The Projection theory

An approach to the “The Theory of everything”

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This paper is divided into two main sections. In Part I, which is the subject of this publication, the fundamentals of the projection theory and the insights and calculation possibilities resulting from this new concept are presented (see Abstract).
In part II, based on the findings in part I that protons and neutrons are not spherically symmetric but cubic particles, a new concept for the structure of atomic nuclei is presented which has nothing to do with quarks and gluons but is based on classical ideas. Part II will be published at a later date in the "Nuclear and Atomic Physics" section.

Part I

Abstract

Projection theory represents a completely new way of looking at our world and thus enables an unusual, novel approach to the theory and calculation of our basic physical quantities.
Inspired by quantum mechanical experiments, which repeatedly show the importance of the observer for the result of a series of experiments, the focus here was on the observer, on a living being and thus ultimately on the basic elements of life.
Two questions from a subarea of microbiology, genetics, which were enormously important for later findings, arose:
- *Why does the genetic code consist of 4 letters or nucleotides?* -
- *Why is exactly one letter (T against U) or rather one nucleotide, namely thymine, exchanged for uracil during the transcription from DNA to RNA?*

The answers to these biological questions led to the realization that our reality is a meta-world, i.e., a world between two dimensions, the 4th and 3rd dimension, which we can also describe as a projection of a four-dimensional into a three-dimensional world and thus as a pseudo-four-dimensional construct. Quite analogous to our photographs, which show the projection of our three-dimensional world on a surface and which we therefore also call pseudo-three-dimensional objects.
In order to represent an object from an n-dimensional in an n-1-dimensional world approximately, we need a medium which can be represented in this reduced world and which is able to reproduce the missing information from the n-th dimension in some form. In a black-and-white photograph, for example, these would be the different shades of grey that can give us an apparent height information.
For our pseudo-dimensional world, the assumption was now obvious that this mediating medium is what we call time. It is therefore time that is able to represent the missing information of the 4th dimension in some form in our seemingly three-dimensional reality.

It is known from digital photography that a pseudo-dimensional construct must be limited upwards and downwards by limiting factors, which we call color resolution or number of pixels in photography. The observations, which many physicists still find irritating, that there is a maximum speed with the speed of light or a minimum unit of action with the Planckian quantum of action, can be seen in analogy to the above-mentioned limiting factors in photography, i.e., these facts find a simple, inevitable explanation in the projection theory postulated here.
A determined examination of the properties of this pseudo-four-dimensional construct showed that it can be described with only three quantities:

- a minimum length (edge length of a cubic pixel)
- a minimum time (minimum length/speed of light)
- the radius of the electron

As a further important quantity, a dimension factor was added, which establishes a reference to the 4th dimension when calculating the forces.
Of course, we have to additionally include in the calculations the quantities measured in the units of measurement defined by us, such as the proton or electron mass or the elementary charge, in order to arrive at the literature values based on these quantities. By exclusively using these above-mentioned quantities, the calculation of the

- *gravitational constant G*

- *the electromagnetic field constants ε_0 and μ_0*

- *the Sommerfeld fine structure constant α*

were finally successful. In addition, was achieved,

- *the proof of the equivalence of heavy and inertial mass*

- *the reduction of 4 basic forces to three,*

and, connected with it,

- *the solution of the hierarchy problem for the gravitational and electromagnetic force*

Introduction

Quantum mechanical experiments astonish us again and again, because in these experiments the experimenter or observer plays a decisive role for the experimental result, which is not in accordance with our experience from classical physics.
In the double-slit experiment, for example, in which electrons are sent through two closely spaced gaps, even the type of observation determines the result of the experiment, i.e., depending on the means by which and the form in which the path of the electron through the double-slit is observed, it behaves sometimes as a wave and sometimes as a particle. In the current interpretation, therefore, each quantum-physical system decides only at the time of observation which state it assumes.

(*This interpretation, however, was suspect even to some renowned physicists. Schrödinger's cat sends his regards)*
Now, at the latest, the role of the observer should be thoroughly questioned.
Who are we? And this not so much in an anthroposophical as much more in an epistemological sense.
Are we prisoners in a cave, chained in such a way that we can only see the shadows of real things, as Plato vividly illustrated in his cave allegory, which is still highly fascinating today? Or are we even part of this shadow world ourselves.
It was obviously appropriate to question life as such. Dealing with this topic led to two questions from microbiology.

1.Why does the DNA have 4 “letters” (A C G T)?

2 Why is exactly one nucleotide, namely thymine, exchanged for uracil during the transcription from DNA to RNA

In answering these two questions, it was not a matter of finding any explanations as isolated solutions of the individual questions, but the solution of all questions had to be in a common superordinate context, which brings us a little closer to understanding what life is
It was possible to find answers to these essential questions and to condense them in the projection theory to a new physical world view. From this completely new view of things, it was only a small step, for example, to the calculation of the gravitational constant, the electromagnetic field constants and the fine structure constant, as well as to the proof of the equivalence of heavy and inert mass and to the reduction of the number of elementary forces.

Question 1

Why does the DNA have 4 “letters” (A C G T)?

This is uninteresting, which has emerged in the course of evolution, is a common answer to the question posed above, although it is often the explanation of such "uninteresting" phenomena that leads to fundamentally new insights, because the four "letters" in the DNA alphabet are indeed astonishing.
One of the main tasks of DNA - and for a long time considered its only task - is the coding of the amino acid sequences in the building blocks of our life, the peptides and protein molecules, which are based on a total of 20 different α amino acids.
Three consecutive nucleotides, i.e., a nucleotide triplet or codon, in the RNA, which in turn has transcribed this information from a section of DNA, determine the position of an amino acid in the later protein molecule. According to the laws of combinatorics, 4^3 different triplets can be formed from four symbols (variations with repetition).
64 codons for only 20 amino acids are quite redundant, whereas nature usually works so economically. However, it is not possible to use nucleotide pairs as codons, for four letters, since only 16 pairs can be formed. Ideal would be 3 nucleotides from which one can form 27 triplets or five and a coding by one pair of nucleotides each. From five symbols you can form 25 different pairs by permutation.
In both cases you have enough codons for the 20 different amino acids of the proteins with

additional 7 resp. 5 options for e. g. start and stop codons.
It was originally assumed that DNA only had the task of controlling the correct construction of the building blocks of life, even when it was already recognized that only a fraction, about 1 - 2%, of the entire genome is needed for this process.
Instead of critically questioning the previous view with this finding, the entire rest of the DNA was declared junk DNA. A "mountain of rubbish" that had obviously accumulated over the millions of years of phylogeny.
It is now known that there is more to DNA than just instructions for the production of building material, especially for a so-called "body plan", in which the spatial structure of a living being is stored in the form of its spatial coordinates.
To illustrate the coding of spatial coordinates, we will look at the procedure in crystallography. A crystal consists of innumerable elementary cells, so-called translation identities, because the macroscopic crystal can be generated by shifting these smallest units in all directions of space, i.e., this smallest unit contains all the information about the structure of the macroscopic crystal.
As a simple example we choose a face-centered cubic elementary cell.
A cubic body can be easily inserted into an orthogonal coordinate system. The cell dimensions are generally identified by *a*, *b* and *c*, where *a* is usually defined as the length of the unit cell along the x-axis, *b* along the y-axis and *c* along the z-axis.
To describe the point positions in the elementary cell, the grid dimensions are each normalized to 1 and the point positions are represented by 0, 1 and fractions of 1. The lower left point of the cube would therefore be the origin of the coordinate system and would therefore be described as 0 0 0. Let us take the upper right point of the cube surface in the paper plane. We take a full step in direction a and one in direction c and none in direction b. The crystallographic point position would therefore be represented by 1 0 1. The center of this area would then be the point location ½ 0 ½ etc.

To make the analogy to DNA a little easier, we use a slightly different system and also rename the b-axis of the crystal lattice to t-axis. We now always start from the origin and mark the points or atoms of the crystal lattice by the single steps there.
So that we can describe also the points in the middle of the cube surfaces, which sit in each case on half distance of the crystal dimensions, we make the following agreement:

a = 2 A
t = 2 T
c = 2 C

Further we specify that dimensions which are not passed through are not specified, zeros as in the system above do not exist. Consequently, the point location at the origin of the coordinate system is not specified, but implied.
If we consider the side of the cube lying in the paper plane, the lower left corner point is by definition our zero point or origin, we reach the lower right corner point by two steps A to the right, the upper left corner point by two steps C upwards, the center point on the surface in the paper plane by one step A to the right and one step C upwards, etc. etc.
The description of our face-centered cube would then look like this:

AACCATACTTCTAACCCCTTATTCAATTAATTCC

Let us compare this with a DNA sequence from the human genome, namely from chromosome 1.

AACCAGTCCATAGGCAAGCCTGGCTGCCTCCAGCTGGGTCGACAGAC

If we now delete all G from this DNA sequence, we come to the letter sequence:

AACCATCCATACAACCTCTCCTCCACTTCACAAC

This already has a certain similarity with the description of our face-centered cell.
The additional letter in the DNA therefore represents an additional axis, which is undoubtedly needed to describe the spatial arrangement of the structural elements of a four-dimensional body.
A three-letter code for the description of actually three-dimensional creatures in our three-dimensional world would be ideal. The structure of three-dimensional bodies could thus be ideally described analogous to the three-dimensional crystals (see above) via the three spatial axes and in addition, three letters would also provide enough triplets (27) to encode 20 amino acids.
So, DNA obviously represents the complete description of **four-dimensional bodies**, which necessarily requires 4 letters, and the resulting redundancy in codons can be accepted as a "luxury problem".
But what sense does a four-dimensional matrix make in our three-dimensional world? In order to understand this, we need to look at the relevance of question 2.

<u>Question 2</u>

Why does the transcription from DNA to RNA involve the exchange of exactly one nucleotide, namely thymine for uracil?

The RNA has the task to realize the building plan of the DNA in this world.
First, the RNA reads out sections of the DNA and then, in the ribosomes, the translation into the building materials of life takes place.
But how is it possible at all to realize a four-dimensional blueprint in a three-dimensional world?

For a better understanding, let us first imagine such a process during the transition from the third to the second dimension by trying to reproduce a three-dimensional construct - whatever that may be - in two-dimensional form, e.g., as a printout on a sheet of paper as a so-called pseudo-three-dimensional representation. For this we need a medium that allows us to reproduce the height information in a surface.
It is well known that grey values, color levels or different colors offer the possibility to display information from the third dimension (height information) in the surface
This process is shown schematically in the following.

Three-dimensional reality	---->	*Pseudo-three-dimensional representation*
	Example	
Hilly landscape as a model		*Hilly landscape e.g., as a grayscale image*

(printout on paper)

Description

Each point is maintained by the coordinates x,y,z defined and modelled — *x,y coordinates are kept, z-coordinates are not recognized by the printer, they must be replaced by gray levels g*

In principle, n-1 coordinates can be retained when representing an n-dimensional object in a world reduced by one dimension. One coordinate must be replaced by a system that can be represented in a world reduced by one dimension.
It was to be suspected, and in the course of further calculations it turned out to be correct, that the medium we need to represent a pseudo-four-dimensional reality is what we call time.

Conception of living beings ---------------> Pseudo-four-dimensional realization in
Four-dimensional building plan of a three-dimensional world
DNA → A C G T RNA → A C G U

T stands for one coordinate of the fourth dimension — U stands for the translation of this coordinate into time context

The next question was: Is there a physical equivalent for the transition between a four-dimensional and a pseudo four-dimensional space-time world derived from biology?
This exists indeed, if one takes the Planck's quantum of action h to help. In the following sections, h will be discussed in detail and reinterpreted. In anticipation of these new realizations, we must know at this point only that for the following equations is valid:

$$\frac{s}{t} = c \tag{I.1}$$

The quantum of action h can be represented as momentum x length or energy x time

$$h = \frac{ms}{t} s \quad \text{(I.2)} \qquad\qquad h = \frac{ms^2}{t^2} t \quad \text{(I.3)}$$

Eliminating m in both equations by ρ (m/V3) and applying Eq. (I.1) we obtain:

$$h' = \frac{h}{\rho c} = V_4 \quad \text{(I.4)} \qquad\qquad h'' = \frac{h}{\rho c^2} = V_3 t \quad \text{(I.5)}$$

With these formulas we can summarize our previous findings once again in a direct comparison.

Three-dimensional reality ------ > *Pseudo-three-dimensional representation*
x, y, z *x, y, g*

Four-dimensional construction plan ------ > *Pseudo-four-dimensional realization*
DNA → A C G T *RNA → A C G U*

Physical equivalent

Four-dimensional space ------ > *Space-time-pseudo-dimension*

$$h' = \frac{h}{\rho c} = V_4 \qquad\qquad h'' = \frac{h}{\rho c^2} = V_3 t$$

The transition between these worlds takes place by means of the space-time conversion factor c, which should therefore also be stored in every living being in some form.

Basic elements of a projective representation

As a rough analogy to our world, which we see as a projection of a four-dimensional into a three-dimensional and thus pseudo-four-dimensional world, we will repeatedly use digital black-and-white photography as the simplest form of pseudo three-dimensional representation in the following sections.
In this method, the gray levels are generated in a simple manner by increasing the brightness in each of the 256 steps (abscissa) by a constant amount with increasing height z, which is normalized to 1 in Fig. 1, resulting in a linear gray scale (blue line).
The speed levels for our pseudo-four-dimensional world as an analogy to the gray levels discussed above are simply obtained by dividing the maximum speed (speed of light) by the natural numbers n_i. However, this leads to a non-linear gradation, i.e., to a hyperbolic curve (red curve), which would lead to a catastrophic result in our digital photos, but which is obviously the correct description for our world, because it has the great advantage that the individual steps become so small at large n_i that the system changes into a quasi-continuum**.**

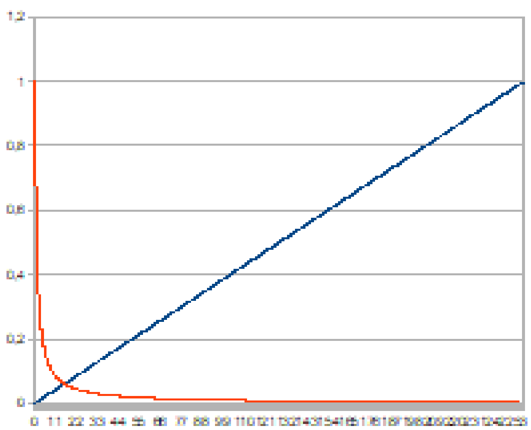


Fig. 1

A projection needs standardized limits; therefore, the speed of light is necessarily a fixed maximum speed, otherwise we would define a new projection system.
This standardization also applies to the spatial resolution, which we call pixels in digital photography, i.e., minimal areas within which no differentiation is possible, thus providing only one piece of information for the entire area.
The smaller the pixel area, the greater the area density of the pixels and thus the resolution and image quality. However, the resolution can never be infinite, as this would entail an infinite amount of information. One can even use the latter statement to define a real and a pseudo dimension:

Real dimension ---> $N_{pix} = \infty$
Pseudo dimension ---> $N_{pix} < \infty$

If we have smallest areas, this implies also smallest distances $\mathbf{s_{min}}$ and by means of the correlation factor **c** we can easily calculate also a minimum time $\mathbf{t_{min}}$ below which no temporal resolution is possible anymore.

$$\mathbf{s_{min} / c = t_{min}} \qquad \text{(GE.1)}$$

As trivial as it sounds, but important is the simple transformation of the above equation, because the result always seems surprising at first, because two minimal quantities should not be able to determine a maximum speed at first sight.

$$\mathbf{s_{min} / t_{min} = c} \qquad \text{(GE.2)}$$

This relationship is of enormous importance for the further derivations.

! During the calculation of the natural constants, it turned out that it is **not speed levels** but **acceleration levels** on which the projection system is built and that above all the volume acceleration plays a decisive role in this system!

$$a_i = \frac{c}{n_i t_{\min}} = \frac{s_{\min}}{n_i t_{\min}{}^2} \qquad \text{(GE.3a)}$$

$$a_{V\,i} = \frac{s_{\min}{}^3}{n_i t_{\min}{}^2} = \frac{V_3}{n_i t_{\min}{}^2} \qquad \text{(GE.3b)}$$

The Planck quantum of action represents, according to the undisputed opinion in today's physics, a smallest action package, what caused Heisenberg to understand this as a lower limit of the products of the conjugate quantities contained in it, like momentum and length or energy and time. From the point of view of projection theory, however, a smallest action means that it also contains the smallest quantities of our system. If we choose the impulse x distance formula for h, we come to the equation below:

$$h = \frac{m_{\min} \cdot s_{\min}}{t_{\min}} \cdot s_{\min} \qquad \text{(GE.4)}$$

Taking into account (GE.2) to

$$h = m_{\min} \cdot c \cdot s_{\min} \qquad \text{(GE.5)}$$

and with a simple transformation into

$$\frac{h}{m_{\min} \cdot c} = s_{\min} \qquad \text{(GE.6)}$$

this equation corresponds completely to the equations for the determination of Compton wavelengths (pulse transfer of hard radiation to elementary particles in a right-angled impact)

$$\frac{h}{m_x \cdot c} = \lambda_{Cx} \qquad \text{(GE.7)}$$

This suggests that to determine s_{min} we must use one of our elementary particles. Since it seems unlikely that the entire construct of this projective world is built on an unstable particle, the only possibilities that remain are the electron and the proton as stable particles, since the free neutron with a half-life of about 15 minutes is also not permanently stable.
If we look at the Compton wavelengths and masses of these two particles, a blatant contradiction becomes immediately apparent. [1]

$m_p = 1.672621\ 10^{-27}$ kg
$\lambda_{Cp} = s_{min?} = 1.3214098\ 10^{-15}$ m
$m_e = 9.109382\ 10^{-31}$ kg
$\lambda_{Ce} = s_{min?} = 2.4263102\ 10^{-12}$ m

Neither particle can satisfy our requirement for the smallest mass and smallest length for the equation (GE.4). Consequently, it is not possible to favor one of these particles as the basis for calculating $s_{min.}$ We need a different criterion. This we get, if we assume that a uniform density exists for all elementary particles (constant elementary particle density), which we do not yet know.

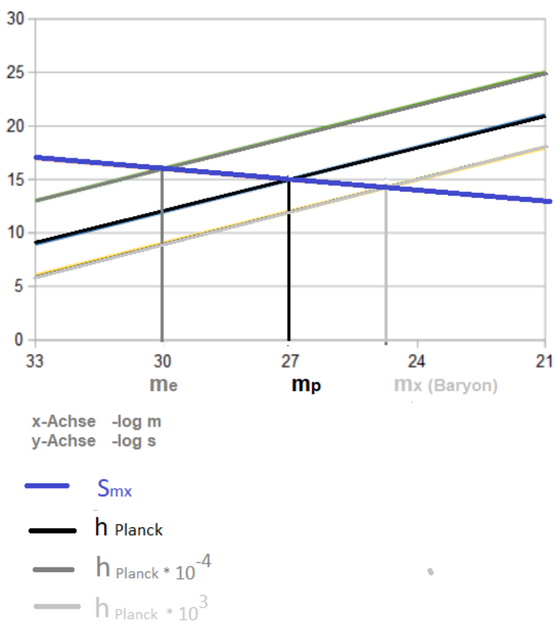


Fig.2

Here we can draw on observations from astronomy. Neutron stars are a gigantic collection of densely packed neutrons, which consequently have approximately the same density as the underlying neutrons themselves and should ultimately provide a useful value for the elementary

particle density.
The density of neutron stars lies between 6 - 8 $\cdot 10^{17}$ kg/m^3 according to the current knowledge of astrophysicists. We use for ρ_N the mean value $7\cdot 10^{17}$ kg/m^3, calculate the edge lengths S_{mx} of the cubic volumes, which we for a simplified consideration for all relevant particles presuppose, as a function of the respective masses by means of formula (GE.8) and obtain the blue straight line in fig.2 above. [2]

$$s_{mx} = \sqrt[3]{\frac{m_x}{\rho_N}} \qquad \text{(GE.8)}$$

As equations (GE.8) and (GE.7) show, s_{mx} is directly and s_{min} indirectly proportional to mass, i.e., we obtain straight lines with opposite slopes and thus always an intersection point that exactly reflects the length we requested above ($s_{mx} = s_{min}$). The position along the y-axis of the straight lines for the values determined from equation (GE.5) depends exclusively on h, since c is constant.
If we use the literature value obtained from measurements for h, which has meanwhile been precisely defined, the intersection between the black and blue straight lines is located quite precisely at the edge length of a cubic **proton**.
For a point of intersection with the edge length of a cubic **electron,** h would have to assume the value of about $x \cdot 10^{-38}$ Js (dark grey line) and for the point of intersection with a hypothetical, stable **baryon** with the mass of about 10^{-25} kg (light grey line), h would have to assume the value of $x \cdot 10^{-31}$ Js.

Starting from the simple consideration that h as a minimal package of action should also be composed of minimal quantities, the comparison of this appropriately modified equation with the determining equations for the Compton wavelengths and an approximate elementary particle density derived from neutron stars, we were able to identify the proton as the determining element of the projective system discussed here via the actually measured value of h. This means that we can now numerically capture some of the quantities important for further calculations.

$$s_{\min} = \lambda_{Cp} = \frac{h}{m_p \cdot c} = 1,3214098 \cdot 10^{-15}\left[m\right] \qquad \text{(GE.9)}$$

$$t_{\min} = \frac{s_{\min}}{c} = 4,4077489 \cdot 10^{-24}\left[s\right] \qquad \text{(GE.10)}$$

$$V_P = s_{\min}{}^3 = V_{Pix} = 2,30734518 \cdot 10^{-45}\left[m^3\right] \qquad \text{(GE.11)}$$

$$^4\rho_{EP} = \frac{m_P}{V_P} = 7,24911876 \cdot 10^{17}\left[\frac{kg}{m^3}\right] \qquad \text{(GE.12)}$$

$$^4\rho_{Ee} = \frac{m_e}{V_e} = \frac{m_e}{4\pi 10^{-49}} = 7,24901722 \cdot 10^{17}\left[\frac{kg}{m^3}\right] \qquad \text{(GE.13)}$$

With the definitions carried out above, also h is no more a natural constant, but can be calculated from the quantities defined there.

$$h = s_{\min} m_p \cdot c \tag{GE.14}$$

Furthermore, eq. (GE.14) is excellently suited to deduce the famous Einstein formula. The Planck constant is as action the product of energy x time. Consequently, we divide the above equation by $t_{\min}$ and get

$$\frac{h}{t_{\min}} = E_h = m_p \cdot c \frac{s_{\min}}{t_{\min}} = m_p \cdot c^2 \left[J \right] \tag{GE.15}$$

The classical derivation of $E = mc^2$ is via the relativistic mass increase.

$$m = m_0 \left(1 - \frac{v^2}{c^2} \right)^{-1/2} \tag{GE.16}$$

The binomial development of eq. (GE.16) leads to the following expression:

$$m = m_0 + \frac{1}{2} m_0 \frac{v^2}{c^2} + \frac{3}{8} m_0 \frac{v^4}{c^4} + ... \tag{GE.17}$$

If one extends this mass calculation by c^2

$$mc^2 = m_0 c^2 + \frac{1}{2} m_0 v^2 + \frac{3}{8} m_0 \frac{v^4}{c^2} + ... \tag{GE.18}$$

it becomes clear, especially at the 2nd term on the right side, that here is now an expression for kinetic energy. Consequently, all other summands and therefore also m_0c^2 must be energy terms. Since this term is without any doubt not a kinetic energy, it must be an intrinsic, a so-called rest energy.
Here we have the effect that the law of constancy of mass, which is no longer valid in relativistic physics because of the increase of mass at high velocities, is merged into a generalized law of constancy of energy, in which now, however, the rest energy has to be included.
The astonishing thing about the equation (GE.15) derived in this work is that no relativistic approach, but only the system of minimal quantities is necessary to come to the equivalence of mass and energy.

However, the above equation is more special, since it does not contain an arbitrary mass, but specifically m_p. However, this does not mean that it is valid only for m_p. We can modify this equation by different factors, especially by the mass ratio of proton to electron kpe, also in different powers x or by simple quantum numbers m = 0, 1, 2, ... The equation given below is only one example for different options.

$$E_{xm} = m \frac{m_p \cdot c^2}{k_{pe}{}^x} \left[J \right] \tag{GE.19}$$

This approach is of great importance in the section "The Bohr atomic model from a new aspect". In contrast to (GE.18), equation (GE.19) makes clear that this energy-mass equivalence refers to transformation processes in the field of elementary particles, e.g., the complete annihilation of positrons and electrons or the only partial transformation of mass into energy in the formation of atomic nuclei from baryons. Thus, it is unrestrictedly correct that any mass corresponds to an energy, but not vice versa that any energy also contains a mass. Thus, according to our opinion, in the case of, for example, a metal rod which one has bent and into which one has consequently put deformation energy, one would not detect any increase in mass even with the very most sensitive scales which could easily measure the calculated change in mass.

Notes

[1] *This contradiction increases by the fact that the radius of the electron is significantly smaller than* s_{min}*, i.e., this is not, as the label suggests, the smallest relevant length in this system. However, it can be resolved due to the peculiarities of a projective representation, since* s_{min} *only limits the resolving power of our projection, but does not say anything about whether there are objects below the pixel size.*
For clarification we will once again use digital photography. Of course, there are countless objects in our world that lie below the resolution of our light sensor chips. Let's assume that such a particle is stationary in the light of the camera for the chosen exposure time. It causes a more or less large shading for one pixel. Unaware of the limited resolving power of our camera, we would equate the particle size with the pixel size.
If we notice, however, that all particles below a certain size always seem to have the same extension and that we cannot observe any internal structure or individual characteristics, we can also start from the idea that these particles have no extension at all but only an effect (in this case a shadowing effect).
Both considerations are valid for the electron. On the one hand, for some calculations the classical electron radius is used, which with $2{,}8 \cdot 10^{-15}$ *m leads to a volume in the order of magnitude of our pixels. On the other hand, today more than ever, we assume a point-like particle that is only characterized by its effect (charge). Both ideas are wrong according to the above explanations.*

[2] *The above graph is designed only for the accuracy of powers of ten, which is, however perfectly sufficient to illustrate this proof. Of course, this coarse grid cannot be used to differentiate between protons and neutrons. We had already excluded the latter, because of its instability as a basic component of our projection.*

[3] *The mean value determined by astronomers for the density of neutron stars (*$\sim 7 \cdot 10^{17} kg/m^3$*) is actually very close to the value for the* ρ_E *elementary particle density calculated above.*

[4] *For the different elementary particle densities, see note in the following section.*

Calculations

<u>The volume of the electron</u>

With the postulate of constant elementary particle density, we can now also calculate the volume of the electron very easily via the volume of the proton, since the known ratio of proton to electron mass also corresponds to the volume ratio of these particles.

$$k_{pe} = \frac{m_p}{m_e} = \frac{V_p}{V_e} = 1836{,}1525 \qquad \text{(VE.1)}$$

[1]
$$V_e = \frac{V_p}{k_{pe}} = 12{,}56619612 \cdot 10^{-49} \qquad \text{(VE.2)}$$

Since the electron with its dimensions is significantly below the resolution of our projection system, i. e. it is not accessible to experimental characterization, it was to be assumed that we could calculate its volume very accurately, but could not make any statement about its shape (sphere, cube, etc.) (see note 1 above). However, the above calculation holds a little surprise. The factor before the power of ten seems to be nothing special at first, but if you divide it by 4

$$\frac{12{,}56619612}{4} = 3{,}14159029 \qquad \text{(VE.3)}$$

anybody interested in mathematics and science will immediately notice the high agreement of the result with π, with a deviation only in the fifth decimal place.

$\pi = 3.141592654$ $\qquad\qquad$ $\Delta_{rel} = 1{,}4 \cdot 10^{-5}$ $\qquad\qquad$ (VE.4)

If one assumes that the actual value for the electron volume is $4\pi\ 10^{-49}$, the radius is obtained - assuming spherical symmetry:

$$r_e = \sqrt[3]{3 \cdot 10^{-49}} \ \left[m\right] \qquad \text{(VE.5)}$$

In contrast to our initial assumption, this result, due to the "strange numerology", allows us to conclude that the electron, unlike the proton, is most likely a spherically symmetric particle.

Note

[1] *The really interesting question in connection with the volume of electrons is whether this is only by chance close to the value of $4\pi\ 10^{-49}$, but in reality, deviates from it by a factor of $1{,}4\ 10^{-5}$, or*

whether this integer value based on π is actually exact. This ambivalent view is also expressed in the elementary densities ρ_{Ep} and ρ_{Ee} listed above. Of course, if we correct ρ_{Ee} for the relative deviation of the electron volume from 4 π, follows $\rho_{Ee} = \rho_{Ep}$.
However, the overall problem behind this, which is even more complex, will be discussed in detail later in this paper.

The (Newtonian) gravitational constant G

Gravity is currently the "unloved child" of theoretical physics, but also of some experimental physicists, namely those who are concerned with measuring the gravitational constants. This is by far the least precisely determined natural constant and despite all experimental efforts no approximation takes place. On the contrary, one has the impression that the chaos of diverging values increases with each series of measurements.

On the other hand, theoretical physicists are not able to derive this constant and calculate it exactly or even to integrate gravity quantum mechanically into the overall concept of other forces. Even the equivalence of heavy and inert mass, on which Einstein has based his entire general theory of relativity, has not yet been theoretically deduced and thus proven, although in this case the very precise satellite-based experiments with relative errors in the range 10-17 clearly speak in favor of equivalence.
Exactly from this equivalence we started and asked ourselves, which expression we get for the mass, if the force equations for the inertial and heavy mass equate, whereby we must of course disregard the proportionality constant G in the latter equation, since this was introduced exactly in order to get also the equation for the inertial mass in the dimensions of a force.

$$\frac{m^2}{s^2} = \frac{m \cdot s}{t^2} \qquad \text{(G.1)}$$

$$m = \frac{s^3}{t^2} = \frac{V}{t^2} \qquad \text{(G.2)}$$

Obviously, mass is equivalent to a volume acceleration, a quantity that we postulated when deriving the fundamentals of projection theory.

$$m = \frac{V}{n_i t_{\min}{}^2} \qquad \text{(G.3)}$$

If we now solve the equation of force for the heavy mass according to G, we obtain the dimensions for the gravitational constant:

$$G = \frac{s^3}{mt^2} \qquad \text{(G.4)}$$

It is a volume acceleration per mass, which still causes physicists headaches today, but which is very easy to understand from the new perspective. Obviously, the gravitational constant is, in a first approximation, nothing more than the conversion factor between what mass actually is, namely a volume acceleration, and what we have quite arbitrarily defined as mass.
Since this is only a first assumption, we will first use the symbol G' here. We translate the formula (G.4) into the formalism of our projection theory:

$$G' = \frac{V}{m n_i t_{\min}^2} \tag{G.5}$$

We therefore need an elementary particle whose volume and mass are known and a suitable value for n_i. A suitable particle is of course the proton, whose mass is sufficiently known and whose volume we have derived in the previous section, in which we also calculated t_{min}. Consequently, in the above equation only a plausible value for n_i is missing, which to find has indeed caused a lot of headaches.
It would now be pointless to use the known, still rather imprecisely measured value for G in equation (G.5) to calculate n_i. This would be a circular calculation and would prove nothing. For a stringent proof n_i must therefore be logically derivable independently of the above equation. Since the gravitational force is the weakest force we know, a first assumption was to place gravity at the lowest acceleration level, i. e. the following assumption was obvious:

$$n_i = n_{max} \tag{G.6}$$

The solution was not the result of complicated mathematical deductions, but of simple considerations that remind us that we are dealing with a projective representation of a higher dimension.
Let's return to our greyscale illustration, which we have already attempted several times. The decisive parameters for their imaging quality are, as already mentioned at the beginning, the area resolution (pixel number N_{pix}) and the color resolution (gray scale number n_{gmax}).
If there is an imbalance between these parameters, the higher-value parameter does not result in any significant improvement in imaging quality, since poor area resolution cannot be compensated for by color resolution, no matter how good it is, and vice versa.
An optimal image quality without redundancies in one direction or the other is thus obviously obtained, if the following applies:

$n_{gmax} \equiv N_{pix}$ or for our system $n_i = n_{max} \equiv N_{pix}$

The question now was, how is N_{pix} defined in this system?

The search for N_{pix} led to the following result:

$$N_{pix} = \frac{s_E t_E}{s_{\min} t_{\min}} \tag{G.7}$$

$$t_E = [1s] \; s_E = [1m] \tag{G.8}$$

It is therefore the number of the smallest time-length areas (pixels) per time-length unit area. The numerical calculation yields:

$$\mathbf{N_{pix} = 1{,}7169025 \cdot 10^{38}} \tag{G.9}$$

We now replace n_i or n_{max} in the initial equation with $\mathbf{N_{pix}}$ and get

$$G' = \frac{V_p}{N_{pix} t_{\min}{}^2 m_P} \left[\frac{m^3}{\mathrm{s}^2\, kg} \right] \tag{G.10}$$

By inserting all known values into the above equation, we obtain numerically:

$$G' = \frac{2,30734518}{1,7169025 \cdot 4,407748^2 \cdot 1,6726217} \cdot 10^{-10} = 4,1355731 \cdot 10^{-10} \left[\frac{m^3}{s^2 kg} \right] \tag{G.11}$$

As expected, this result does not yet correspond to the experimentally determined data

$$G = 6,67384(80) \cdot 10^{-11} \left[\frac{m^3}{s^2 kg} \right] \text{ (CODATA 2014)} \tag{G12}$$

Finally, G' is a pure conversion factor, i.e., a scalar, while G itself represents the proportionality constant in a force equation with vectorial character.

For G itself consequently still direction factors are to be considered.
According to our knowledge, the gravitational force starts from the surfaces of a cube (graviton). With a measurement of the force between two test bodies, however, always only one side comes into effect, i.e., the first directional factor to be considered for the calculation of G is therefore 1/6.

$$G'' = \frac{V_p}{6 N_{pix} t_{\min}{}^2 m_P} \left[\frac{m^3}{\mathrm{s}^2\, kg} \right] \tag{G.13}$$

Numerically, this results in

$$G'' = 6,8926218 \cdot 10^{-11} \left[\frac{m^3}{\mathrm{s}^2\, kg} \right] \tag{G.14}$$

This value comes very close to the literature value. Dividing this value by the literature value gives the interesting factor:

$$\frac{G''}{G_{lit}} = 1,0327 \tag{G.15}$$

This value is interesting because it represents the following term quite accurately:

$$f = \frac{1}{\sqrt{1 - \left(\frac{1}{4}\right)^2}} \tag{G.16}$$

or numerically

f=1,03279

Since G" > G_{lit}, the above equation for G" must be divided by f, resulting in the following final formula for calculating G:

$$G = \frac{V_p}{6N_{pix}t_{\min}{}^2 m_P}\sqrt{1-(\tfrac{1}{4})^2}\left[\frac{m^3}{\mathrm{s}^2\,kg}\right] \tag{G.17}$$

or numerically

$$G_{ber} = 6,673749\cdot 10^{-11}\left[\frac{m^3}{\mathrm{s}^2\,kg}\right] \tag{G.18}$$

The factor (G.16) is a special case of the Lorentz factor, which is well known from special relativity theory and describes the time or length dilation of objects as a function of their relative speed to the maximum speed (speed of light).

$$f_L = \frac{1}{\sqrt{1-(\tfrac{v}{c})^2}} \tag{G.19}$$

For the time dilation of an object with the velocity v the expression results:

$$t' = \frac{1}{\sqrt{1-(\tfrac{v}{c})^2}}\cdot t \tag{G.20}$$

Since there is inevitably not only a maximum speed c but also a maximum acceleration a_{max} in our projection system, we can apply the Lorentz transformation to accelerations in a completely analogous manner.

$$a_{\max} = \frac{c}{t_{\min}} \tag{G.21}$$

$$t'^2 = \frac{1}{\sqrt{1-(\tfrac{a}{a_{\max}})^2}}\cdot t_{\min}{}^2 \tag{G.22}$$

Since we are moving on a line when measuring the gravitational force, so to speak in one-dimensional space, the maximum volume acceleration a_{max} must be included in the calculation proportionally per dimension, i.e., reduced to ¼, since the gravitational force in the form of the volume acceleration **does not change to 3, as actually expected, but quite obviously to 4! dimensions** evenly distributed.   Since the volume acceleration in the equation of determination for G with $V_p = (s_{min})^3$ contains a minimum volume, which cannot be reduced, a reduction of the acceleration **a** can take place only by an increase of $(t_{min})^2$. So we replace in the calculation of the gravitational constant $(t_{min})^2$ by a yet to be calculated t'^2

$$G = \frac{V_p}{6N_{pix}t'^2 m_P} \tag{G.23}$$

The calculation of t'^2 is done, as explained above, by means of a modified Lorentz factor, by using $a_{max}/4$ for **a** in the numerator under the root.

$$t'^2 = \frac{1}{\sqrt{1-(\tfrac{a}{a_{\max}})^2}}\cdot t_{\min}{}^2 \tag{G.24}$$

If we now replace t'^2 with the right side of the above equation, we arrive at the formula which we have already obtained empirically by simple comparison of numerical values.

$$G = \frac{V_P}{6N_{pix}\frac{1}{\sqrt{1-(\frac{a_{\max}}{4a_{\max}})^2}}(t_{\min})^2 m_P} = \frac{V_p}{6N_{pix}(t_{\min})^2 m_P}\sqrt{1-(\tfrac{1}{4})^2}\left[\frac{m^3}{s^2\,kg}\right] \qquad \text{(G.25)}$$

The above equation contains two highly interesting factors, N_{pix} and dimensional correction, both of which confirm the new view of things brilliantly. It is certainly the first time that a pixel number appears in the calculation of an elementary physical constant (not in any technical calculations in the field of digital image processing or similar). And a force correction that takes a fourth dimension into account is probably also unique and shows how closely we are obviously interwoven with the fourth dimension. The equation of determination for G can be presented in a very memorable simple form by using the calculation quantities for Npix

$$G = \frac{V_p}{6\frac{s_E t_E}{s_{\min} t_{\min}}\,(t_{\min})^2 m_P}\sqrt{1-(\tfrac{1}{4})^2}\left[\frac{m^3}{s^2\,kg}\right] \qquad \text{(G.26)}$$

$$G = \frac{V_P \cdot c}{6m_p \cdot s_E t_E}\sqrt{1-(\tfrac{1}{4})^2}\left[\frac{m^3}{s^2\,kg}\right] \qquad \text{(G.27)}$$

In the equations for calculating G is the reciprocal elementary particle density ρ_E, by means of which we can simplify the equations for determining G.

$$G = \frac{c}{6\rho_E \cdot s_E t_E}\sqrt{1-(\tfrac{1}{4})^2}\left[\frac{m^3}{s^2 kg}\right] \qquad \text{(G.28)}$$

To further simplify the equation, we summarize all directional and dimensional factors in one

$$f_{R46} = \frac{\sqrt{1-(\tfrac{1}{4})^2}}{6 \cdot s_E t_E} = 0{,}16137431\left[\frac{1}{m \cdot s}\right] \qquad \text{(G.29)}$$

and obtain the following equation, which one would not have expected in this simplicity for the "legendary" G.

$$G = \frac{c}{\rho_E} f_{R46}\left[\frac{m^3}{s^2 kg}\right] \qquad \text{(G.30)}$$

There is another fascinating calculation formula for G. Fascinating because it does not contain masses, but only the elementary charge, directional factors and the minimum sizes s_{min} and t_{min} derived in the previous section that define our projection. For this calculation, however, you need a formula for ε_0, which is only derived in the next section. However, as this section is the platform for calculating the gravitational constants, it will also be briefly introduced here and the inclined reader may want to deal with it again here after studying the next chapter.

We know from what has been said so far that there is a universal elementary particle density and that this is reciprocally included in the calculation of G. We can therefore use V_e and m_e instead of V_P and m_P in equation (G.27) and solve the equation after m_e.

$$m_e = \frac{V_e f_{D4}}{6 N_{pix} t_{\min}{}^2 G} \; [kg] \qquad \text{(G.31)}$$

We now need the above-mentioned formula for the electric field constant ε_0.

$$\varepsilon_0 = \frac{e^2 f_{D42} t_{\min}{}^2}{8\pi s_{\min}{}^3 m_e} \left[\frac{C^2}{Nm}\right] \qquad \text{(E.4)}$$

For m_e we now use the right side of the equation (G.31) and, taking into account the equation of determination for N_{pix} and the size of the electron volume of $4\pi \cdot 10^{-49}$ m^3, we obtain a equation which directly links ε_0 and G.

$$\varepsilon_0 = G \frac{6e^2 f_{D42}{}^2 s_E t_E}{32\pi^2 c^3 s_{\min} f_{D4}} 10^{49} \left[\frac{C^2}{Nm}\right] \qquad \text{(G.32)}$$

Since ε_0 is linked to μ_0 via c^2, the equation can be simplified even further by using μ_0 with the fixed value $4\pi 10^{-7} \left[\frac{kg \cdot m}{C^2}\right]$ for ε_0.

$$\varepsilon_0 = \frac{1}{4\pi 10^{-7} c^2} = \frac{6e^2 f_{D42}{}^2 s_E t_E}{32\pi^2 c^3 s_{\min} f_{D4}} 10^{49} G \left[\frac{C^2}{Nm}\right] \qquad \text{(G.33)}$$

We multiply the equation by the denominator of the first fraction, solve to G and obtain

$$_1 G = \frac{8\pi c s_{\min} f_{D4}}{6e^2 f_{D42}{}^2 s_E t_E} 10^{-42} = 6{,}673839522 \quad 10^{-11} \left[\frac{m^3}{s^2\, kg}\right] \quad {}_2\Delta_{rel} = 7{,}2 \cdot 10^{-8} \qquad \text{(G.34)}$$

Notes

[1] *At first glance, the dimensions do not seem to be right. However, we have to keep an eye on the exact derivation of the equation, since via 4π 10 $^{-49}$ the electron volume and via 4π 10 $^{-7}$ the magnetic field constant have been included in the equation, the dimensions of which cannot be neglected.*

[2]*This error calculation is based on the author's conviction, which in turn is derived from all the calculations in this work, that the CODATA value 2014 for G is exact at 6.67384, although it was obtained from a large number of very inhomogeneous measurements and is also given with a high tolerance. G = 6.67384 (80.) In addition, after 2014 the official value was adjusted several times to the more recent experimental findings. However, it is not plausible that this value was corrected significantly upwards after 2014 and, above all, that the error margin was massively reduced, since it was precisely during this period that new measuring methods (deflection of laser-cooled rubidium atoms on tungsten blocks), i. e. methods that do not function according to the basic principle of the torsion balance, were used, which led to measured values that were significantly below the previous data. Obviously, it was probably slowly too embarrassing, despite enormous efforts in recent years, to arrive at ever larger error limits instead of*

continuously improving the measurement accuracy, as with other elementary constants.

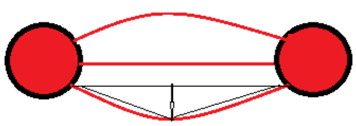
The dimension factor f_{D42}

Protonen / Neutronen

f_{D4} Abb. 3

protons / neutrons

Elektronen / Positronen



electrons / positrons

f_{D42} Abb. 4

The dimension factor f_{D4} was discovered as a necessary correction factor when calculating the gravitational constant and was interpreted to mean that this factor is responsible for the reduction of the total force, which is uniformly distributed in the form of the volume acceleration in 4 dimensions, to the one dimension in which the measurement is made. In the case of gravity, we had assumed that there is essentially (or completely, what still has to be clarified) a force effect between cubic bodies (protons / neutrons), i.e., the field lines run parallel between plane-parallel surfaces. In this constellation the entire force acts in the direction of the force measurement (see Fig. 3).

The situation is different when the force acts between two spherically symmetrical bodies. As is well known from electrostatics, the field lines in this case are curved and the vector decomposition of the lines of force shows that a small proportion of the force (see Fig. 4, black arrow) is perpendicular to the direction of measurement and therefore does not contribute to the transmission of force between the specimens.

To calculate this effect, we assume an electron with radius r_e.

$$E_{\max} = \frac{e}{4\pi r_e^2} \qquad \text{(D.1)}$$

The electric field has its maximum value at the surface of the sphere, whereby the maximum value decreases with increasing distance from the center with the square of the radius.

For our derivation we need two concentrically nested spheres, with the electron as the inner sphere and an outer sphere surface with the radius s_{min} (see fig. 5)

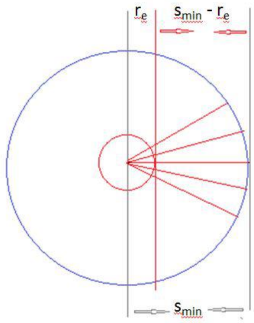


Fig. 5

For our purposes, we now have to calculate the relative change of the electric field (field line density) at the transition from the surface of the electron to the surface of the sphere with the radius s_{min}, i.e., for the distance s_{min} -r_e. This difference is ultimately due to the fact that the electric charge of the electron itself does not emanate from the center, but from the surface, just as in the case of charged macroscopic bodies.
But why do we have to use s_{min} for the radius of the outer sphere? As we will see in the summary of this work, the whole system is based on the three basic quantities r_e, s_{min} and t_{min}, so that there is no other choice for the construct presented above.

$$\Delta E_{rel} = \frac{r_e^{\,2}}{(s_{\min} - r_e)^2} \tag{D.2}$$

In its general form

$$\Delta E_{rel} = \frac{r_e^{\,2}}{(s_x - r_e)^2} \tag{D.3}$$

this function aims at the value 0 with increasing s_x. But we are interested in the mirror function in this context,

f = 1-ΔE_{rel}

which approaches the value 1 with increasing distance and reproduces nothing else but the effect sufficiently known from optics, that first radial light rays emanating from a spherical surface (e. g. sun), appear as parallel rays at a great distance (mathematically exact: at an infinitely great distance) from the light source.
This factor, which should reasonably be called geometric factor f_{geo}, has only to be inserted into the original calculation of the dimensional factor f_{D4} for the value 1, which in turn stands for distance-independent parallel field lines.

$$f_{geo} = 1 - \frac{r_e^{\,2}}{(s_{\min} - r_e)^2} = 0,9971522 \tag{D.4}$$

$$f_{D42} = \sqrt{1 - \left(\frac{f_{geo}}{4}\right)^2} = 0,9684293 = \frac{1}{1,0325998} \tag{D.5}$$

Since this factor often appears in square form, this value is also reported here.

$$f_{D42}{}^2 = 0,93785531 = \frac{1}{1,06626255} \tag{D.6}$$

Electromagnetic field constants ε_0 and μ_0

a) The electrostatic field constant ε_0

We start from the electrostatic force equation, resolve it to ε_0 and substitute for the force the quantities defining it (see eq. (E.1b)

$$F_E = \frac{e^2}{4\pi\varepsilon_0 s^2}\,[N] \quad \text{(E.1a)} \qquad F = m_x \frac{s}{t^2} \quad \text{(E.1b)}$$

$$\varepsilon_0 = \frac{e^2}{F_E 4\pi s^2} = \frac{e^2 t^2}{4\pi s^2 m_x s}\left[\frac{C^2}{Nm^2}\right] \tag{E.2}$$

We transfer this formula into the formalism of our projection theory and use the respective minimum sizes for all lengths and times.

$$\varepsilon_0 = \frac{e^2 t_{\min}{}^2}{4\pi s_{\min}{}^3 m_x}\left[\frac{C^2}{Nm^2}\right] \tag{E.3}$$

The question arises, which mass m_x is to be used here. If we solve the equation according to m_x, a rough calculation leads to the value ~1.9 10^{-30} This value is obviously much closer to m_e than to m_p, so that we insert the electron mass into the equation (E.1) and simplify it by the relation $s_{min}/c = t_{min}$.

$$\varepsilon_{0ber} = \frac{e^2 t_{\min}{}^2}{4\pi s_{\min}{}^3 m_e} = \frac{e^2}{4\pi c^2 s_{\min} m_e} = 1,88817828\left[\frac{C^2}{Nm^2}\right] \tag{E.4}$$

$$\varepsilon_{0Lit} = 8,8541878128 \cdot 10^{-12} \left[\frac{C^2}{Nm^2}\right]$$

$$\frac{\varepsilon_{0ber}}{\varepsilon_{0Lit}} = 2,132525676 \tag{E.5}$$

The relative deviation calculated by equation (E. 5) probably includes the factor 2 among others. In fact, after appropriate division, a known factor results from the previous section, namely

$$\frac{\varepsilon_{0ber}}{2\varepsilon_{0Lit}} = 1,066262838 \approx \left(\frac{1}{f_{D42}}\right)^2 \tag{E.6}$$

Let's take both factors into account when calculating ε_0 we get:

$$\varepsilon_{0ber} = \frac{e^2 t_{\min}{}^2}{4\pi s_{\min}{}^3 m_e}\frac{f_{D42}{}^2}{2} = 8,85419146 \cdot 10^{-12}\left[\frac{C^2}{Nm^2}\right] \qquad \Delta_{rel} = 4,2 \cdot 10^{-7} \tag{E.7}$$

The fact that we find here the factor f_{D42} and not f_{D4} confirms our previous assumption that the electron is spherical in contrast to the cubic protons and neutrons.
For the calculation of Sommerfeld's fine structure constant α we need the formula (E. 7) in a slightly transformed form. We replace t_{min}/s_{min} by c, extend the fraction by m_p, set k_{pe} for m_p/m_e and h for $s_{min} \cdot c \cdot m_p$.

$$\varepsilon_{0ber} = \frac{e^2 k_{pe} f_{D42}{}^2}{8\pi hc} \left[\frac{C^2}{Nm^2}\right] \tag{E.8}$$

Although we have found some nice formulas for calculating ε_0, we have not yet gained a deeper understanding of the nature of the electric force. For this purpose, we will try to find a formula analogous to the formula for the conversion factor G' in the previous section. To do this, we convert m_e into a volume acceleration by means of G', insert this term into equation (E. 7) and form the reciprocal of the fraction in order to correctly position the quantities that are comparable to those in the equation (G.10).

$$m_e = \frac{V_e}{n_{\max} t_{\min}{}^2 G'} \; [kg] \tag{E. 9}$$

$$\frac{1}{\varepsilon_0} = \frac{8\pi V_P V_e}{e^2 t_{\min}{}^2 n_{\max} t_{\min}{}^2 f_{D42}{}^2 G'} \left[\frac{Nm^2}{C^2}\right] \tag{E.10}$$

To make the whole thing clearer, we separate a little, draw the square root and actually get an equation that is constructed in a way that is completely analogous to the gravitational conversion factor G' (G.10), namely in this case a volume acceleration not per mass but per charge.

$$f_e = \sqrt{\frac{f_{D42}{}^2 G'}{8\pi\varepsilon_0}} = \frac{\sqrt{V_p V_e}}{e \cdot \sqrt{n_{\max}} t_{\min}{}^2} = 1{,}320205 \left[\frac{m^3}{C \cdot s^2}\right] \tag{E.11}$$

b) The magnetic field constant

We start from the equation for the magnetic force between two current-carrying conductors.

$$F_M = \frac{\mu_0}{2\pi} \frac{I_1 I_2}{s} L \tag{E.12}$$

L = Length of the conductors
s = Distance of the conductors
I_1 and I_2 Current

We simplify the above equation and set for:

$I_1 = I_2 = I = e/t$

We dissolve to μ_0 and use the dimensions of force (see eq E.1b)

$$\mu_0 = \frac{t^2 2\pi r}{e^2 L} \frac{m_x s}{t^2} \left[\frac{kg \cdot m}{C^2} \right] \qquad \text{(E.13)}$$

We transfer this formula again into the formalism of our projection theory and replace all length and time specifications accordingly. We bet for

$L = s_{min}$ $s = s_{min}$ per conductor = 2 s_{min} $t = t_{min}$

and obtain the simple formula:

$$\mu_0 = \frac{4\pi s_{\min} m_x}{e^2} \left[\frac{kg \cdot m}{C^2} \right] \qquad \text{(E.14)}$$

We know from experience in the calculation of ε_0 that in the electromagnetic force system the mass of the electron plays the decisive role and must be used for m_x in equation (E.12). In addition, it can be assumed that, as with ε_0, we still need correction factors.

$$\mu_{0ber} = \frac{4\pi s_{\min} m_e}{e^2} = 5,89272181 \cdot 10^{-7} \left[\frac{kg \cdot m}{C^2} \right]$$

$$\mu_{0lit} = 4\pi 10^{-7} \left[\frac{kg \cdot m}{C^2} \right] \qquad \text{(E.15)}$$

$$\frac{\mu_{0lit}}{\mu_{0ber}} = 2,13252398 \qquad \text{(E.16)}$$

$$\frac{\varepsilon_{0ber}}{\varepsilon_{0Lit}} = 2,132525676 \qquad \text{(E.5)}$$

$$\frac{\mu_{0lit}}{2\mu_{0ber}} = 1,06626199 \approx \left(\frac{1}{f_{D42}} \right)^2 \qquad \text{(E.15)}$$

$$\mu_{0ber} = \frac{4\pi s_{\min} m_e}{e^2} \frac{2}{f_{D42}{}^2} = 12,56637477 \cdot 10^{-7} \left[\frac{kg \cdot m}{C^2} \right] \qquad \Delta_{rel} = 3,3 \cdot 10^{-7} \qquad \text{(E.16)}$$

By means of the equations of determination for ε_0 (E.6) and μ_0 (E.13) developed here, the relationship between these quantities can also be calculated very easily.

$$\varepsilon_0 \mu_0 = \frac{e^2 t_{\min}{}^2}{4\pi s_{\min}{}^3 m_e} \frac{f_{D42}{}^2}{2} \frac{4\pi s_{\min} m_e}{e^2} \frac{2}{f_{D42}{}^2} = \frac{t_{\min}{}^2}{s_{\min}{}^2} = \frac{1}{c^2} \qquad \text{(E.17)}$$

$$\mu_0 = \frac{1}{\varepsilon_0 c^2} \qquad \text{(E.18)}$$

Because of the simple relationship between the electric and magnetic field constants shown in (E.18), a separate derivation of the relationship between μ_0 and the volume acceleration is not necessary. Therefore, the final formulas are only compared below.

$$f_e = \sqrt{\frac{f_{D42}{}^2 G'}{8\pi\varepsilon_0}} = \frac{\sqrt{V_p V_e}}{e \cdot \sqrt{n_{\max}} t_{\min}{}^2} \left[\frac{m^3}{C \cdot s^2} \right] \qquad \text{(E.11)}$$

$$f_e = \sqrt{\frac{f_{D42}{}^2 G' \mu_0 c^2}{8\pi}} = \frac{\sqrt{V_p V_e}}{e \cdot \sqrt{n_{\max}} t_{\min}{}^2} \left[\frac{m^3}{C \cdot s^2} \right] \qquad \text{(E.19)}$$

and, as a reminder, the equation (G.10)

$$G' = \frac{V_p}{n_{\max} t_{\min}{}^2 m_P} \left[\frac{m^3}{kg\, s^2} \right] \qquad \text{(G.10)}$$

The decisive difference between equations (E.11) and (E.19) on the one hand and (G.10) on the other hand is that the maximum acceleration level n_{max} from eq. (G.10) is present in the electromagnetic equations as a square root in each case.

The importance of these equations for the understanding of the elementary forces is explained in detail in the following section.

<u>Summary consideration of the elementary forces</u>

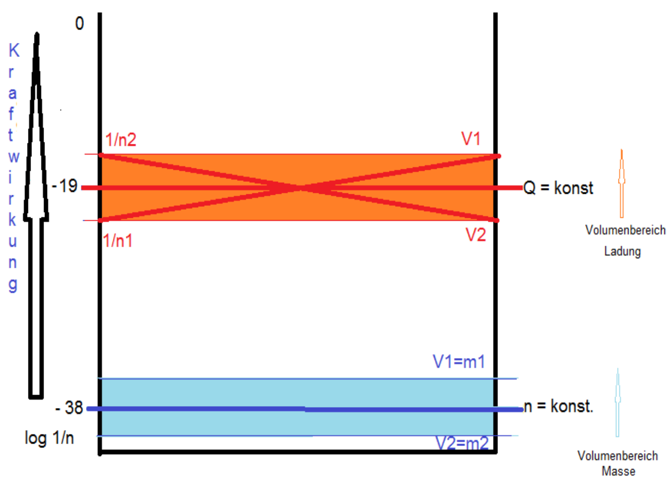


Fig. 6

A Masses

1. The mass in the form of volume acceleration is always based on the lowest acceleration level:

   $1/n_i = 1/n_{max}$ = constant. (S.1)

2. From this it follows that there is indeed, as already postulated at the beginning, a universal elementary particle density ρ_E.

B Electric Charge

1. The charge is also a volume acceleration, but at a significantly higher acceleration level. As can be seen from the schematic diagram above, on a logarithmic scale it lies exactly in the middle of the overall scale from 0 to -38.

   The charge is precisely defined as the <u>geometric mean</u> of the two elementary volumes for proton V_p and electron V_e and as the <u>geometric mean</u> of the minimum ($1/n_{max}$) and maximum ($1/n_{min}$) acceleration levels.

$$e = \frac{\sqrt{V_p V_e}}{\sqrt{n_{\min} n_{\max}}} \frac{1}{t_{\min}^2} \tag{S.2}$$

With $n_{min} = 1$

the equation is simplified to

$$e = \frac{\sqrt{V_p V_e}}{\sqrt{n_{\max}}} \frac{1}{t_{\min}^2} \tag{S.3}$$

2.The elementary electric charge is always constant regardless of the volume.

The changes in volume are compensated by an adequate correction of the acceleration level n_i, so that the quotient of V_i and n_i always remains the same.
Let's take the mass or volume ratio for electron and proton already introduced at the beginning of this paper

$$\frac{m_p}{m_e} = \frac{V_p}{V_e} = k_{pe} \tag{S.4}$$

we can express the charge through the individual volumes by using k_{pe} as correction factor for acceleration stage n_i.
We receive:

$$e = \frac{V_p}{\sqrt{k_{pe}}\sqrt{n_{\max}}} \frac{1}{t_{\min}^2} \tag{S.5}$$

$$e = \frac{\sqrt{k_{pe}} V_e}{\sqrt{n_{\max}}} \frac{1}{t_{\min}^2} \tag{S.6}$$

General for a volume x with the definition for k_{xpe} below

$$\frac{V_x}{\sqrt{V_p V_e}} = k_{xpe} \tag{S.7}$$

we receive:

$$e = \frac{V_x}{\sqrt{k_{xpe}}\sqrt{n_{\max}}} \frac{1}{t_{\min}{}^2} \tag{S.8}$$

While at masses exists constant density, at electric charge exists constant charge at variable density of charges.

In contrast to gravity, the electric charge is bipolar. The bipolarity is also likely to be responsible for the factor 2 or ½ in the equations for ε_0 and μ_0. One can explain this with a very simple model: In this construct, there is a given maximum measure of volume acceleration as an electric and gravitational force, which is distributed equally over all four dimensions and, in the case of the electric force, over the opposing force components e+ and e-:

Consequently, the following correction factors are obtained for the corresponding force measurements:

$f_{ge} = \frac{f_{D42}{}^2}{2}$ Total correction factor electromagnetic force (S.9)

$f_{gg} = f_{D4}$ Total correction factor gravitational force (S.10)

One of the best-known hierarchical problems of the physics is the much-discussed question, why gravity is so much weaker than the electromagnetic force (s, eq. (S.14)).
Paul Dirac, one of the most outstanding physicists of the last century, has dealt intensively with this question and, since such enormous powers of ten are actually observed only in cosmic dimensions, he suspected a deeper connection between cosmology and atomic physics.
Indeed, from the diameter of the universe R_U and the size of the proton r_P the following connection can be calculated:

$$\frac{R_U}{r_P} = \frac{\sim 10^{25}}{\sim 10^{-15}} \approx 10^{40} \approx \frac{F_e}{F_G} \tag{S.11}$$

Furthermore, according to an estimation of A. Eddington, the particle number of the universe amounts to $137 \cdot 2^{256} \sim 10^{78}$ and thus to $\sim (F_e/F_G)^2$.
In spite of the remarkable coincidence of the powers of ten, such number acrobatics are to be evaluated with large skepticism and represent in our opinion no basis for further leading cognitions, since

a) so far, no physical relation between the elements of the above calculations could be established and

b) also, the basics of the calculations are still questionable. Thus, the expansion of the universe R_U is not yet set in stone and the particle number of the universe, which is only based on the estimation - mind your estimation - of a single, even if renowned scientist, does not necessarily have an indisputable validity. Apart from the fact that newer knowledge about the total mass of the cosmos (e. g. dark matter) can throw such estimations completely over the heap.

Whether Dirac would have been happy with the solution presented here may be doubted. Because, as can easily be seen from fig. 6, we are dealing here with the trivial problem of a square root of a maximum number of approx. 10^{38} acceleration steps and not with mysterious cosmological connections.

Although the situation is quite clear from the schematic drawing above (see Fig. 6), the force ratio F_e/F_G was calculated explicitly again as follows:

a) conventional (eq. (S.12) - (S.14))

b) after conversion of charge and mass by f_e (see Eq. (S.15)) resp. G' (see Eq. (S.17)) into volume accelerations, i.e., into the new system presented in this work

$$F_e = \frac{e^2}{r^2 4\pi\varepsilon_0}[N] \quad \text{(S.12)} \qquad F_G = \frac{m_p m_e G}{r^2}[N] \quad \text{(S.13)}$$

$$\frac{F_e}{F_G} = \frac{e^2}{G m_p m_e 4\pi\varepsilon_0} = 2,2688\cdot 10^{39} \quad \text{(S.14)}$$

$$f_e = \frac{\sqrt{V_p V_e}}{e^- \sqrt{n_{\max}} t_{\min}{}^2} = 1,3202045\left[\frac{m^3}{Cs^2}\right] \quad \text{(S.15)} \Rightarrow e^- = \frac{\sqrt{V_p V_e}}{f_e \sqrt{n_{\max}} t_{\min}{}^2}[C] \quad \text{(S.16)} \Rightarrow F_e = \frac{V_p V_e}{r^2 f_e{}^2 n_{\max} t_{\min}{}^4 4\pi\varepsilon_0}[N] \quad \text{(S.17)}$$

$$G' = \frac{V_p(V_e)}{m_p(m_e) n_{\max} t_{\min}{}^2} = 4,13557\frac{m^3}{kgs^2} \quad \text{(S.18)} \Rightarrow m_p(m_e) = \frac{V_p(V_e)}{G' n_{\max} t_{\min}{}^2}[kg] \quad \text{(S.19)} \Rightarrow F_G = \frac{V_p V_e G}{r^2 G'^2 n_{\max}{}^2 t_{\min}{}^4}[N] \quad \text{(S.20)}$$

$$\frac{F_e}{F_G} = \frac{G'^2}{G f_e{}^2 4\pi\varepsilon_0} n_{\max} = 13,21\cdot n_{\max} = 2,2688\cdot 10^{39} \quad \text{(S.21)}$$

$$n_{\max} = 1,7169\cdot 10^{38}$$

Except for the little factor 13.21, which is due to the transformation into the new system, eq. (S.21) confirms that the enormous difference of electric and gravitational force is ultimately based on the term

$$\left(\sqrt{n_{\max}}\right)^2 = 1,7169\cdot 10^{38}$$

The Sommerfeld fine structure constant α

The fine structure constant has been keeping the world of theoretical physics in suspense for about 100 years, mainly because, as a dimensionless constant, i.e., free of our randomly chosen units of measurement, it could possibly allow deeper insights into our physical reality. The renowned physicist Wolfgang Pauli was particularly addicted to the magic of the number 137 (~1/α). From the point of view of this history, the solution to the problem found here then seems almost shamefully trivial.

There is an empirically found connection between α and some other elementary quantities, which is very helpful here.

$$\alpha = \frac{e^2}{2c\varepsilon_0 h} \tag{F.1}$$

We set the right term from equation (E.8)

$$\varepsilon_0 = \frac{e^2 k_{pe} f_{D42}}{8\pi hc} \tag{E.8}$$

into the above equation and get a very simple expression for α, which contains only two directional factors and the mass ratio of proton to electron (k_{pe}).

$$\alpha = \frac{2e^2 4\pi hc}{2e^2 f_{D42}{}^2 hck_{pe}} = \frac{4\pi}{f_{D42}{}^2 k_{pe}} = 7,297352183 \cdot 10^{-3} \tag{F.2}$$

$$\Delta_{rel} = 5,3 \cdot 10^{-8} \tag{F.3}$$

$$\alpha_{lit} = 7,297352569 \cdot 10^{-3}$$

Not only the simplicity of the resulting calculation, but also the decisive term in this formula is quite astonishing, since one would not necessarily expect the mass ratio of proton to electron as the only quantity with concrete physical meaning for a natural constant which plays a decisive role in the field of electromagnetic processes.
On the other hand, the calculated result is too precise to assume a fundamentally wrong approach. Especially since also the factor f_{D42}, which could possibly be the cause of a critical consideration as an arbitrary adjustment factor, does not represent a special factor for exactly this calculation, but was stringently derived from fundamental considerations and was also already successfully used for the calculation of ε_0 and μ_0.
For this reason, the Bohr atomic model, as the basis for understanding many electromagnetic processes, will be critically examined in the following section.

The Bohr atomic model under a new aspect

Before we take a closer look at Bohr's atomic model, we want to make a small simplification by introducing the dimension-space factor f_{DR}.

$$f_{DR} = \frac{4\pi}{f_{D42}^{\;2}} \qquad (B.1)$$

$$\alpha = \frac{f_{DR}}{k_{pe}} \qquad (B.2)$$

The Bohr radius for the hydrogen atom can be simply derived classically via the centripetal force on one side and the electrostatic attraction force on the other.

$$r_{ni} = \frac{h^2 \varepsilon_0}{\pi m_e e^2} n_i^{\,2} \qquad (B.3)$$

If you insert the right term from equation (E.6) into the above equation for ε_0 and extend the fraction by f_{DR} you get the following equation;

$$r_{n_i} = n_i^{\,2} \frac{f_{DR}}{2\pi\alpha^2} s_{\min} \qquad (B.4)$$

and for the orbit of course the expression

$$U_{n_i} = n_i^{\,2} \frac{f_{DR}}{\alpha^2} s_{\min} \qquad (B.5)$$

It can be seen that radius and orbit are to be understood as a multiple of our repeatedly occurring minimum distance and thus edge length of our proton, whereby the multiplier is essentially determined by α more precisely by α^2.

Our minimum sizes also reappear at the orbital speed of the electron. However, as we now know sufficiently well, the quotient of the smallest distance and the shortest time results in a maximum speed and α determines the fraction of the speed of light with which the electron moves on its orbit.

$$v_{n_i} = \frac{\alpha}{n_i} \frac{s_{\min}}{t_{\min}} = \frac{\alpha}{n_i} c \qquad (B.6)$$

Main lines

The energy levels for the electron transitions can also be represented by α in a simple series, the formula for the main lines being consistently was derived from the classical formula for the orbital energy according to the same scheme as above. As is well known, the total energy for an electron on an orbit results from the sum of kinetic and potential energy, where the potential energy is opposite to the kinetic one.

$$E_{ges} = E_{kin} - E_{pot} \tag{B.7}$$

$$E_{ges(ni)} = -\frac{1}{n_i^2}\frac{m_e e^4}{8\varepsilon_0^2 h^2}\ _1 \tag{B.8}$$

$$\varepsilon_{0ber} = \frac{e^2 k_{pe} f_{D42}^{\ 2}}{8\pi hc} \tag{E.8}$$

Here, as above deriving α, the equation (E. 8) is used again for the substitution of ε_0. This leads to the following equation after extending the fraction with 2:

$$E_{ges(n_i)} = -\frac{1}{2n_i^2}\left(\frac{4\pi}{k_{pe} f_{D42}^{\ 2}}\right)^2 m_e c^2 \left[J\right] \tag{B. 10}$$

The expression in brackets in Eq. (B.9) corresponds to α according to the explanations in the previous section, so we can drastically simplify the formula for the calculation of all main spectral lines n_i of the hydrogen atom.

$$E_{ges(n_i)} = -\frac{1}{n_i^2}\frac{\alpha^2}{2} m_e c^2 \left[J\right] \tag{B.11}$$

$$E_{ges(n_i)} = -\frac{1}{n_i^2}\left[\frac{\alpha^2}{2} m_e c^2\right]\left[J\right] \tag{B.12}$$

The expression in the square brackets of eq. (B.12) corresponds to the Rydberg constant R∞.

The connection between α and the Rydberg constant was also found <u>empirically</u>, which in this case was quite simple, as the equation below proves, since it consists only of the fine structure constant and the Compton wavelength of the electron λ_{ce} in a very simple mathematical connection.

$$R_\infty = \frac{\alpha^2}{2}\frac{1}{\lambda_{Ce}}\left[m^{-1}\right] \quad \text{(B.12)} \qquad \text{with} \qquad \lambda_{Ce} = \frac{h}{m_e c}\left[m\right] \quad \text{(B.13)} \Rightarrow R_\infty = \frac{\alpha^2}{2}\frac{m_e c}{h}\left[m^{-1}\right] \quad \text{(B.14)} \Rightarrow R_\infty = \frac{\alpha^2}{2} m_e c^2 \left[J\right] \quad \text{(B.15)}$$

In this thesis, the above connection was <u>derived</u> from the classical approach for the first time.

<u>Fine structure</u>

The splitting of the spectral lines at high resolution into multiple lines with a small energetic distance is called spectral fine structure. From the spectral data, Sommerfeld was able to work out a constant that allowed the line spacing to be calculated. This Sommerfeld's fine structure constant α has already been discussed in the previous section and has been traced back to the well-known, important constant (k_{pe}).

The splitting of the main lines of H is based on established physical concepts:

a) the spin-orbit coupling, i.e. coupling of the orbital angular momentum l (l = 0...n-1) and the electron spin (s = ± ½) to the total angular momentum j and

b) the relativistic change in mass of the electron due to its natural orbital velocity v.

$$v_{eni} = \frac{\alpha}{n_i} c \qquad \text{(B.16)}$$

The sum of the above effects results in the "classical" calculations, where eq. (B.17) represents the splitting amount and (B.18) the absolute position of the levels on the energy scale depending on the principal quantum number n and total angular momentum quantum number j, respectively

$$\Delta E_{nij} = E_{ni} \frac{\alpha^2}{n_i} \left(\frac{3}{4n} - \frac{1}{j+1/2} \right) \qquad \text{(B.17)}$$

$$E_{nij} = E_{ni} \left[1 + \frac{\alpha^2}{n_i} \left(\frac{3}{4n} - \frac{1}{j+1/2} \right) \right] \qquad \text{(B.18)}$$

[2]*The* ***fine structure constant*** *a dimensionless physical constant that indicates the strength of the* ***electromagnetic interaction.*** *In quantum electrodynamics, the fine structure constant represents* ***the strength with which the exchange particle*** *of the electromagnetic interaction, the photon, couples to an electrically charged elementary particle, for example an electron..*

Since the fine structure constant α, which we derived in the previous section, has only the mass ratio of proton to electron as a quantity with concrete physical content, in addition to two directional factors, the "classical" interpretation, like the interpretation from Wikipedia given above, is quite questionable for this reason alone.
In addition, the equation (B.11) shows that α and α^2 are only a conversion factor, which represents the energy balance of the electron in interaction with other energy carriers, such as heat or radiation, in fractions (brackets in (B.19)) of the total resting energy of the electron ($m_e c^2$).
We therefore assume that any energy transfer leads to a change in the electron itself, e.g., in the form of a change in volume, which, according to the explanations in the section "Summary consideration of the elementary forces", leads to a change in both charge and mass, since in both cases we are dealing with a quantized volume acceleration. Although it was said in the section mentioned above that the charge is always constant in contrast to the mass, this does not apply to

short-lived, excited states.
Surprisingly, the elementary charge does not play a role in this calculation, although according to eq. (B.20) it seems to be included in the calculation with the 4th power. However, ε_0^2 also contains e^4, so that the charge is reduced.
Decisive for the fine structure of the spectra is thus the change in mass, which we here, however, do not attribute to the relativistic effects dependent on the orbital speed of the electron, but to the equivalence of mass and energy resulting from the formula E = mc^2.

The energy change ΔE in shares of the rest energy of the electron is

$$\Delta E = \Delta m_e c^2 = \left(\frac{\alpha^2}{2n_i^2}\right) m_e c^2 \quad [J] \tag{B.19a}$$

This results in a mass change of:

$$\Delta m_e = \left(\frac{\alpha^2}{2n_i^2}\right) m_e \, [kg] \tag{B.19b}$$

We must now insert this mass into the original energy calculation eq. (B.11), whereby it must be taken into account that the energy calculation consists of two summands (B.20), the difference in mass thus being divided equally into each summand

$$E_{ges(ni)} = E_{kin(ni)} + E_{pot(ni)} = \frac{1}{n_i^2}\frac{m_e e^4}{8\varepsilon_0^2 h^2} - \frac{1}{n_i^2}\frac{m_e e^4}{4\varepsilon_0^2 h^2} = -\frac{1}{n_i^2}\frac{m_e e^4}{8\varepsilon_0^2 h^2} = -\frac{1}{n_i^2}\frac{\alpha^2}{2} m_e c^2 \, [J] \tag{B.20}$$

$$m_e{*} = \frac{\Delta m_e}{2} = \frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right) m_e \tag{B.21}$$

$$E_{\Delta Fn1} = -\frac{1}{n_i^2}\frac{m_e{*} e^4}{8\varepsilon_0^2 h^2} = \left(\frac{\alpha^2}{2n_i^2}\right) m_e{*} c^2 \quad [J] \tag{B.22}$$

If we now replace m_e* by the expression on the right-hand side of Eq. (B.21), we get:

$$E_{\Delta Fn1} = -\left(\frac{\alpha^2}{2n_i^2}\right)\frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right) m_e c^2 = \frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right)^2 m_e c^2 \, [J] \tag{B.23}$$

$$E_{\Delta Fn1} = \frac{1}{n_i^4}\left[\frac{1}{2}\left(\frac{\alpha^2}{2}\right)^2 m_e c^2\right] \tag{B.24}$$

The expression in the square bracket of the equation (B.24) represents the maximum splitting energy in the area of fine splitting and thus corresponds to the Rydberg constant for the main quantum numbers.

$$\begin{aligned} E_{\Delta Fn1} &= 146{,}09 m^{-1} \Rightarrow n_i = 1 \\ E_{\Delta Fn2} &= 9{,}13 m^{-1} \Rightarrow n_i = 2 \\ E_{\Delta Fn3} &= 1{,}80 m^{-1} \Rightarrow n_i = 3 \\ E_{\Delta Fn4} &= 0{,}57 m^{-1} \Rightarrow n_i = 4 \end{aligned} \tag{B.25}$$

The energy values listed above represent the minimum energetic subsidence of the hypothetical main lines calculated without fine structure due to the conversion of energy into mass and correspond to $E_{\Delta ni\ min}$ in the calculations below.

But this alone does not describe the observed line splitting correctly. As in the classical derivation, we need another quantum number, which, however, has nothing to do with the coupling of angular momentum, but is based on the idea that the mass (Δm) as quantized volume acceleration can be given its own quantum number which we will designate in the following as the secondary quantum number m_i and which can take the following values: $m_i = 1, 2 \ldots n$

If we combine the main and secondary quantum number in blocks of two, we get four permutations:

nn nm mn mm

Since each of these permutations provides the same amount of energy, the energy from equation (B.26), which is based on the permutation nn, represents only ¼ of the energy to be considered for the fine structure splitting, i.e. the maximum energy to be used in the calculation of the fine structure is given by equation (B.27).

$$E_{\Delta Fni\,min} = \left(\frac{\alpha^2}{2n_i^2}\right)\left(\frac{\alpha^2}{4nn}\right) m_e c^2 \quad [J] \Rightarrow E_{\Delta Fni\,max} = \left(\frac{\alpha^2}{2n_i^2}\right)\left(\frac{\alpha^2}{nn}\right) m_e c^2 \quad [J]$$

(B.26) (B.27)

This maximum amount is modified by the ratio of the energy generated by m and the minimum energy of the respective main group and subtracted in this form from the maximum energy. For the case m = n, the sum is 0, which of course does not correspond to the observations. This amount must - as already discussed above - be corrected by the fundamental decrease of the respective main energy level $E_{\Delta ni\ min}$.

This results in the following total:

$$\Delta E_{Fn_im_i} = E_{\Delta Fn_i\max} - E_{\Delta Fn_i\max}\frac{E_{\Delta Fn_im}}{E_{\Delta Fn_i\min}} - E_{\Delta Fn_i\min} = E_{\Delta Fn_i\max} - E_{\Delta Fn_i\max}\frac{n}{m} - E_{\Delta Fn_i\min} \tag{B.28}$$

with $E_{\Delta Fn_i\min} = \frac{1}{4}E_{\Delta Fn_i\max}$ results after factoring out $E_{\Delta Fn_i\max}$

$$\Delta E_{Fn_im_i} = E_{\Delta Fn_i\max}\left(1 - \frac{n_i}{m_i} - \frac{1}{4}\right) = E_{\Delta Fn_i\max}\left(\frac{3}{4} - \frac{n_i}{m_i}\right) \tag{B.29}$$

We change the sign and factor out ¼

$$\Delta E_{Fn_im_i} = -E_{\Delta Fn_i\min}\left(4\frac{n_i}{m_i} - 3\right) \tag{B.30}$$

We replace $E_{\Delta ni\ min}$ by eq (B.26)

$$E_{\Delta F n_i \min} = -m_e c^2 \frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right)^2 \tag{B.26}$$

and obtain the following, very elegant formulas[1] for calculating the spectral fine structure splitting (B.28) resp. the energy levels (B.29) of these lines as a function of the main quantum number n and the secondary quantum number m

$$\Delta E_{F n_i m_i} = -m_e c^2 \frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right)^2 \left(4\frac{n_i}{m_i} - 3\right)[J] \tag{B.28}$$

$$E_{n_i m_i} = m_e c^2 \left[\frac{\alpha^2}{2n_i^2} - \frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right)^2 \left(4\frac{n_i}{m_i} - 3\right)\right][J] \tag{B.29}$$

Although the equations B28 and B17 are derived from different models, they are completely identical, which is shown in the following equations.

$$\Delta E_{nij} = E_{ni} \frac{\alpha^2}{n_i}\left(\frac{3}{4n} - \frac{1}{j+1/2}\right) = -E_{ni} \frac{\alpha^2}{n_i}\left(\frac{1}{j+1/2} - \frac{3}{4n_i}\right) \tag{B.17}$$

If one sets m for j+1/2 in (B. 17), factor out $1/4n_i$ and uses the expression based on α for the main quantum number level E_{ni} from (B.11) the result is the blue marked part in (B.30), which is identical to equation (B.28).

$$\Delta E_{nij} = -E_{ni} \frac{\alpha^2}{n_i}\frac{1}{4n_i}\left(4\frac{n_i}{m} - 3\right) = -E_{ni} \frac{1}{2}\frac{\alpha^2}{2n_i^2}\left(4\frac{n_i}{m} - 3\right) = -m_e c^2 \frac{\alpha^2}{2n_i^2}\frac{1}{2}\frac{\alpha^2}{2n_i^2}\left(4\frac{n_i}{m} - 3\right) = -m_e c^2 \frac{1}{2}\left(\frac{\alpha^2}{2n_i^2}\right)^2\left(4\frac{n_i}{m} - 3\right) \tag{B.30}$$

This result is somewhat surprising, since the different paths taken here, i.e. relativistic and energetic mass change, lead to very similar but not exactly the same results, as can be easily calculated.

$$\frac{m_{Ener}}{m_{\mathrm{Re}l}} = \sqrt{1 - \frac{3}{4}\alpha^4 - \frac{1}{4}\alpha^6} = 0{,}9999999989363110$$

m_{Ener} mass increased by energy supply

$m_{\mathrm{Re}l}$ mass increased by relativistic effect

The surprising coincidence of the equations derived above is due to the fact that the classical calculation is an approximate calculation. It is derived via a series expansion (see B.32 and B.33) and since the findings from (B.34) hold, the higher members of this series can be neglected, so that only the term on the right in (B.33) gives the relativistic correction
In practice, this simplification is fully justified. For example, the difference for the Lyman α1 line

when calculated using the full or simplified relativistic calculation - the latter corresponding to the energy approach used here - is only 0.005 m^{-1}

For comparison: Fine structure splitting: 146 m^{-1}
Hyperfine structure splitting: 4.7 m^{-1}

Unfortunately, it will probably not be possible to prove this small energetic difference experimentally, so that a verification of one of the two different models will not succeed in this way.

$$\sqrt{1+\frac{p^2}{m_0{}^2c^2}}=1+\frac{1}{2}\frac{p^2}{m_0{}^2c^2}-\frac{1}{8}\left(\frac{p^2}{m_0{}^2c^2}\right)^2+.......$$

(B.32) [3]

$$E=\left(\frac{1}{2}\frac{p^2}{m_0}+E_{pot}\right)-\frac{1}{8}\frac{p^4}{m_0{}^3c^2}+.......$$

(B.33) [3]

$$E_{kin}\ll m_0c^2\Rightarrow\frac{p^2}{2m_0{}^2c^2}\ll 1$$

(B.34) [3]

In summary, one can state with a certain astonishment that one arrives at identical solution equations when calculating the fine structure lines of hydrogen with two quite different solution approaches. Considering our new knowledge about α from the previous section, namely that it represents nothing else than an expression for $1/k_{pe}$ corrected by two directional factors, only the solution approach derived in this work about the volume and thus energy change of the electron itself makes sense, since in this construct k_{pe} is connected as a corrective with the charge as volume acceleration (see equations below), so that it seems plausible that also short-term charge changes (excited states) and thus short-term volume change occur in fractions of kpe.

[1] The calculations performed here refer exclusively to hydrogen. Thus Z is always 1 and is not considered in the formulas.

[2] Wikipedia: "Fine structure constant" (2019)

[3] Physics IV Atoms, Molecules, Heat Statistics Lecture
script for the lecture in SS 2003
Prof. Dr. Rudolf Gross
Walther-Meissner-Institut Bayerische Akademie der Wissenschaften and
Chair of Technical Physics (E23) ¨ Technische Universität München“

The equivalence principle

Einstein made the equivalence of inert and heavy mass the basis of his general theory of relativity, because he assumed that for an isolated observer, which is connected to the outside world only by the force acting on him, the situations of being in an accelerated system or in the gravitational field of a mass body are indistinguishable. Even if one formulates this assertion even more sharply to the effect that there is basically no experiment that makes such a distinction

possible, this is not proof of this thesis.
Although the general view in physics is that Einstein's General Theory of Relativity and thus the equivalence principle has been confirmed, drop tests - especially with the new possibilities in space - are still being carried out to check with ever greater precision whether the acceleration in a gravitational field changes as a function of the mass of the test specimen.

$$\frac{m_{xi\,g} m_G G}{s^2} = m_{xit} \cdot a_G$$

Equations of force (AE.1)

m_{xi} test specimens, once in their property as
m_{xig} heavy masses or as
m_{xit} inert masses
m_G large mass
a_G acceleration in the gravitational field of m_G
s distance

$$\frac{m_G G}{s^2} = \frac{m_{xit}}{m_{xi\,g}} \cdot a_G \tag{AE.2}$$

Of course, the gravitational acceleration is only exactly the same for <u>all</u> specimens if the heavy and inertial masses of the respective specimens (m_{xi}) are absolutely identical, and therefor in the equation (AE.2) the quotient m_{xit}/m_{xig} is equal to 1.

But even such a precision measurement does not prove the equivalence of heavy and inert mass. It can only show that the equivalence hypothesis is correct within the scope of the measurement accuracy.
By new view of masses as volume accelerations however, equivalence of heavy and inert mass can be deduced very easy and clear.

With m_{g1} and m_{g2} we introduce two gravitons (protons without positrons) into the classical equation for the gravitational force, convert m_{g2} into volume accelerations by means of G' and represent the volume V_{g2} as area times length.

$$F_G = \frac{m_{g1} m_{g2}}{s_x^{\ 2}} G \tag{AE.3}$$

$$F_G = \frac{m_{g1} V_{g2}}{s_x^{\ 2} n_{\max} t^2 G'} G = \frac{m_{g1} s_{\min}^{\ 2} s_{\min}}{s_x^{\ 2} n_{\max} t^2 G'} G \qquad [AE.4]$$

To make the equation (AE.4) clearer, the conversion factors, the proportionality constants and n_{max} are moved to the left side of the equation.

$$F_G' = \frac{m_{g1} s_{\min}^{\ 2} s_{\min}}{s_x^{\ 2} t^2} \tag{AE.5}$$

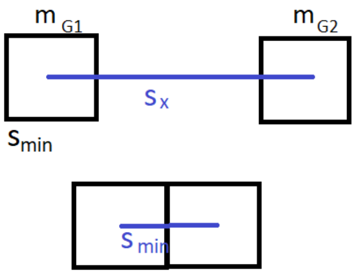


Fig. 7

The upper part of the figure 7 shows the initial situation with the gravitons at distance s_x, measured from the center of the cubes. The lower part shows the situation after the two mass particles have approached s_{min}.

$$F_G{}' = \frac{m_{g1} s_{\min}{}^2 s_{\min}}{s_{\min}{}^2 t_{\min}{}^2} = \frac{m_{g1} s_{\min}}{t_{\min}{}^2} \qquad \text{(AE.6)}$$

As soon as the distance $\mathbf{s_x}$ between the two gravitons 1 and 2 shrinks to $\mathbf{s_{min}}$, i. e. as soon as the opposite faces of both cubes **touch** each other (see lower part of figure 7), we can reduce the fraction by s_{min}^2 and transfer the second graviton to linear acceleration, whereby the equation for the calculation of the force between heavy masses changes into that for the force calculation of inertial masses.

So as soon as an **indirect long-distance effect** becomes **an immediate direct effect**, m_{g1} changes from an initially heavy mass to an inert mass, without us having made any changes to it.

<u>Summary</u>

The discontinuity of our reality (quantization) and the phenomenon of a maximum speed (speed of light) is now generally accepted by physicists on the basis of observations and calculations, although there is no plausible explanation for this. The construct of a projection presented here, on the other hand, provides a simple, absolutely plausible explanation, since these two phenomena, which limit the system upwards and downwards, are <u>inevitably</u> elements of any projective representation.

It is fascinating that for the description of the whole system, the definition of only **3 elementary sizes**, 2 length units and one time unit is sufficient. Other definitions, such as the speed of light as a basic parameter, are also possible, but this seems to us to be the most elegant solution.

$s_{min} = 1.3214098\ 10^{-15}\ m$ *edge length of the cubic proton*

$r_e = (3 \cdot 10^{-49})^{1/3}\ m$ *radius of the spherical electron*

$t_{min} = 0.4407748\ 10^{-23}\ s$ *minimum resolution time*

In the following, our elementary masses and charges with the experimentally determined values are to be used in the conventional sizes and units, although they could be converted into volume accelerations without any problems using the respective conversion factors and thus could be described again exclusively using the above-mentioned specified sizes, which would however lead to very unfamiliar terrain, which will not be covered here yet.

With the elementary quantities listed above, of course, the speed of light c is not a natural constant, but is derived from s_{min} and t_{min}

$$c = \frac{s_{\min}}{t_{\min}} \left[\frac{m}{s} \right] \tag{SO.1}$$

as well as the Planckian action quantum, if we include the "classical" proton mass.

$$h = m_p c s_{\min} \left[Js \right] \tag{SO.2}$$

The proton was identified as the basic building block of this projective system. From this it follows that it is identical in shape and size to the smallest resolved spatial units.

$${s_{\min}}^3 = V_{Pix} = V_P \left[m^3 \right] \tag{SO.4}$$

The electron volume is determined by the electron radius, one of the basic quantities listed above

$$V_e = \frac{4\pi}{3} {r_e}^3 = 4\pi 10^{-49} \left[m^3 \right] \tag{SO.5}$$

Because of the constant elementary particle density, the ratio of proton to electron mass kpe, which is very important for many calculations, corresponds to the ratio of the respective volumes and can therefore be calculated independently of the masses.

$$k_{pe} = \frac{V_P}{V_e} \tag{SO.6}$$

However, if we assume the idealized value for Ve, see Eq. (SO.5), a discrepancy arises from the ratio of the masses. This requires a discussion of principles, which will be treated in the following.

However, if we assume the idealized value for V_e see eq. (SO.5), there is a discrepancy with the ratio of the masses. This requires a discussion of principles, which is dealt with below.

A real novelty in the construct presented here are the two dimensional factors, but they were by no means introduced as free parameters or unexplained constants in order to reconcile measurement and calculation respectively. Rather, they can be consistently derived from the embedding of our reality in a fourth dimension, for the calculation of which, as for all other variables considered so far, only the above-mentioned elementary variables are required.

$$f_{D4} = \sqrt{1-\left(\frac{1}{4}\right)^2} \quad \text{(SO.7)}$$

$$f_{D42} = \sqrt{1-\left(\frac{f_{geo}}{4}\right)^2} \qquad f_{geo} = \left(1-\frac{r_e}{s_{\min}-r_e}\right)^2$$

(SO.8) (SO.9)

Also, the fact that we need two dimensional factors is not a shortcoming, i.e., no auxiliary construction to calculate the results more nicely. Conversely, it would be astonishing if there were only one factor, since we would then have to assume the same directional characteristic for field lines originating from plane surfaces and those originating from curved surfaces, which is of course nonsensical.

Conversely, the dimension factor fD42 in electrostatics strengthens our assumption that the electron is actually a spherically symmetrical structure. An assumption that has so far only been derived from the special numerical value for the electron volume (4π10-49).

The fact that even the correction factor f_{geo}, which leads from f_{D4} to f_{D42}, can be calculated exclusively by means of the above-mentioned elementary length units r_e and s_{min}, was a big, but positive surprise in this research and rounds off the construct presented here to a consistent overall picture.

$$n_{\max} \mathrel{\hat{=}} N_{Pix} = \frac{s_E t_E}{s_{\min} t_{\min}} \quad \text{(SO.10)}$$

The above-mentioned quantities N_{pix} (spatial resolution) and n_{max} (maximum number of acceleration steps) are, like the dimension factors, a novelty in theoretical physics, while they are sufficiently known in the field of our digital photography as area and color resolution.

The systemically given definition of the number of pixels was determined empirically and the numerical equality of N_{pix} and n_{max} was initially only one, albeit plausible, assumption, which has, however, proved to be excellent in all calculations so far. This means that both sizes can be traced back exclusively to two of the above-mentioned basic sizes. The unit sizes s_E and t_E are not newly defined elementary sizes, but are only due to the fact that pixel numbers are usually defined as the number of minimum areas per unit area.
Thus, we have all elements of which the more complex factors, among others, are made up, and thus the latter themselves, can be traced back to the 3 elementary quantities highlighted in colour above, which can be checked again directly using the following equations.

Fine structure constant

$$\alpha = \frac{4\pi}{f_{D42}{}^{2} k_{pe}} \qquad \text{(SO.11)}$$

Electrical field constant

$$\varepsilon_0 = \frac{e^2 t_{\min}{}^{2}}{4\pi s_{\min}{}^{3} m_e} \frac{f_{D42}{}^{2}}{2} \left[\frac{C^2}{Nm} \right] \qquad \text{(SO.12)}$$

Magnetic field constant

$$\mu_0 = \frac{4\pi s_{\min} m_e}{e^2} \frac{2}{f_{D42}{}^{2}} \left[\frac{kg \cdot m}{C^2} \right] \qquad \text{(SO.13)}$$

Gravitational constant (calculated using the proton mass)

$$G = \frac{V_p}{6 N_{pix} t_{\min}{}^{2} m_P} \sqrt{1-(\tfrac{1}{4})^2} \left[\frac{m^3}{\mathrm{s}^2\, kg} \right] \qquad \text{(SO.14)}$$

Gravitational constant (calculated using the elementary charge)

$$G = \frac{8\pi c s_{\min} f_{D4}}{6e^2 f_{D42}{}^{2} s_E t_E} 10^{-42} \left[\frac{m^3}{\mathrm{s}^2\, kg} \right] \qquad \text{SO.15)}$$

Finally, a great success of this work is that the equivalence of heavy and inertial mass with the concept of volume acceleration is almost inevitable, since when two elementary bodies act directly on each other, the volume acceleration is transformed into a linear acceleration.

Since k_{pe} is the determinant variable in the fine structure constant α, it now has a special significance. However, there are three variants for the value:

$$k_{pe} = \frac{m_P}{m_e} = 1836{,}152673 \quad \Delta_{rel} = 1{,}9\ 10^{-5} \qquad \text{(SO.16)}$$

$$k_{pe} = \frac{V_P}{V_e} = \frac{V_P}{4\pi 10^{-49}} 1836{,}126954 \quad \Delta_{rel} = 4{,}8\ 10^{-6} \qquad \text{(SO.17)}$$

$$k_{pe} = 6\pi^5 = 1836{,}11811 \qquad \text{(SO.18)}$$

Whether and how the discrepancy between the values of the individual calculations above can be resolved is the subject of further consideration. It would be interesting if the entire construct were actually based on π, as illustrated in the schematic fig.8 below.

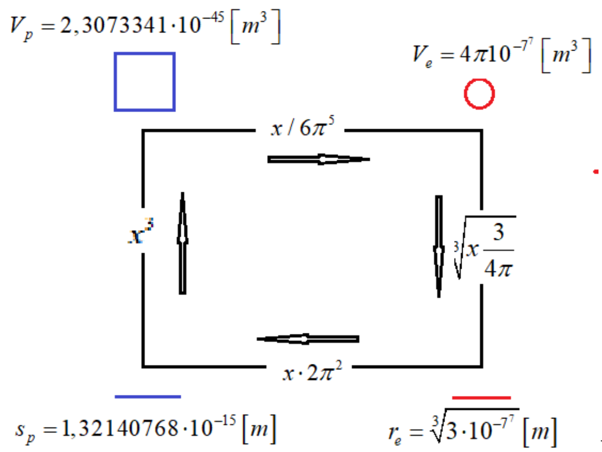


Fig. 8

Thus, it would also be of interest whether the value $k_{pe} = 6\pi^5$ in the 4th dimension, i.e., for the ratio of "proton tesseract" to "electron hypersphere" also results in an integer value based on π. This is indeed the case, as the following calculation shows. Thus, we would have another hint for a special relation of our reality to the 4th dimension besides the factors f_{D4} and f_{D42} referring to the 4th dimension.

$$k_{pe4} = \frac{\left(\sqrt[3]{4\pi \cdot k_{pe} \cdot 10^{-49}}\right)^4 \cdot 2}{\left(\sqrt[3]{3 \cdot 10^{-49}}\right)^4 \pi^2} = \frac{\left(\sqrt[3]{4 \cdot 6\pi^6 \cdot 10^{-49}}\right)^4 \cdot 2}{\left(\sqrt[3]{3 \cdot 10^{-49}}\right)^4 \pi^2} = 32 \cdot \pi^6 \qquad \text{(SO.19)}$$

$$k_{pe4} = \frac{\left(\sqrt[3]{4 \cdot x\pi^y \cdot 10^{-49}}\right)^4 \cdot 2}{\left(\sqrt[3]{3 \cdot 10^{-49}}\right)^4 \pi^2} \qquad \text{(SO.20)}$$

The check of the above general formula (SO.20) showed that only with the exponent y = 6 and the factor x = 6 n^3 (n = 1, 2, ...) integer volume ratios based on π can be expected in the 4th dimension. Considering that a physically reasonable frame must be kept for V_p/V_e, only the value 48 π^5 (n=2) can be additionally considered for k_{pe}. Provided that k_{pe} is really based on π, the value observed in our physical reality is consequently not an arbitrary random value, but can be derived quite exactly by means of the above-mentioned calculations and considerations.

As a special surprise of this elaboration, the calculations of the electron volume must be classified, which is still discussed very controversially among physicists with volumes between ~10^{-44} and 0 m^3 (point-like). The volume calculated here of 4π 10^{-49} m^3 with a relative error to 4π of only 1.4 10^{-5} is so astonishing because we have here a coincidence between a size with an

arbitrarily chosen linear measure (meter) and an integer value based on π. (In terms of the unit of length, the relative error is even only 4.7 10^{-6})
In other words, how is it possible that from the almost infinite possibilities of defining units of length, we have chosen exactly the one that is the only one that leads almost exactly to this coincidence? Especially as the history of the origin of the meter also seems a little strange. Why did the strange idea come up at the end of the 18th century to define the ten millionth part of an Earth meridian quadrant as the new measure of all things? Especially since this survey was difficult at that time and the accuracy left much to be desired. Wouldn't it have been much easier to precisely define one of the then common measures such as step (0.71 m), cubit (0.45 - 1.713 m) or foot (0.3028 m), to cast it in platinum-iridium and to declare it a binding length measure worldwide? They are all units of measurement that came from practical experience and would therefore have been just as suitable for everyday use as our meter.
Finally, if we look at the radius of the electron and decode the power of ten, we get the expression,

$$r_e = \sqrt[3]{3 \cdot (10^{-7})^7} \qquad \text{(SO.21)}$$

which can only be represented by the numbers 3 and 7, which are considered almost holy especially in the Christian-Jewish cultural area. Here, however, we leave the framework of a purely physical work and move into more ideological-religious terrain, so that this aspect will not be pursued further here, but only give impulses for further independent thinking.

Finally, some superordinate aspects of this new theory, which are essentially important for cosmology resp. astrophysics, shall be discussed.
The detection of gravitational waves was celebrated in 2017 with a Nobel Prize under great media interest. According to the results of our work, however, the proof must necessarily be a misinterpretation, since

- gravitation is a volume acceleration and not a curvature of space-time, as postulated by A. Einstein1 and therefore no gravitational waves are generated.

- even if there would be these waves, the resulting, on the LIGO interferometer related length change of approx. 10-17-10-18 m lies clearly under the resolving power (10-15 m) of our projective world, ergo is not measurable.

We live in a world based on accelerations. We have got to know the volume acceleration as forces. The linear acceleration we observe obviously, if we look into the universe as an apparently accelerated expansion of our cosmos, which is usually recorded numerically via the Hubble constant.

$$H_0 \sim 72 \text{ km / (s Mpc)} \qquad \text{(SO.22)}$$

If we convert the megaparsec (Mpc) into seconds, we get the Hubble acceleration of ~ 7 10-10 m/s2.

An acceleration of the same magnitude plays a role in the so-called spiral galaxy anomaly. Spiral galaxies show an anomaly in the regions far from the center. There, according to Kepler's laws, the orbital velocities of the stars should gradually decrease. In fact, they remain nearly constant as soon as the orbital acceleration has dropped to about 10-10 m/s2. Thus, the suspicion is obvious that we have encountered here a lower linear acceleration, which cannot be fallen below and also then, if from the calculation a smaller one is demanded, remains constant at the minimum value. The projection theory, however, demands a minimum linear acceleration, which is also very easy to calculate:

$$a_{\min} = \frac{s_{\min}}{n_{\max} t_{\min}{}^2} = 3{,}9615 \cdot 10^{-7} \left[\frac{m}{s^2} \right] \qquad \text{(SO.23)}$$

However, the comparison of the values measured by the astrophysicists and the one calculated above shows a discrepancy by a factor of about 500, which still has to be clarified in more detail, but is probably due to the fact that we ourselves are part of the accelerated system and therefore only measure acceleration differences and not the absolute acceleration. In spite of this discrepancy, which is not yet completely clarified, we assume that we have encountered both with the accelerated expansion of the cosmos and with the galaxy anomaly the linear acceleration inherent in the system, and in fact in these two cases the minimal linear acceleration With this, also the idea of the big bang with its speculative calculations, which in the meantime are getting out of hand, should no longer be tenable.
We must go even with the change of our view of the things still a piece further and with it we strike the bow to the beginning of this work, to the biology which had suggested the basic idea of a projection.

There are almost innumerable treatises to the question, how, when and why the life originated here on the earth or however in the expanses of the cosmos. Unfortunately, all these surely often very clever ideas and explanation attempts are obsolete, because the question is simply wrong. The life did not originate in this world, but the world originated with the life, because the life carries the time in itself and therefore this space-time construct was only created with the life itself.

Note

[1]*At this point respect is to be paid once again to Albert Einstein, this great physicist and wise man, a man who even possessed the greatness to question his entire life's work himself at the end of his life. Thus, in August 1954, about 8 months before his death, he wrote to his old friend Michele Besso:*

"But I consider it quite possible that physics cannot be founded on the field concept, that is, on continuous entities. Then nothing of my castle in the air including the theory of gravitation remains".