$$P_{grav} = -m_1 \frac{\Delta t_1}{t_{1b}{}^2} c^2 - m_2 \frac{\Delta t_2}{t_{2b}{}^2} c^2 \tag{51}$$

One arrives from (51) to the gravitational energy by integrating the power over time $t_b$ is integrated:

$$E_{grav} = \int P_{grav}\, dt_b = \int \left(N_1 \frac{\hbar}{t_{1b}{}^2} + N_2 \frac{\hbar}{t_{2b}{}^2}\right) dt_b = -N_1 \frac{\hbar}{t_{1b}} - N_2 \frac{\hbar}{t_{2b}} + c \tag{52}$$

The integration constant $c$ is zero, as the comparison of equation (07) with (53) shows.

Equation (50) and (52) can then be used to write the equation (07) already derived above without any problems:

$$E_{grav} = \frac{\Delta t_1}{t_{1b}} m_1\, c^2 + \frac{\Delta t_2}{t_{2b}} m_2\, c^2 \tag{53}$$

For earth and moon equation (53) applies again $\boldsymbol{E_{grav} = -3.54\ 10^{30}\ Ws.}$ This result also means that the equations (39) and (47) are admissible and correct.

**5. Gravitational waves**

Equation (27) can be transferred into a frequency notation. In this way one arrives at the respective gravitational frequency of the mass.

$$t_b = \frac{T_b}{2\pi} = \frac{N\hbar}{\Delta m c^2} \tag{54}$$

$$f = \frac{1}{T_b} \qquad f_1 = \frac{\Delta m_1 c^2}{N_1 h} \qquad f_2 = \frac{\Delta m_2 c^2}{N_2 h} \qquad \text{with} \quad h = 2\pi\hbar \tag{55}$$

With this calculation rule the earth and the moon have the following gravitational frequencies:

$$f_1 = 5.01\ 10^{-18}\ Hz \qquad f_2 = 2.99\ 10^{-13}\ Hz$$

With these frequencies of the gravitational waves the gravitational energy for the two masses results one more time:

$$E_{grav} = -N_1 h f_1 - N_2 h f_2 \qquad \boldsymbol{E_{grav} = -3.54\ 10^{30}\ Ws} \tag{56}$$

The wavelengths, which result from it, are imaginary and cannot be determined in the space, because the longitudinal waves are in the second temporal dimension, the imaginary present. $t_i = it$ imaginary present. They propagate, as will be shown below, with the propagation velocity of gravitation $c_i = ic$ without time delay instantaneously.

$$\lambda_1 = \frac{c_i}{f_1} \qquad \lambda_2 = \frac{c_i}{f_2} \tag{57}$$

On the other hand, the de Broglie matter wavelengths $\lambda_{dB1} = \lambda_{dB2} = h/(m_1 v_1) = h/(m_2 v_2)$ are equal for both masses, because the amounts of the impulses of both masses are equal. These wavelengths are extremely small and therefore not measurable in space.

The ART assumes a propagation of gravity with speed of light. Gravitation, however, spreads instantaneously in the space about the one-dimensional present. This is part of the imaginary time as second temporal dimension. The instantaneous propagation can be described as propagation with the velocity $c_i$ in the imaginary present $t_{ig}$ conceived. Since it is a propagation in only one dimension, gravity waves can be only longitudinal waves. Direction of oscillation and direction of propagation must coincide. How can the propagation speed of these waves be proved?

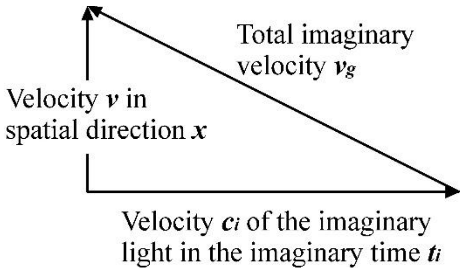


**Figure 3:** Model of the addition of a space velocity with the velocity of imaginary light

Let us assume that gravitational waves travel longitudinally with an imaginary speed of light $c_i = ic$ in a second time dimension $t_i = it$ oscillate. Gravitational waves would have to occur in a two-mass system as it is described here in all chapters. The second temporal dimension $t_i$ is perpendicular to all three space dimensions and the real time dimension $t$. Since one can assign the direction of motion of two masses falling on each other to a space direction, the second temporal dimension is also perpendicular on the direction of motion $x$. Let us look at the collision of both masses. Here it should come to a vectorial addition of the object velocity and the gravitational wave velocity (see figure 3).

$$v_g = \sqrt{{c_i}^2 + v^2} = \sqrt{v^2 - c^2} \qquad (58)$$

How can the result from equation (58) be checked? With a special conservation of momentum $p_s$, which includes the velocity of the gravitational waves [14.]. The mass $m$ at rest and with the velocity $c_i$ of the gravitational waves would have to have the same momentum as the mass in motion $m_b$ with the velocity $v_g$ which results from the object and the velocity of the gravitational waves. This consideration assumes a second time dimension $t_i$ by which together with ether photons the field energy arises and which interacts with all object masses. As a second temporal dimension, it is, so to speak, "the missing element" for a more complete description of nature.

$$p_s = mc_i = m_b v_g = m_b\sqrt{v^2 - c^2} \qquad (59)$$

Equation (59) is to be converted according to the moving mass $m_b$ and simplified:

$$m_b = \frac{mc_i}{\sqrt{v^2-c^2}} = \frac{m}{\sqrt{\frac{v^2}{{c_i}^2} - \frac{c^2}{{c_i}^2}}} = \frac{m}{\sqrt{1-\frac{v^2}{c^2}}} \qquad (60)$$

The equation shows in the result the known velocity-dependent increased relativistic mass. This is the proof that the conservation of momentum according to equation (59) exists. How can now finally the propagation velocity of gravitational waves with $c_i$ be proved? If both masses have their velocity-conditioned mass increases $\Delta m_1$ and $\Delta m_2$ as a result of the effect of the described gravitational waves, these mass increases should lead directly to the gravitational energy:

$$E_{grav} = -(m_{1b} - m_1)c^2 - (m_{2b} - m_2)c^2 = -\Delta m_1 c^2 - \Delta m_2 c^2 \qquad (61)$$

$$E_{grav} = -\left(\frac{m_1 c^2}{\sqrt{1-\frac{{v_1}^2}{c^2}}} - m_1 c^2\right) - \left(\frac{m_2 c^2}{\sqrt{1-\frac{{v_2}^2}{c^2}}} - m_2 c^2\right) \qquad (62)$$

$$E_{grav} = -\Delta m_1 c^2 - \Delta m_2 c^2 \qquad \boldsymbol{E_{grav} = -3.54\ 10^{30}\ Ws} \qquad (63)$$

This is exactly the case, the velocity-conditioned mass-increases, which followed from the momentum conservation according to equation (59) with participation of the gravitational waves, lead directly to the gravitational energy.

Consequently, all masses in the universe must be in an instantaneous connection via gravitational waves. This can be interpreted as instantaneous information coupling. Since it is a gravitational process, this does not mean yet that one can transfer other information also instantaneously.

The imaginary time has a real basis, because it must exist for every event somewhere in the universe. The imaginary time refers to events which are so far away that they cannot causally influence an event here and now or cannot be influenced by an event here and now. A solar flare 6 minutes ago cannot affect the weather here and now because it takes light about 8 minutes to get here. The event is in the imaginary past of the current weather here. The same event on the sun becomes real for later events here, e.g. 10 minutes after the eruption. Later events here can be influenced consequently by the solar flare. If a laser beam is currently sent to the sun from here, it cannot influence a solar flare in 6 minutes, but it can in 10 minutes. The solar flare is in the imaginary future of the emission of the laser beam here and now. The event here becomes real for later events on the sun. Later events on the sun can be influenced consequently by the emission of the laser beam.

One can well imagine that the imaginary past and the imaginary future also exist in our immediate vicinity. If a very short distance $s$ from one event here and now to another event at a very near place, the time between the events must be chosen only $t < s/c$ must be chosen small enough, so that the events can not influence each other. One event is then nevertheless in the imaginary time of the other event, although the events happen in our immediate proximity.

What could happen in the imaginary present? Hereby events are meant, which take place absolutely at the same time (present) at other places related to an event here and now. They can never be causal to an event here and now, they are all in the imaginary present. A significant realization is that the age of the universe has exactly this property. It must be the same everywhere, otherwise it would have no meaning. It is the present events that take place here and everywhere else. Interesting in the age $t_{uni}$ of the universe is that it progresses although it is identical everywhere. Since the mass decreases with the age of the universe and this age occurs everywhere simultaneously, the mass must also decrease everywhere simultaneously. Since the masses are in the gravitational connection, the simultaneous mass reduction is also a reason of the instantaneous effect of the gravitation.

An imaginary time span takes place in imaginary time, thus remains acausal to an event here and now in its entire course. The known time span $t_b$ in the moving state of a mass, which passes slower due to velocity, can be simply defined as an imaginary time interval $t_i$ define [15.]:

$$t_b = t_0\sqrt{1-\frac{v^2}{c^2}} \qquad t_i = t_0\sqrt{\frac{v^2}{c^2}-1} = it_0\sqrt{1-\frac{v^2}{c^2}} = it_b \qquad {t_i}^2 = i^2{t_b}^2 = -{t_b}^2 \quad (64)$$

## 6. Results and findings for the universe

Gravity could be described in three different ways using the example of a two-mass system: Mechanical, electromagnetic and quantum mechanical.

The gravitation is based on the magnetic effect of magnetic monopoles which cannot exist in the space and form the time. The interaction particles of gravitation are imaginary ether photons which allow an instantaneous effect of gravitation. Thus, gravitation can be understood as a radiation phenomenon and can be represented by gravitational waves.

The time arises from the structure change of the objects due to the mass decay and is composed of magnetic monopoles. Time is erased by the gravitational effect. It is transferred thereby into the mass structure of neutrinos. Time possesses an information equivalent which is derived from the structure change of masses.

The informal problem of the pair creation and annihilation in the vacuum from chapter 2 is discussed so far hardly in the science, but usually only the energetic one. In the same time as the particles and antiparticles created by quantum fluctuation annihilate, the structure of the particle and its antiparticle is also created and annihilated. Just as for the quantum creation space energy must be borrowed and returned in a well-defined very short period of time, the structure information of particle and antiparticle must be borrowed and returned. This information can be only in the time part of the Planck's quantum of action. A further proof for the information equivalent of the time.

The constant entropy of the universe is the sum of all its effects, where the space age can be understood as imaginary present. For its entropy applies [16.]:

$$S_{uni} = \frac{k}{\hbar} m_{uni} t_{uni} c^2 = N_{uni} k \qquad (65)$$

As equation (23) shows, there exists in the universe the fabulous number of $N_{uni} = 6.5\ 10^{121}$ effects, which according to (42) corresponds exactly to the number of one-dimensional radiation modes. The actual radiation temperature of the one-dimensional radiation of the universe is only $\mathcal{T}_{uni} = m_{uni} c^2/(N_{uni} k) = \hbar/(k t_{uni}) = 1.75\ 10^{-29} K$ and falls further with its age.

Magnetic charges have no sources in space, but in time, whose two temporal dimensions are perpendicular to each of the three spatial dimensions. Therefore, we can perceive only closed magnetic field lines in space.

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