A CRITICAL EXAMINATION OF FUNDAMENTALS IN PHYSICS

Motto:

"The difference between a good experiment and a good theory is in the fact that the theory gets old quickly and it is replaced by another one, based on more perfect ideas. It will be forgotten quickly. The experiment is something else. The experiment, which has been thought well and performed carefully, will step in the science forever. It will become its part. It is possible to explain such experiment differently in different periods of times."

P. L. KAPICA

"The laws of nature are so grandiose, that they have to evoke admiration. We can fully relish the feeling only if we can share it with someone. This is not easy affair, however, to share that feeling. The deeper the man plunge into the unknown, the less fellow-travelers one has. In the end of the process, when he arrives there for real where no one else has been before, he is alone."

H. SELEY

"No scientist can have and even require a guarantee, that his opinions will not be contradicted in the future. He can only hope, that he will set the sufficiently valid and significant relations between the facts, which, even if they will be contradicted later, will serve as a basis of the discoveries of new facts and new coherencies."

J. D. BERNAL

ABSTRACT

Coming out from the motto we are going to revalue the experiments of Fizeau, Harres, Kaufmann, Michelson-Morley, which gave rise to Einstein's special and general theory of relativity. All these experiments are revalued from the point of view of the submitted new theory of relativity based on the new definition of medium, the new generalized law of inertia, the new law of propagation of light (waves, intensity), the new definition of equivalent coordinates system, the new principle of relativity. It has been derived the asymmetric form of intensity of the electric field of moving charge at the velocity of $0.001c$-c. The theoretical values resulting from the new theory are compared with the experimental Kaufmann's values. It is affirmed the general validity of Maxwell's equations (not only in statics).

The results of Fizeau's and Harres' experiments prove the theory of non-linear form of interference field in moving medium without the drag coefficient. There are mentioned the correct relations for Doppler's effect. In the results of the theory there is outlined the possible generalization for the fields, in which the speed of propagation is finite. For the gravitational field there is outlined the way of getting off the Earth by means of rotation. It is explained the new determination of energies and velocities of particles for nuclear field. There are mentioned the relations for energy and the calculations of the radius of moving particles force reach.

INTRODUCTION

The theory of relativity as well as any other scientific theory cannot be considered as a certainty established once and for all, which cannot be mistaken, hor as a theory which will never prove wrong in some respect. Each theory is an approximate reflection of reality and its application is of limited use for various reasons. At present a considerable number of scientists speculate that the theory of relativity (the special theory as well as the general one) is wrong, when applied in case of very small distances (significantly smaller than the presumed size of "elementary" particles). There are obvious reasons to assume, that the theory of relativity can be inapplicable, when applied to extremely large areas of space of order of presumed size of universe (up to the areas, where the "red shift" becomes quite considerable). One should be prepared for its critical revaluation and its eventual replacement for a more exact theory. It can be radically different from the theory of relativity. That itself differs from the Newtonian mechanics.

First, the topic of the paper is very difficult as the one concerns very special knowledge based on less known experiments (Harres) and less accessible ones (Fizeau). Meanwhile present physicists very difficult eliminate prejudice caused by the former convoluted thinking (using old, outdated terms, that do not precisely correspond with the substance).

Therefore the paper will surely be clear to people not necessarily expert in special relativity.

The new theory is so clear, simple and understandable, the results, Consequences 1 and Consequences 2 are in such a magnificent harmony with facts and experiments in physics that there can be no one who would not become enthusiastic about it.

I would like to ask the reader to transform himself or herself into an entirely unprejudiced researcher without prejudice required by Einstein's special theory of relativity, starting out from Einstein's vicious circle (item 1.1.1.). If the reader achieves that, he or she will comprehend the paper. But if the reader remains in Einstein's vicious circle, he will never manage it. It is necessary to give up of such terms as inertial systems (new term - equivalent system, item 1.2.4.)), ether (new term - medium, item 1.2.1.)), local time, covariant equations, physical definition of simultaneity, invariant interval, Lorentz transformation equations...

It is very difficult to eliminate the above terms if one has been using them for years (I have my own experience with this). Yet if one is indeed able to manage that, he or she will find a superb clarity and simplicity in understanding off all paradoxes derived from the theory of relativity (paradox of twins, length shortening by motion ...).

The paper is long, because it deals with principles of physics, from the works of Newton through Maxwell, Huygens, Einstein up to the present times. It contains a number of experiments and outputs which should prove a test to the work. Who reads the paper in parts only, he or she must always face recognized imperfect theories, because they serve him as a criterium for its evaluation. Hence, the work should be read as a whole.

The topic of the paper is difficult and demanding. It requires patience and tolerance in understanding new yet unusual terms and results, which are, however, real and logical. I believe that it will entice the reader (who will come to understand the magnificence of the theory, mainly the Consequences 1, 2, containing the radius of force reach of particles, cross-section ...) and through the reader, most physicists, who will read this paper.

1. NOMENCLATURE AND TERMINOLOGY

Motto:

"Who does want to see, he will see, who does want to hear, he will hear, who does want to understand, he will understand."

In the endeavor to achieve the almost description of nature, the author is constrained to remove old (not correspondent to the substance nomenclature and terminology) used:

1. in current physics (uniform motion in a straight line, retarded potentials, ...)
2. in special relativity theory (inertial systems, SPACE-TIME, local time, covariant equations, physical definition of simultaneity, invariant interval, Lorentz transformation equations, ..)
3. in old physics (ether, drag coefficient, ...) and replace it with several new terms (medium, equivalent system, quasi-circle motion, new form of the intensity of moving charge of electric field, non-linear form of the interference field, new generalized law of inertia...).

The author is constrained to eliminate bad, harmful and illusory terms. Those terms have been proved as bad by a number of other authors (ether, SPACE-TIME, inertial systems, ...).The author hopes that this will not distract the reader. The author wishes that the reader will take time to study and learn new nomenclature and terminology. The terminology in physics (but also in philosophy and in science in general) is as variable as grade knowledge. Being opposed to this means to stop progress. It is very difficult to express through human language should one wish to explain the finest differences and deviations from ideal terms. All ideal terms used in physics (as well as in philosophy and in the science generally) are a mere approximation to the real state. Thousands of scientists are convinced about that in their struggle for understanding the world. But one must express in some way, so he uses ideal terms, such as straight-line motion, ideal circle motion, etc. Yes, it is impossible to realize those terms in real world, as even the most precise experiments have deviations, error measurements, etc. For more accurate expression it is therefore suitable to use terms with a „quasi-" (quasi-circle ...). The physicist believe that synchrotron radiation is a movement of electrons along the ideal circle. But in reality, very small deviations from this ideal circle occur, thus electrons move along the quasi-circle, a little deformed circle or rosette respectively (swiveling of perinucleum). In that case they move in slight acceleration in a certain section and a somewhat decelerated in another (alternatively) against the ideal constant velocity along the circle considered by physicists, see Consequences 2, point 20. Synchrotron radiation is really in author's theory. But electron moves at quasi-circle not on the ideal circle. The ideal circle motion does not exist in reality by radiation of electron.

A stationary cloud is just a rosette, see Consequences 2, point 20, in which the electron moves around the nucleus in the atom. Should the author define every term used in physics, the paper would be even longer. The author has attempted to define principal terms different from those used generally (e. g. medium, see 1.2.1.).

Words "intensity of a moving charge" - see, e. g. [5], [6].

The intensity of electric field characterizes electric field in a similar way as the acceleration of gravity characterizes gravitation field. So as no gravitation field could exist, without acceleration of gravity no electric field could exist, without the intensity of the electric field.

Therefore, the field is characterized by its intensity.

Experiments by Fizeau, Harres, Kaufman and Michelson-Morley were evaluated in Einstein's theory of relativity in light of the old (wrong) terms, such as: ether, inertial systems, straight-line motion, Lorentz transformation equations, physical definition of simultaneity, linear form of the interference field...

It is therefore necessary to reassess those experiments in light of the new terms. Such as: medium, non-linear form of interference field, Maxwell equations not only valid in statics, new form of intensity of moving charge of electric field, new generalized law of inertia ... In light of our new theory, also see a motto - page 2 (by P. L. Kapica): "... the theory gets old quickly and it is replaced by another one, based on more perfect ideas... . The experiment, which has been thought through well and performed carefully, will enter a science forever to become its part. Such experiment can be explained differently in different time periods." If I have wrong terms (e. g. ether), at first, I must define them (e. g. medium). Only then I can explain an experiment correctly. I can't explain an experiment correctly on the basis of wrong terms.

It is what Einstein's theory of relativity has done. Selection of symbols is connected with the fact that the author intended to explain and remove a number of terms from present physics, such as "retarded potentials", "dependence of mass on velocity", "physical definition of simultaneity" ... in the simplest and most practical manner.

In order to achieve that, he always had to make a simultaneous record of the position of the charge moving at velocity v and the intensity of the electric field, transmitted the in medium at velocity c, independently from the velocity of the charge. He thus achieved the shape of the intensity of the moving charge (see Fig. 2.1 to 2.10 and the accompanying text (part 2.1.1)).

1.1. Criticism of Einstein's theory of relativity

Sir Carl Popper:

"Knowledge and information progresses faster thanks to scientists who try to question the theory rather than those who want to prove it."

Einstein made a serious mistake taking the Galilei's principle of relativity, valid only for velocities $v \ll c$, c - velocity of light, as the basis of the special (and general) theory of relativity. He excluded the Galileian system of coordinates and preserved the validity of law of inertia. He also generalized its validity for systems moving at velocity $v \approx c$.

Einstein has written: "Prominent theoretical physicists were therefore more inclined to reject the principle of relativity, in spite of the fact that no empirical data had been found as contradictory to this principle." - RELATIVITY, THE SPECIAL AND THE GENERAL THEORY BY A. EINSTEIN, AUTHORIZED TRANSLATION BY ROBERT W. LANSON, FOURTH EDITION, LONDON 1921. We will show the empirical data contradictory to Einstein's principles of relativity.

In this juncture the question of validity of the idea of space-and-time frame has become ready to be discussed. The answer to the question may be negative. Nevertheless, there are two general facts, initially favorable to the validity of the idea of space-and-time frame.

They are:

A. The form of the interference field

B. The form of the intensity of the moving charge

In part 2 we will show, that the form of the interference field of the moving medium is not-linear (it remains to prove by the metrologers that the interference field is also non-linear for the medium at rest).

We will also show, that the form of intensity of the moving charge is asymmetric.

Einstein made a major mistake. The author proves it in revaluation Kaufmann's, Fizeau's and Harres's experiments in light of the new theory (intensity of moving charge, non-linear form of the interference field, etc.).

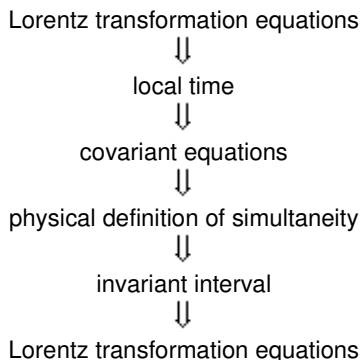### 1.1.1. Einstein's closed vicious circle

Einstein's two axioms:

a) law of propagation of light in all inertial frames

b) laws of physics (i. e. the law of propagation of light), identical in all inertial frames, mean that the light is propagated in all inertial frames at the speed of c. We can agree with this affirmation only in line with the closed coordinates system, with different media firmly connected with the frames (i. e. their coordinate axes). Otherwise, if we have the coordinate axes (skeletons) of inertial frames with a common medium, then is only one frame (skeleton - x, y, z axes) firmly connected to the medium. Although the light is propagated at the speed of c, with regard to other inertial frames, it is not true! In all inertial frames not firmly connected to the medium with regard to the frames (skeletons - x, y, z, axes only) the light does not propagate at the speed c, nevertheless the light cannot propagate in empty inertial frames (skeletons x, y, z)!

According to Einstein, the expression of vacuum (emptiness) indents to be apparently the unitive medium. That is again not correct.

Nevertheless, the vacuum consists of elementary particles, which also persist in a certain motion. It means that it is possible to connect firmly with a given vacuum the only one frame, which "moves at the speed of $v = 0$" with regard to the vacuum (medium). It is evident, that it is possible to create the vacuum laboratories on various planets. In all of them, the light is propagated at speed c. But with regard to different inertial frames of planets the speed is different. There are different vacuums, which move at different speed. Einstein had to shelter himself behind the law of propagation of light "at all times" so that both Einstein's axioms could be "valid" simultaneously.

Einstein corrected the real difference of light speeds in different inertial frames (skeletons) by "different times" in a fictitious "SPACE-TIME". He helped himself with a mixture of "space-time" mathematically expressed by the Lorentz transformation equations. Then he helped himself with other new expressions, that rescue what is not possible to rescue, whereby those notions represent the following closed vicious circle:

<div align="center">

Lorentz transformation equations

⇓

local time

⇓

covariant equations

⇓

physical definition of simultaneity

⇓

invariant interval

⇓

Lorentz transformation equations

</div>

We have shown that the idea of space-time frames is entirely wrong. All notions in the closed vicious circle, including "mean proper lifetime of particle" calculated on the basis of the Einstein's theory of relativity which was not measured experimentally in fact are absolutely wrong. Physics is overflown by such anabashed points. It is necessary to clean the physics. It is necessary to strictly distinguish the measured values of the particles lifetime from the so called proper (shorter) Einstein's doubtful particle lifetimes, which takes into consideration velocity and shortens the real lifetime to the shorter fictitious (incorrect) proper lifetime, shown in the tables. The table proper lifetimes of particles have to be removed from the physical literature and be replaced by the measured real lifetimes simultaneously with the measured velocities of elementary particles. The incorrect notions of Einstein's closed vicious circle lead to logical assumptions for the incorrect notions in physics such as different times in different frames, length contraction, energy-momentum tensor, paradox of twins, clock paradox, equivalence of mass and energy etc. That's why it is necessary to remove this chaos from physics and to bring the results of classical experiments in the right proportion (the place they belong to).

It is not possible to reject Einstein's theory of relativity by one or by a few experiments. It is necessary to start from vicious circle... The combination of the time "coordinate" with space coordinates into space-time and vicious circle originating from this is a big mathematical mistake.

This is deception of physicists including Einstein.

1.1.2. Experiments revaluation

The big part of "proofs" of validity of the special theory of relativity arose in the earlies, when the theory was new and not yet generally accepted. The experiments should examine, test or contradict the special theory of relativity.

They are Fizeau's, Harre's, Kaufmann's, Michelson-Morley's experiments.

All of them will be judged in light of the new theory of relativity. We suppose it will be done on the basis of a new definition of medium, our new generalized law of inertia, law of propagation of light (waves, intensity), our new definition of equivalent system of coordinates of our principle of relativity, Doppler's principle of correct relations, of the form of intensity of moving charge of electric field - the new theory, non-linear form of interference field in moving medium, and the always valid (not only in statics) Maxwell's equations.

1.2. Our new theory of relativity

The explanation of light as the electromagnetic waves phenomenon was one of major triumphs of Maxwell's electromagnetic theory.

But the waves in what?

In Michelson-Morley's experiment it was the result the decision of "death" for the theory of calm ether sea, which all mass moves through.

That is why I propose a new definition of medium, where the light (wave, intensity) is propagated.

1.2.1. New definition of medium, in which the light (wave, intensity) is propagated

"All mass (standstill and moving) including vacuum, consists of elementary particles, via which the light (wave or intensity) is propagated by Huygens principle. This principle states that each point of wave front (electromagnetic wave front) can be considered as a source of secondary wavelets (small intensities) propagated in all directions. Each source of secondary wavelets (small intensities) i. e. each particle of medium moves at the speed of the medium. In other words, the drag coefficient equals one (the complete drag).

At any moment the wave front (intensity front) is the envelope of these wavelets (electromagnetic wavelets)."

The medium is composed of elementary particles oscillating around their equilibrial positions. It is completely entrained as a whole, e. g. by Earth gravitation field (considering the Earth, the equilibrial positions of their elementary particles are at rest).

The medium oscillated around the equilibrial positions of its particles in microspaces due to the spread of wave motion.

But as a whole, it does not move, while just local medium (elementary particles) are in micromotion around their equilibrial positions (which are at rest considering the Earth, however, because the it rotates and circles around the Sun, the equilibrial positions are also in motion considering fixed stars or the Sun respectively). An absolute vacuum, i. e. zero pressure, does not really exist. It is only a certain, nearly an ideal term, impossible to achieve in any laboratory. Not to state that „one of the great "triumphs" of relativity is that the medium was declared superfluous - not needed in all coordinate systems" - this is one of the biggest defects of theory of relativity, frequently criticized today. The difference between the medium and ether is substantial. While the ether was defined as penetrating through the entire matter, at the same time it was firmly connected with the absolute

stationary space and torn off by environment with a different tearing coefficient = drag coefficient α. The medium is an environment, in which wave motion is spread. If we would endeavor to compare "tearing coefficient" of medium and the ether respectively, always for the medium $\alpha = 1$. It is necessary to realize that there is a large number of media in the Universe, mutually moving, while the "jump" of wave motion from one moving medium to another one is ensured by Huygens principle (see 1.2.3).

Ground spheres of air as well as media are completely entrained by Earth's gravitational field. Considering the Earth, it is difficult to speak about a relative motion of medium regarding the Earth ("ether wind").

The stellar aberration is also composed of other media besides the ground level of the atmosphere (medium immediately around the star-the source of light, media between the star and the Earth, media around the Earth and higher levels of the atmosphere). It is not possible to say that it is one medium in these experiments (Michelson's experiment and stellar aberration), and put them in contradiction.

The author has a medium, no ether. The author has a theory of a non-linear form of the interference field - Beckmann [11] has not this theory.

With own theory of medium and of non-linear form of the interference field, we can explain Fizeau's experiment, stellar aberration and Michelson-Morley experiment, at the same time.

1.2.2. Our generalized law of inertia

Let's have a real coordinates system firmly connected with a real laboratory on Earth, where all experiments testing the physical theories are performed. We know that this coordinates system moves around the Earth axis during an astronomical day i. e. it performs a quasi-circular motion. During the year it rotates around the Sun approximately in a quasi-circle together with the Earth. During 2.10^8 years it circulates in the quasi-circle around the center of the Galaxy. It performs a quasi-uniform motion in a quasi-circle together with the Sun. The Galaxy performs a quasi-uniform and quasi-circle motion around the center within the framework of metagalaxies of star clusters and our laboratory coordinates system on Earth together with it, etc. From the experimental testing of the law of inertia it is known that the body moves along the "plane" stated by a waterlevel, i. e. in fact it is not a straight-line uniform motion, but it is the motion in the circle of the Earth radius of $R=6378$ km. The space aeronautics show that space ships, Earth satellites and orbital laboratories move quasi-uniformly in almost a circle around the Earth.

The atomic theory shows that the electrons and the nucleus circulate around the center of gravity of atom in approximate circles. The body rotating around its own axis (a flywheel) persists in this status. Similarly, the planets, stars, galaxies, molecules, nuclei and elementary particles rotate around their own axes. Since the uniform straight-line inertial motion cannot be achieved in a microworld, its place here is exclusively in the inertial quasi-circle motion. It is analogous in the macroworld. Each real "straight-line" motion can be replaced by a circle of a huge radius. This discussion results in the following: "Every mass (atom, molecule, particle, body, vacuum) persists in the status of the quasi-rest or quasi-uniform motion in a quasi-circle as far as it the external forces do not force it to change its status. (This notion is called the generalized law of inertia)." The inertial rotation of body consists of a quasi-uniform motion (in the quasi circles) of body's atoms. The inertial rotation of particle consists of a quasi-uniform motion (in the quasi-circles of subparticles - quarks, prequarks.

Finally, it is necessary to stress, that since the idea of inertial straight-line uniform motion has no place in physics, neither the idea of the inertial system (in our theory it is replaced by the notion of equivalent system-see 1.2.4.) nor the notions of Einstein's principle of relativity, local time, co-variant equations, nor Lorent'z transformation equations physical definition of simultaneity, nor invariant interval has any place in physics.

No real motion can be straight-line one. Every motion drawing near the straight-line one is just a part of curvilinear circular motion with final radius. It will never reach the radius $R = \infty$.

We have already known that straight-line motion does not really exist, it is only possible a hypothetical approximation for large radii of curvature. On surface of Earth, the circle with radius $R_E = 6378$ km is a "straight line" (in light of the origin of this term at Newton - laboratory desk - a plane defined by the level).

These radii of curvature are even larger for galaxies - they have the size of several light years - and they are more similar to the straight line, which they will never reach. In reality we have not uniform motion in a circle, but a non-uniform in ellipse (quasi-uniform motion in a quasi-circle) or rosette respectively-see Consequences 2, point 20.

Centripetal acceleration forces in the author's theory are not constant - they change: alternatively it is growing and declining. In a "circle" can be uniform or a non-uniform motion.

The non-uniform motion has a sequel: a little deformed circle on ellipse or rosette respectively and creation of stationary cloud.

Centripetal acceleration $\dfrac{v^2}{r}$ is not the acceleration in direction of the curve of the circle (tangential one), but in direction perpendicular to this curve, it has nothing in common with the acceleration in direction of curve. It determines the size of curvature of circle line only, and in the extreme case, the size of the straight line (for $r \to \infty$ $\dfrac{v^2}{r} \to 0$). However, it is not possible to realize these extreme positions in reality. For any "straight-line" motion it is valid that $\dfrac{v^2}{r} = 0$. On the surface of the Earth, on an ideal plane determined by the water level, normal acceleration on the "straight line", that lies in this plane, equals $\dfrac{v^2}{r} = \dfrac{v^2}{6378}$!

The standard Newtonian physics is somewhat corrected by Generalized Law of Inertia.

1.2.3. Our law of propagation of light (wave, intensity)

"The light (wave, intensity) is propagated in the medium in which the light is propagated (see 1.2.1.).

Thus the points of the boundary between the standstill and moving medium are the sources of secondary wave (intensity) motion. The speed of light (waves, intensity) in the medium in which the light (wave, intensity) is propagated is the same in all directions.

1.2.4. New definition of equivalent system of coordinates as the coordinates system in which it is valid:

a) our generalized law of inertia ...1.2.2.

b) our law of propagation of light (wave, intensity) ...1.2.3.

1.2.5. Our principle of relativity:

"The laws of physics are equivalent in all equivalent coordinates systems, or what is an equivalent affirmation respectively: the results of each physical experiment is the same, if it is performed in identical initial conditions in any equivalent system."

1.2.6. Radiation of intensity (waves, light, energy)

A mass (body, atom, molecule, particle, charge) persisting in absolute standstill or in an ideal uniform motion in an ideal circle does not radiate neither energy, wave, intensity, nor light with regard to the medium (in real physics the ideal state is a mere approximation). Alternation of very small deviations from this ideal state i. e. quasi-standstill or quasi- uniform motion in a quasi-circle - alternative slightly accelerated a motion and a slightly decelerated one is the only source of wave motion (intensity, light, energy).

Likewise the mass is the characteristic property of the matter, pulsating motion is another characteristic property of the matter (body, atom, molecule, particle, charge).

The matter is a material object (body, particle, photon, charge, vacuum, etc.)

The mass is defined by the action of force of mutual action of the force (gravity) between two material objects.

1.2.7. Some Remarks Concerning the Experiments Related to the Origin of the Special Theory of Relativity

With Michelson's, Fizeau's, and Harre's experiments, the medium of the wave emittance fully dragging with drag coefficient $\alpha = 1$, however, Fizeau's and Harre's experiments should be explained by non-linear form of interference field. With star aberration it is the case of classical condition in which the tangents of the inclination angle of looking glass axis equals *v/c*. Transversal Doppler's effect will be discussed as a special case of Doppler's effect.

2. THEORY AND ITS COMPARISON WITH EXPERIMENT

2.1. Form of Intensity of the Moving Charge Electric and Magnetic Field

2.1.1 Intensity of the Moving Charge Electric Field - A New Theory

Let us have a system of coordinates *(x, y, z)* connected with the medium causing propagation of light. Let the electric field intensity in this medium propagate at speed *c* in all directions. It is known from Coulomb's law that intensity of the still standing charge in relation to the system of coordinates *(x, y, z)* decreases with the square of distance from that charge then represented by hyperboles symmetrical to the charge, illustrated in section as follows:
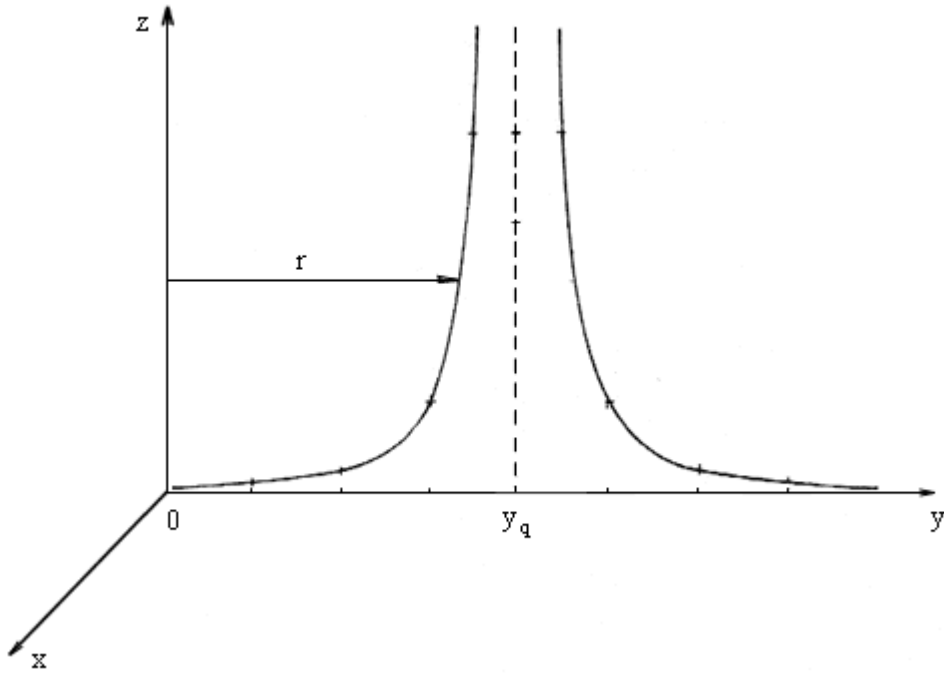
Fig. 2.1. The intensity of the stillstanding charge

r - distance of the hyperbole point from the beginning

Charge *q* is situated at level *yz* and in the distance of y_q from the beginning in the direction of axis *y*.

Let us now examine what would happen with the form of curves representing the intensity of the electric field, if charge *q* will move in a uniform straight line motion in the direction of the axis *y* at a constant speed *v*. Let's thus join firmly the system of coordinates *(x', y', z')* with the charge *q*, see fig. 2.2.

r - distance of the hyperbole point from the beginning
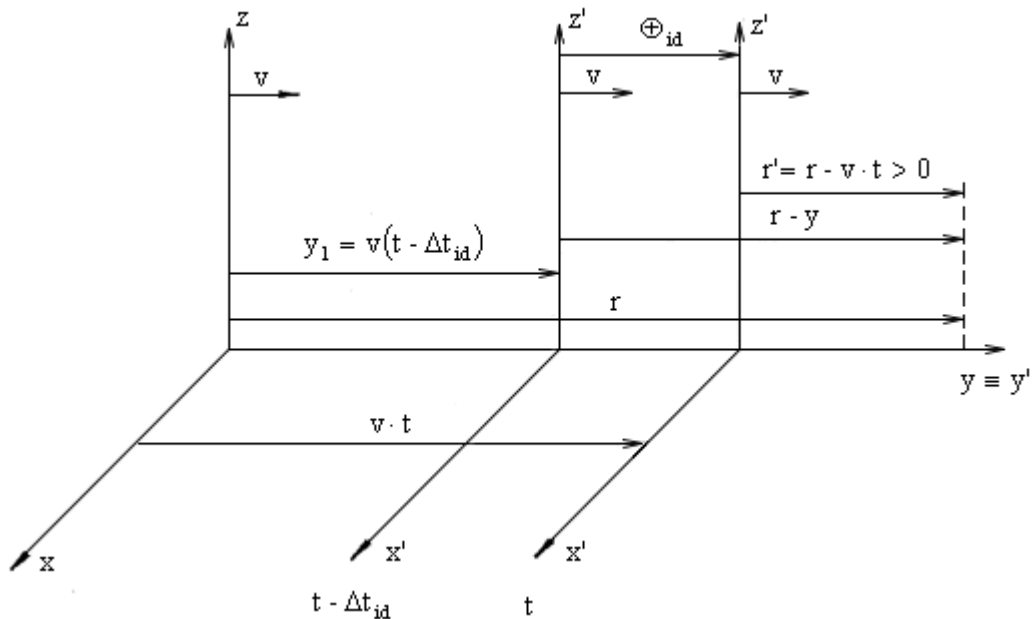
Fig. 2.2. The system of coordinates *(x', y', z')*

Distance *r'* is measured in direction of axis *y'* from the charge (or from the beginning O' respectively), while it is

valid

$$r' = r - vt \tag{2.1}$$

At the moment $t_0 = 0$ both systems become identical.

When $t - \Delta t_{id}$, the charge finding itself at the distance of $y_1 = v(t - \Delta t_{id})$ would emit intensity propagating at speed c, which at the moment of t would come to point r in time of

$$\Delta t_{id} = \frac{r - y_1}{c} = \frac{r - v(t - \Delta t_{id})}{c} \tag{2.2}$$

thus

$$\Delta t_{id} = \frac{r - vt}{c - v} \tag{2.3}$$

The index $_{id}$ means that is the case of propagation of the electric field intensity in direction of the charge motion.

Let the $\oplus_{id}$ be the distance between the position of the charge at the moment of $t - \Delta t_{id}$ (i.e. when the charge has emitted the intensity to point r) and position of the charge at the moment t, when the intensity emitted "has reached" the point r.

At the time of Δt_{id} the charge will cover the distance of

$$\oplus_{id} = v \cdot \Delta t_{id} = \frac{v(r - vt)}{c - v} = \frac{v}{c - v} r' \tag{2.4}$$

This is the distance at which the charge "outrun" the intensity propagated in direction of the charge motion. Consequently the intensity of the moving charge in relation to the system of coordinates (x, y, z) will change its form in the respective $\oplus$ of various r: it will be deformed (see fig. 2.3)
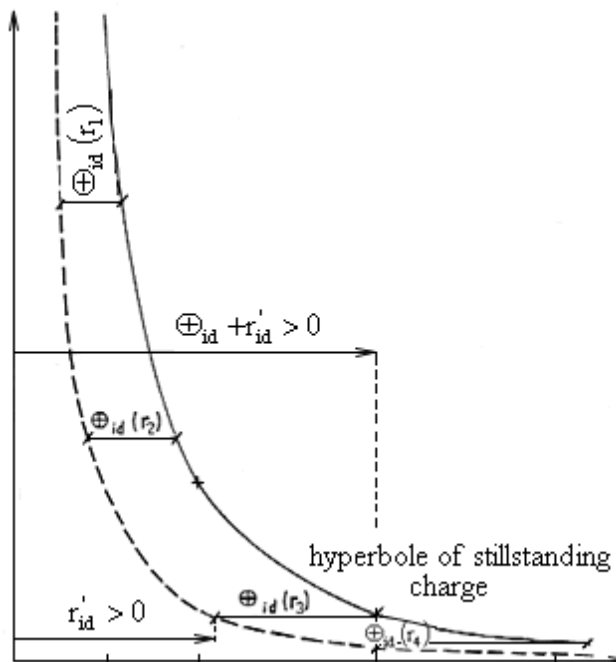
Fig. 2.3. The intensity of the moving charge in the direction of the motion E_{mov}^{id}

It is evident that with increasing distance r_i ($i = 1,2,3,...$) the respective "retardation of intensity" $\oplus_{id}$ (r_i) also increases, as can be seen in equation (2.4.). As the intensity of the moving charge in the direction of the motion E_{mov}^{id} at point r' and moment t equals the intensity of the stillstanding charge at point $\left(r' + \oplus_{id}\right)$ at the moment of intensity emittance $t - \Delta t_{id}$, then:

$$E_{mov}^{id}\left(r'\right) = E_{still}\left(r' + \oplus_{id}\right) \tag{2.5}$$

From the Coulomb's law:

$$E_{still}\left(r' + \oplus_{id}\right) = const\ \frac{1}{\left(r' + \oplus_{id}\right)^2} \tag{2.6}$$

$$E_{still}\left(r'\right) = const\ \frac{1}{r'^2} \tag{2.7}$$

r are distances of points of hyperbola from the beginning of the non-dashed system, r' are distances of points of hyperbola from the beginning 0' in a dashed system, r, r' are variables of the same function E_{still} (represented by hyperbolas). In other words, there is distance r, that numerically equals $r' + \oplus$ distance. Such distance r' numerically equals $r' - \oplus$ distance, both being variables of the same function E_{still}. For detail refer to (2.6) and (2.7). The issue concerns the same Coulomb's law.

By substituing of (2.5) and (2.4) we get

$$E_{mov}^{id}\left(r'\right) = const\ \frac{1}{\left(r' + \oplus_{id}\right)^2} \tag{2.8}$$

Then by utilizing (2.3), (2.6) and (2.7) we calculate

$$\frac{E_{mov}^{id}\left(r'\right)}{E_{still}\left(r'\right)} = \frac{r'^2}{\left(r' + \oplus_{id}\right)^2} = \left(1 - \frac{v}{c}\right)^2 \tag{2.9}$$

that is

$$E_{mov}^{id} = E_{still}\left(1 - \frac{v}{c}\right)^2 \tag{2.10}$$

Thus we managed to express the intensity of the moving charge in direction of motion by means of the intensity of the stillstanding charge in the given point. Analogically we express the intensity of the electric field of the moving charge against the direction of motion (indexes $_{ad}$), see fig. 2.4.
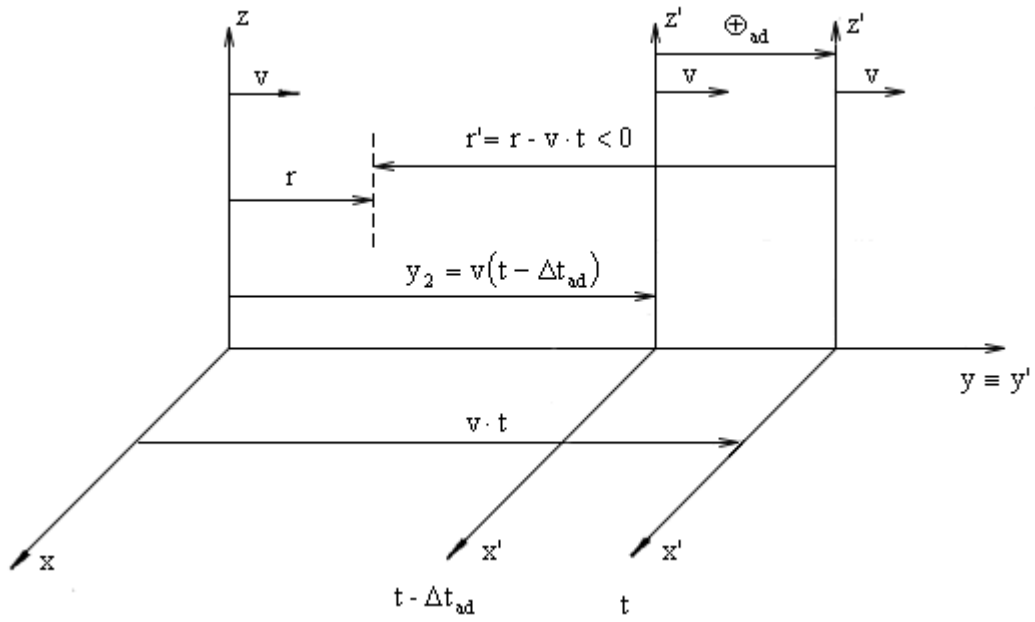
Fig. 2.4. The distance $\oplus_{ad}$

The charge moving at the speed of v parallel to the axis y is situated (at the moment t) in the distance of $v.t$ from the axis z.

At the moment $t - \Delta t_{ad}$ the charge, situated in the distance of $y_2 = v\left(t - \Delta t_{ad}\right)$ will emit the intensity to the point r.

This intensity will reach at the moment t just the point r in time of

$$\Delta t_{ad} = \frac{y_2 - r}{c} = \frac{v\left(t - \Delta t_{ad}\right) - r}{c}$$

(2.11)

from where

$$\Delta t_{ad} = \frac{vt - r}{c + v}$$

(2.12)

$\oplus_{ad}$ is the distance between the position of the charge at the moment $t - \Delta t_{ad}$ i.e. when the charge emitted the intensity to the point r and the position of the charge at the moment t, when the emitted intensity "has reached" the point r.

The charge will cover the distance

$$\oplus_{ad} = v \cdot \Delta t_{ad} = \frac{v}{c + v}\left(v \cdot t - r\right) = \frac{-v}{c + v} r'$$

(2.13)

at time Δt_{ad}, while $r'<0$ and $\oplus_{ad} > 0$.

This is the distance by which the intensity that propagates in the direction opposite to the movement of the charge, is shifted against the intensity of the stillstanding charge in the direction away from the charge, see fig. 2.5.

Analogically to equations (2.5)-(2.10) we achieve the following:

$$E_{mov}^{ad}\left(r'\right)= E_{still}\left(r'+\oplus_{ad}\right) \tag{2.14}$$

$$E_{still}\left(r'+\oplus_{ad}\right)= const\ \frac{1}{\left(r'+\oplus_{ad}\right)^2} \tag{2.15}$$

$$E_{still}\left(r'\right)= const\ \frac{1}{r'^2} \tag{2.16}$$

$$E_{mov}^{ad}\left(r'\right)= const\ \frac{1}{\left(r'+\oplus_{ad}\right)^2} \tag{2.17}$$

$$\frac{E_{mov}^{ad}\left(r'\right)}{E_{still}\left(r'\right)}=\frac{r'^2}{\left(r'+\oplus_{ad}\right)^2}=\left(1+\frac{v}{c}\right)^2 \tag{2.18}$$

$$E_{mov}^{ad}=E_{still}\left(1+\frac{v}{c}\right)^2 \tag{2.19}$$

The form of intensity for $v=0.5c$ see fig. 2.6.
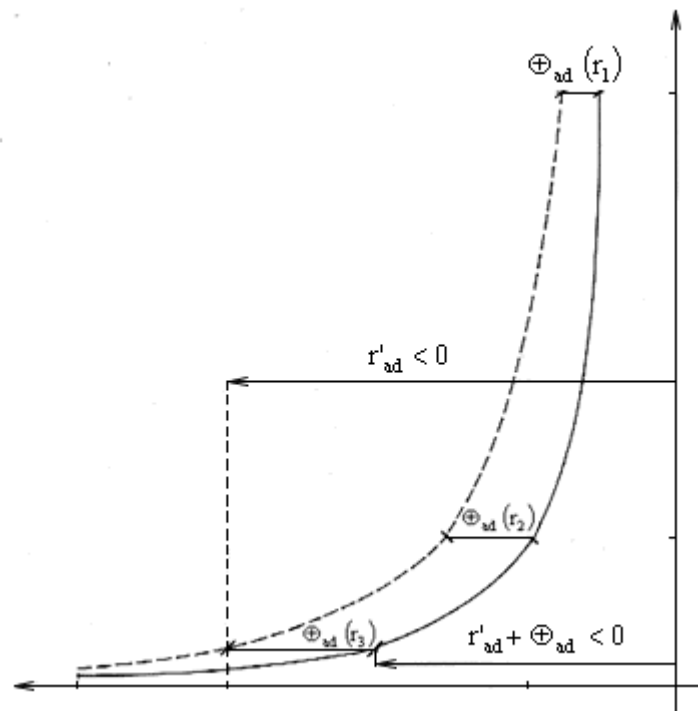
Fig. 2.5. The intensity of the electric field by means of the moving charge against the direction of motion E^{ad}
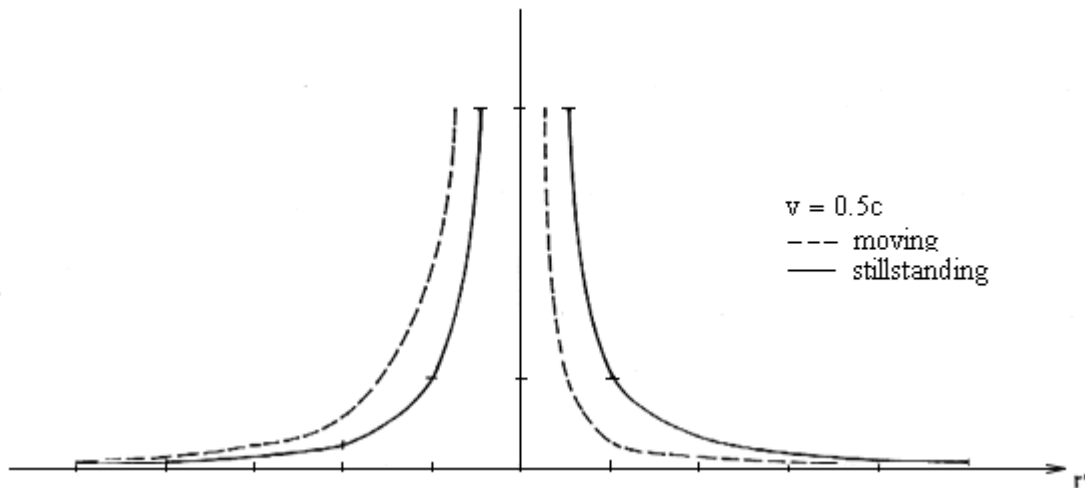
Fig. 2.6. The form of intensity for $v = 0.5c$

The equations (2.10) and (2.19) are placeable by common equation

$$E_{mov} = E_{still}\left(1 - \frac{v}{c}\cos\vartheta\right)^2 \qquad (2.20)$$

where ϑ is the angle between the direction of the charge motion (the speed v) and the direction of propagation of intensity.

At level xy, the section of the intensity hyperboloid is, for the stillstanding charge, the circle with its centre in the charge, for the moving charge it is the case of all types of Pascal's screw stocks with the charge at the beginning of the coordinates, see figs. 2.7, 2.8, 2.9 and 2.10.
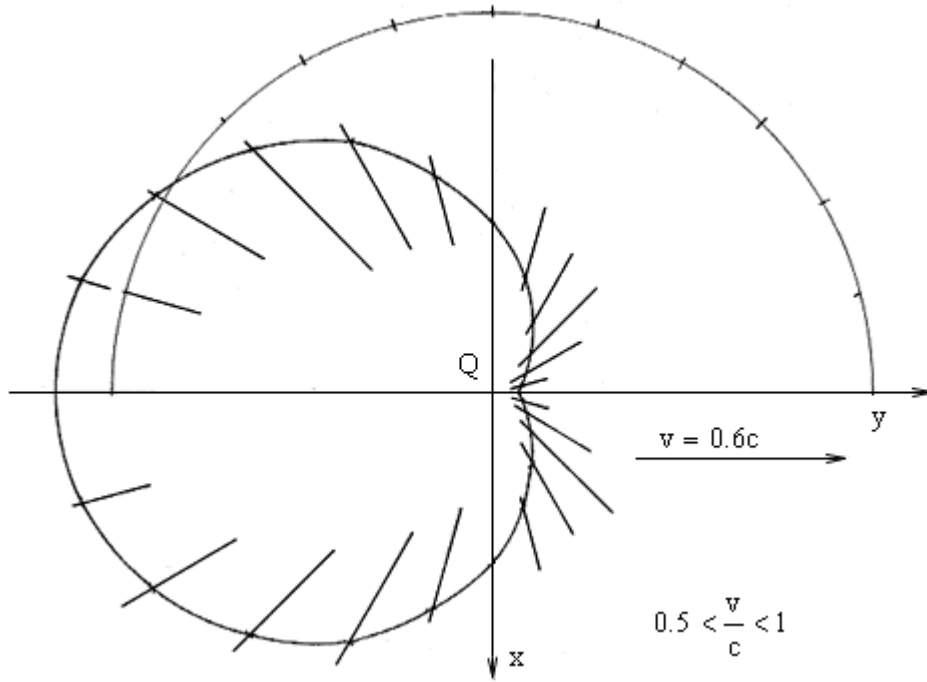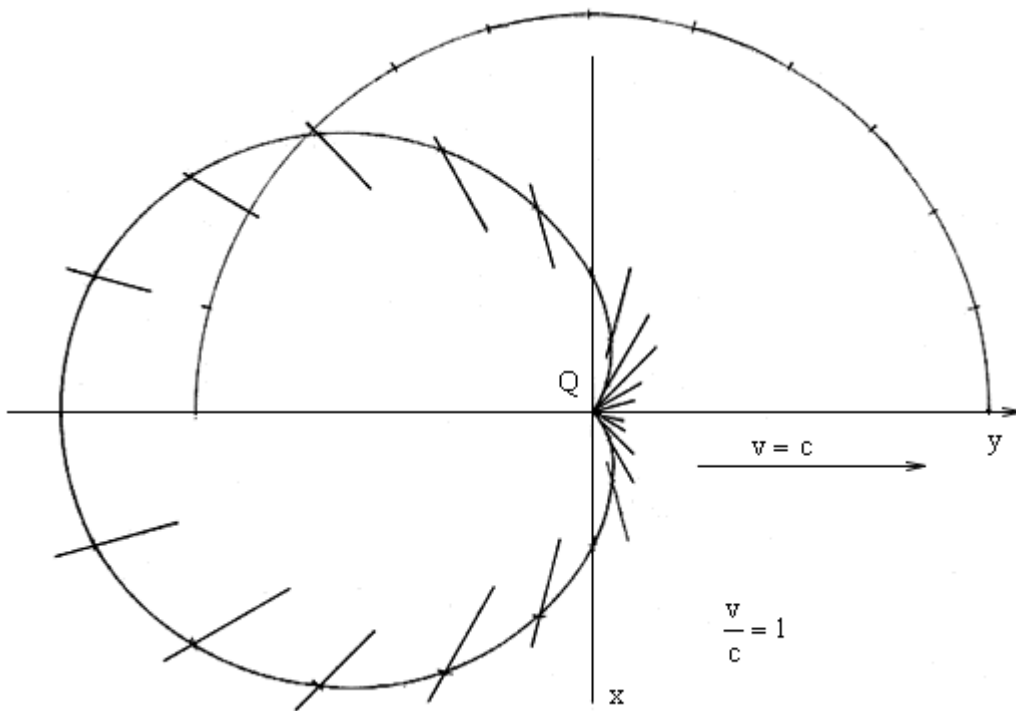
$$v = 0.6c$$

$$0.5 < \frac{v}{c} < 1$$
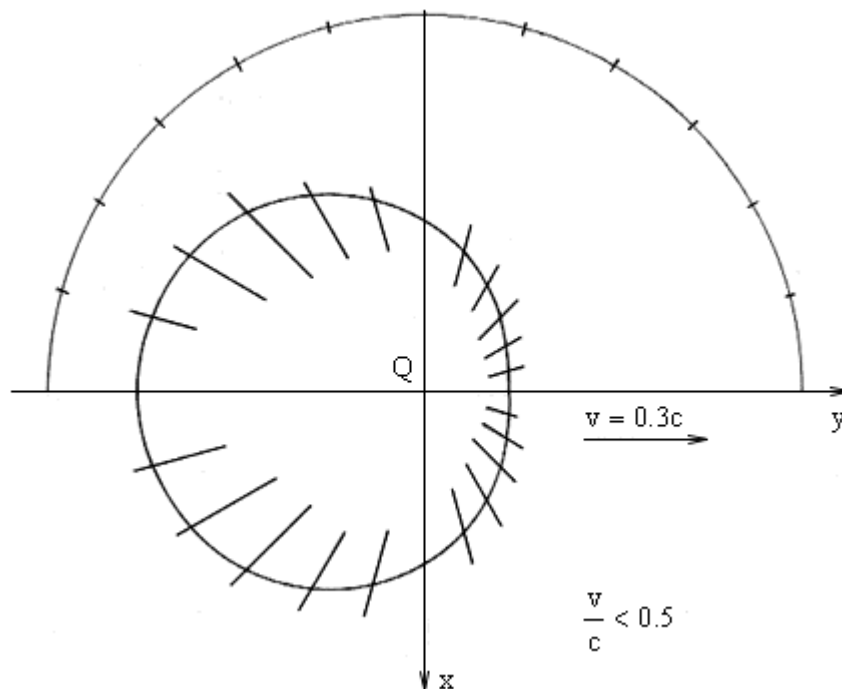
Fig. 2.7, 2.8. At level *(x, y)* section of the "hyperoloid" of the intensity for various speeds of the moving charge have a shape of all types of Pascal's screw stocks with charge at the beginning of the coordinates
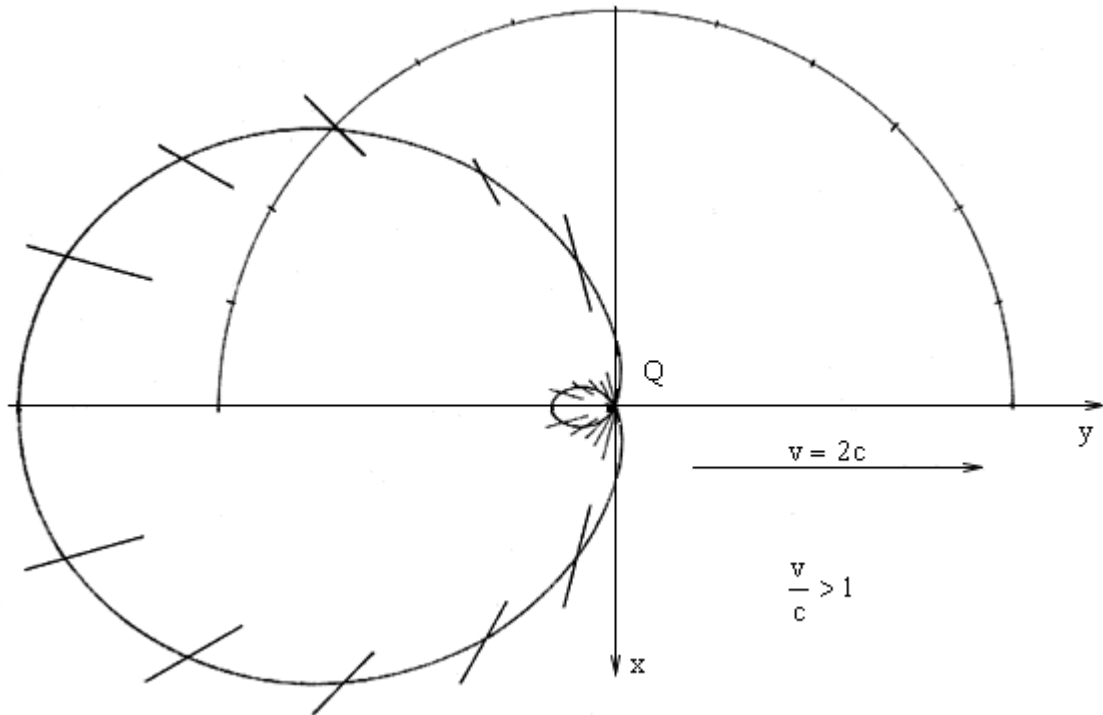

$$v = c$$

$$\frac{v}{c} = 1$$

Fig. 2.9, 2.10. At level *(x, y)* section of the "hyperoloid" of the intensity for various speeds of the moving charge have a shape of all types of Pascal's screw stocks with charge at the beginning of the coordinates

---

2.1.2 Kaufmann's Experiment

In the period from 1901 to 1906, Kaufmann wrote a number of works, the most coherent of them seems to be[1]: concerning experimental evidence of "the changeability of mass with speed". We shall revalue his experiment and will prove - on the basis of the theory given in the preceeding section 2.1.1 - the subject is the influence of intensity of the moving charge on the magnitude of the deviation of influence of intensity of the moving charge on the magnitude of the deviation of beta-rays in the crossed electromagnetic field, and not the changeability of mass with speed.

The attempt is done through a short correct description for sake of qualitative examination of the experiment, utilising some of the measured and calculated values given by Kaufmann in (1).

Beta-rays from Ra source, moving at speed $v \in\ <0.48c; 0.99c>$ are simultaneously deflected in the crossed electric and magnetic field, see diagram in fig. 2.11.
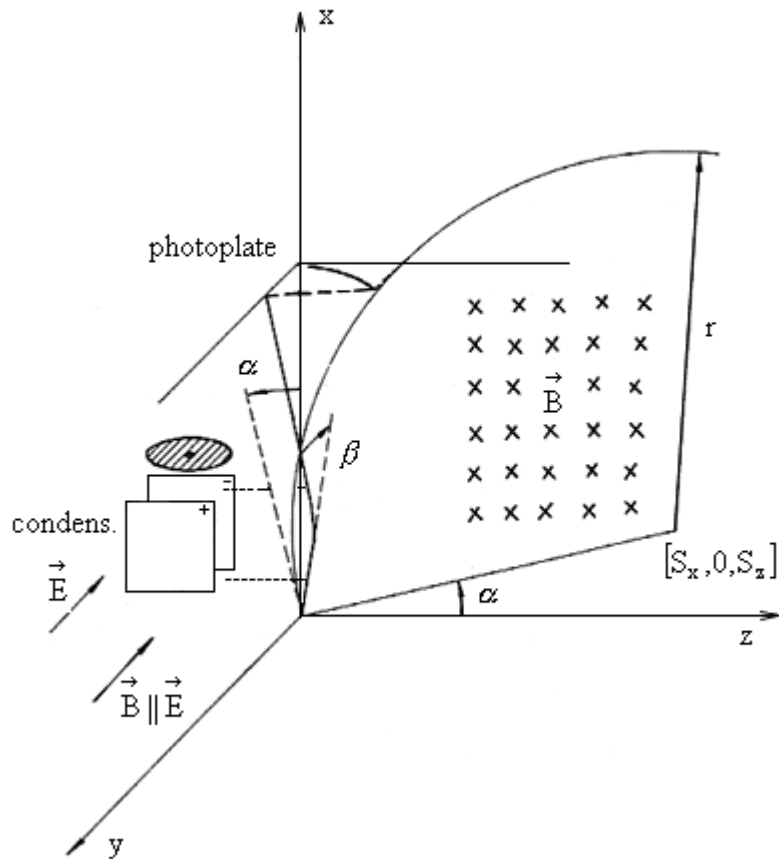
Fig. 2.11. Kaufmann's Experiment - diagram

The device is situated in the evacuated glass vessel. The rays go out from the Ra source, pass the electric screen and create a small spot on a photographic plate.

When the electric field will be created on the condenser plates PP', the additional stripe in the y- direction will arise apart from the non-diverting middle spot close to 0 (consisting of gamma and little diverting $\alpha - \text{rays}$).

When the entire device is situated between the poles of the U-shaped magnet (with the electric field switched off), the stripe will arise in the direction of the axis z.

While at the magnetic field we have the movement of electrons along circles expressed in the following equations

$$(x - S_x)^2 + (z - S_z)^2 = r^2 \qquad (2.21^*)$$

$$S_x = 1.0979 \text{ cm}$$
$$S_{z1} = 65.0608 \text{ cm}$$
$$S_{z2} = 5.8505 \text{ cm}$$
$$r_1 = 65.0684 \text{ cm}$$
were $r_2 = 5.9348 \text{ cm}$

in the electric field we first have the movement along straight line

$$y = -x \text{tg}\beta \qquad (2.22^*)$$

- electrons are emitted from the source under the angles $\beta \in \langle 1°35', 5° \rangle$ then they move between the

condenser plates along the parabola

$$y = (x - 0.246)^2 \frac{e}{m} \frac{E}{2v_0^2 \cos^2 \beta} - x \, \mathrm{tg} \beta \tag{2.23*}$$

then again along the straight line

$$y = 1.969 \cdot \frac{0.246}{0.270} \, \mathrm{tg} \beta \tag{2.24*}$$

The points of intersection of straight lines (2.24*) with the level of the photographic spot $x = x'^2 = 3.969$ will give us the deviation y.

The values E used in the calculations

$$E = 205.5 \cdot 10^{10} \quad 328 \cdot 10^{10} \quad 409.5 \cdot 10^{10} \quad (\text{for } v = 0.48c) \tag{2.25*}$$

would give, after substitued into (2.23*) and (2.24*) the deviations $y = 0.2363 \quad 0.3873 \quad 0.4985$ which are almost four times bigger as those acquired (y_b) by Kaufmann.

Considering out theory on $E_{mov}^{id,ad}$ and the values (2.25*) be multiplied by $\left(1 - \frac{v}{c}\right)^2$ we achieve deviations identical with the results of Kaufmann's experiment, see table 1. Thus the theory under 2.1.1 concerning the intensity of the moving charge of the electric field may be regarded experimentally confirmed.

Table 1.

	1631 V	2603 V	3250 V
y_b[cm]	0.1236 0.1119	0.1493 0.1302	0.1664 0.1616
β	2°	3°11'	4°30''
y[cm]	0.23626	0.3873	0.4985
y_T[cm]	0.0629	0.09947	0.12557
y_T-theoretical value (our new theory): $y_T \sim y_b$			

2.1.3 The electromagnetic field. Maswell's equations.

Let us take the equation (2.20) in the vector form:

$$E_{mov} = E_{still} \left(1 - \frac{v}{c} \cos \vartheta \right)^2 \tag{2.21}$$

The force acting on the moving electric charge is

$$F = QE_{mov} = QE_{still}\left(1-\frac{v}{c}\cos\vartheta\right)^2 = QE_{still}\left(1+\frac{v}{c}\sin\phi\right)^2 =$$

$$= QE_{still} + QE_{still}\left(2+\frac{v}{c}\sin\phi\right)\frac{v}{c}\sin\phi \qquad (2.22)$$

whereby $-\cos\beta = \sin\phi$

It is known, in line with the classical theory, that a magnetic field is created by the moving charges and electric currents. The result is that the moving charge creates its own magnetic field of induction B_q. It continues in this field in motion. According to Lorentz, the force acting on the moving charge in the electromagnetic field at speed v in the magnetic field of induction B and in the electric field of the following intensity E it is valid:

$$F = F_{el} + F_{m} = QE + Q(v \times B) \qquad (2.23)$$

Let us compare the equations (2.22) and (2.23).

Intensity E of the electric field according to Lorentz equals to our intensity E_{still}.

As the forces acting on the acting on the moving charge are equal, it must be valid

$$E_{still}\left(2+\frac{v}{c}\sin\phi\right)\frac{v}{c}\sin\phi = v \times B \qquad (2.24)$$

With regard to the fact that both the direction E_{still} and the direction of the vector $v \times B$ are identical, for the absolute values it is possible to write

$$E_{still}\left(2+\frac{v}{c}\sin\phi\right)\frac{v}{c}\sin\phi = v \cdot B \cdot \sin\phi$$

i.e.

$$B = \frac{E_{still}}{c}\left(2+\frac{v}{c}\sin\phi\right) \qquad (2.25)$$

This means that the charge moving at speed v creates around itself its own magnetic field of the following

induction: $\qquad B = \frac{E_{still}}{c}\left(2+\frac{v}{c}\sin\phi\right)$

while the vectorial equation is in force

$$v \times B = E_{mov} - E_{still} \qquad (2.26)$$

Where from

$$E_{mov} = E_{still} + v \times B \qquad (2.27)$$

The intensity of moving charge comprises in itself also the magnetic field induction B created by the charge moving at speed v.

Based on (2.27), Maxwell's equations which are always valid (not only in static) acquire the form:

1.

$$\nabla E_{mov} = \nabla\left(E_{still} + v \times B\right) = \nabla E_{still} + \nabla\left(v \times B\right) = \frac{\rho}{\varepsilon_0} \qquad (\text{...Gauss law}) \qquad (2.28)$$

as

$$\nabla\left(v \times B\right) = 0 \qquad (2.29)$$

2.

$$\nabla B = 0 \qquad \text{there are no magnetic charges} \qquad (2.30)$$

3.

$$\nabla \times E_{mov} = \nabla \times\left[E_{still} + \left(v \times B\right)\right] = \nabla \times E_{still} + \nabla \times\left(v \times B\right)$$

As in the statics $\nabla \times E_{still} = 0$

further $\nabla \times\left(v \times B\right) = v\left(\nabla B\right) - B\left(\nabla v\right)$

We use (2.29) and except of constant it is valid

$$\nabla \cdot v = \frac{\partial}{\partial t} \qquad (2.31)$$

Then

$$\nabla \times E_{mov} = -\frac{\partial B}{\partial t} \qquad (\text{...Faraday's law}) \qquad (2.32)$$

4. Amper's law in statics

$$c^2 \nabla \times B_{stat} = \frac{j}{\varepsilon_0} \qquad (2.33)$$

$$B_{dyn} = B_{stat} + \left(B_{dyn} - B_{stat}\right) = B_{stat} + B_Q$$

Total magnetic field

$$B_{dyn} = B_{stat} + B_Q \qquad (2.34)$$

where

$$B_Q = B_{dyn} - B_{stat} \qquad (2.35)$$

Let's calculate $c^2 \nabla \times B_{dyn} = c^2 \nabla \times B_{stat} + c^2 \nabla \times B_Q$

On the own magnetic field B_Q of the charge moving at speed v it is possible to write:

$$c^2 B_Q = \left(v \times B_Q\right) \times v \qquad (2.36)$$

$$\nabla \times\left[\left(v \times B_Q\right) \times v\right] = \left(v \times B_Q\right)\left(\nabla v\right) - v\left[\nabla\left(v \times B_Q\right)\right] =$$

$$= \frac{\partial\left(v \times B_Q\right)}{\partial t} = \frac{\partial\left(E_{mov} - E_{still}\right)}{\partial t} = \frac{\partial E_{mov}}{\partial t}$$

because (2.29),(2.31) and (2.27) are valid and because

$$\frac{\partial E_{still}}{\partial t} = 0 \tag{2.37}$$

i.e.
$$c^2 \nabla \times B_{dyn} = \frac{j}{\varepsilon_0} + \frac{\partial E_{mov}}{\partial t} \tag{2.38}$$

what represents the 4th Maxwell's equation.

Let's accept the following designation

$$
\begin{aligned}
dyn &= mov & E_{dyn} &= E_{mov} & E_{d\text{-}s} &= E_{dyn} - E_{stat} \\
stat &= still & E_{stat} &= E_{still} & E_{m\text{-}s} &= E_{mov} - E_{still}
\end{aligned}
$$

The equation (2.27) can be written in the following form:

$$E_{d\text{-}s} = v \times B_{d\text{-}s} \tag{2.39}$$

Analogically with the section 2.1.1 for E_{mov} we derive relations for the intensity of the dynamic magnetic field H_{dyn}

$$H_{dyn} = H_{stat}\left(1 - \frac{v}{c}\cos\Omega\right)^2 = H_{stat}\left(1 + \frac{v}{c}\sin\Phi\right)^2$$

where H_{stat} is the intensity of the static magnetic field and corresponding angles ϑ, ϕ relate to angles Ω, Φ.

$$H_{dyn} = H_{stat} + H_{stat}\left(2 + \frac{v}{c}\sin\Phi\right)^2 \frac{v}{c}\sin\Phi = H_{stat} + D_{d\text{-}s} \times v$$

while
$$D_{d\text{-}s} = \frac{H_{stat}}{c}\left(2 + \frac{v}{c}\sin\Phi\right)$$

i.e. $H_{dyn} - H_{stat} = D_{d\text{-}s} \times v$

or $\quad H_{d\text{-}s} = D_{d\text{-}s} \times v \qquad\qquad$ respectively $\tag{2.40}$

substituing for
$$H_{d\text{-}s} = \frac{B_{d\text{-}s}}{\mu_0}, \quad D_{d\text{-}s} = \varepsilon_0 E_{d\text{-}s}$$

we get
$$\frac{1}{\varepsilon_0 \mu_0} B_{d\text{-}s} = E_{d\text{-}s} \times v \tag{2.41}$$

as
$$c^2 = \frac{1}{\varepsilon_0 \mu_0} \tag{2.42}$$

Then
$$c^2 B_{d\text{-}s} = E_{d\text{-}s} \times v \tag{2.43}$$

By multiplying (2.39) ε_0 we get $\varepsilon_0 E_{d\text{-}s} = \varepsilon_0 \mu_0 v \times H_{d\text{-}s}$

Where from
$$c^2 D_{d\text{-}s} = v \times H_{d\text{-}s} \tag{2.44}$$

It is possible to write the equation (2.38) also in the following form:

$$\nabla \times H_{dyn} = j + \frac{\partial D_{dyn}}{\partial t} \tag{2.45}$$

2.2. The non-linear form of the interference field

Until recently it has been assumed that the shape of the interference field is "linear". The corresponding fraction of the shift of the interference fringes is directly proportional to the corresponding part of the wave length. If, for example, the distance of two interference fringes is divided into 100 divisions and the shift of 23 divisions is detected, we thus assume that the change occured over a length of $\dfrac{23}{100} \cdot \dfrac{\lambda}{2}$.

In other words, the shift of the fringes is considered to be equivalent to the change of length. This view corresponds to the linear form of the interference field, see fig. 2.12.
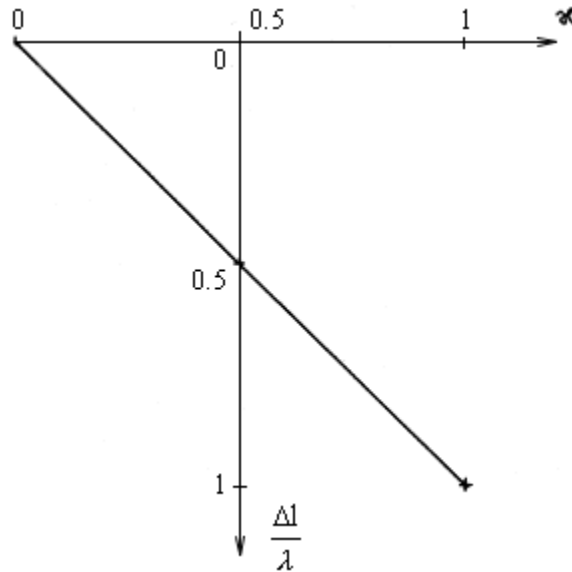
Fig. 2.12. The "linear" form of the interference field

What justifies us our assumption that the interference field is linear? Is the assumption correct?

In physics we are used to picture the experimental results through curves which are not "saw-tooth" as is the case with the linear interference field, but which have a nicely rounded shape. Let us replace the "saw-tooth" linear interference field by some rounded non-linear interference field.

Let us choose sinusoides or semi-circles instead of the sawtooth abscissas. In case of semi-circles according to fig. 2.13 we get:
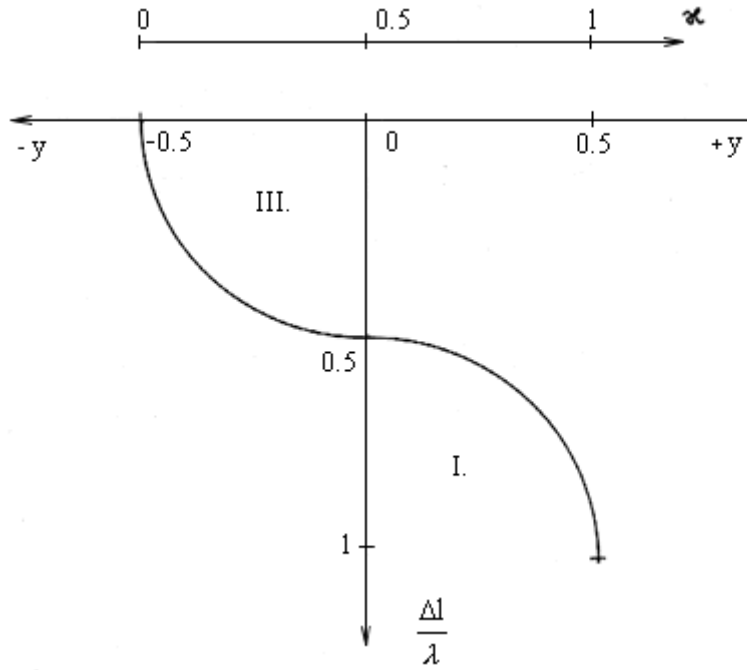
Fig. 2.13. The non-linear form of the interference field

in the 3rd quadrant: $y^2 + \left(\dfrac{\Delta l}{\lambda}\right)^2 = 0.5^2$, as

$$\kappa - 0.5 = y \qquad \kappa^2 - \kappa + 0.5^2 + \left(\frac{\Delta l}{\lambda}\right)^2 = 0.5^2$$

$$\kappa_{12} = 0.5 \pm \sqrt{\left[0.25 - \left(\frac{\Delta l}{\lambda}\right)^2\right]} \tag{2.46}$$

In the shifted 1st quadrant

$$(\kappa - 0.5)^2 + \left(\frac{\Delta l}{\lambda} + 1\right)^2 = 0.5^2$$

$$\kappa_{12} = 0.5 \pm \sqrt{\left[0.25 - \left(\frac{\Delta l}{\lambda} + 1\right)^2\right]} \tag{2.47}$$

2.2.1. Fizeau's Experiment

Let us revalue the results of the Fizeau's experiment from the aspect of non-linear interference field. Fizeau [3] used light of wave length $\lambda = 0.526\ \mu m$, two tubes, each L=1.4875 m long in which water flowed at speed u=7.059 m/s. As the experiment is generally known, we shall not describe it in detail. We shall only reassess its results.

The relation $\dfrac{\Delta l}{\lambda} = 0.4103$ corresponds to equal values of the shift of fringe κ supposing the interference field to be linear. In reality the experimentally observed values from the interval ranged from 0.167 to 0.307 in the average of $\overline{\kappa} = 0.23016$. That was explained by Fresnel's theory of partial drag of ether with the drag coefficient α . Should we consider the non-linear form of the interference field, then according to (2.46) we get

$$\kappa = 0.5 \pm \sqrt{\left(0.25 - 0.41^2\right)} = 0.22$$

which is in line with the experimentally observed mean value $\overline{\kappa}$. We do not need any coefficient α . Fizeau's experiment confirms also that the interference field has a non-linear form.

2.2.2. Harres's Experiment

Harres [4] used two wavelengths of light

$$\lambda_{625} = 0.625\,\mu\text{m} \qquad \lambda_{535} = 0.535\,\mu\text{m}$$

which were passing through ten firmly fastened prisms in a rotating apparatus at speed 400-600 revolutions/min. According to [4], if the drag coefficient $x = \alpha$ is not included

$$\frac{\Delta l}{\lambda} = \frac{200\,n^2\pi}{z_m \lambda c}\,0.20409 + \frac{200\,\pi}{z_m \lambda c}\,0.00188$$

were $z_m = 0.99727z$, z - is the number of sideral time seconds required by the apparatus to make 50 revolutions.

After the arrangement

$$\frac{\Delta l}{\lambda_{625}} = \frac{1.70148214}{z} \tag{2.48}$$

$$\frac{\Delta l}{\lambda_{535}} = \frac{2.00028242}{z} \tag{2.49}$$

The average value $\overline{z} = 5.11$ (tab. 1) after substitution in (2.48) gives

$$\frac{\Delta l}{\lambda_{625}} = 0.333$$

Substituing $\dfrac{\Delta l}{\lambda}$ to (2.46) we get

$$\kappa = 0.5 - 0.3755 = 0.1245$$

According to the experiment $\kappa_{Harres} = 0.132$ is again in line with the theory of the non-linear interference field. The comparison of Harres's experimental values that do not include the drag coefficient α with both linear and non-linear form of the interference field, as well as the results of Fizeau's experiment, are shown in figs. (2.14)-(2.21).

Fig. 2.14.-2.21. The comparison of Harre's experimental values which do not comprise the drag coefficient with both linear and non-linear form of the interference field, as well as the results of Fizeau's experiment.
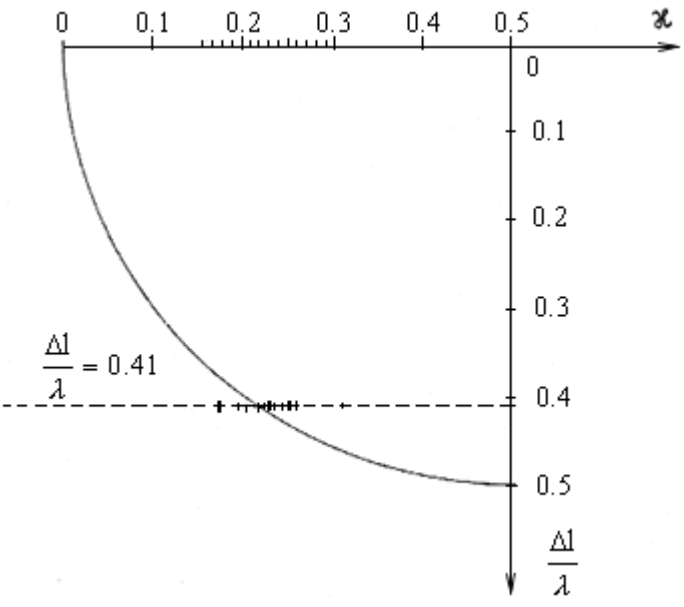
Fig. 2.14. Fizeau's experiment [3] p. 392
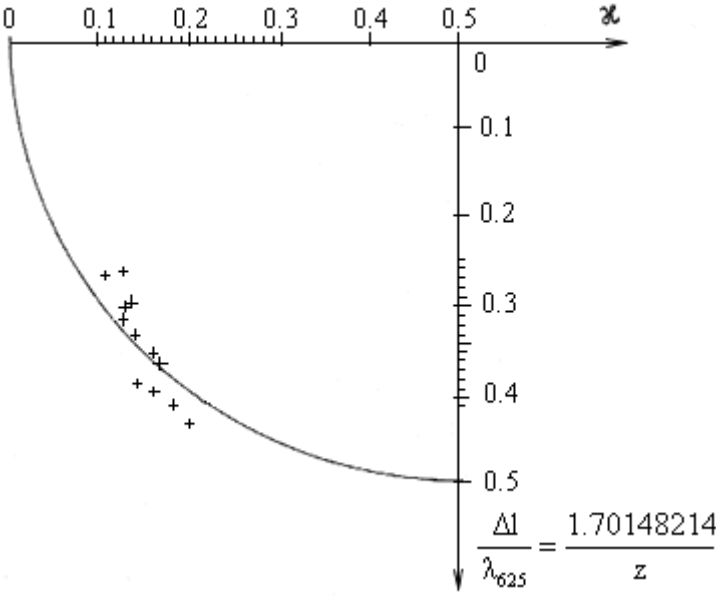
Fig. 2.15. [4] Tab. 1., 1. Reihe

Fig. 2.16. [4] Tab. 1., 2. Reihe

$$\frac{\Delta l}{\lambda_{625}} = \frac{1.70148214}{z}$$

Fig. 2.17. [4] Tab. 1., 3. Reihe

$$\frac{\Delta l}{\lambda_{625}} = \frac{1.70148214}{z}$$

$$\frac{\Delta l}{\lambda_{625}} = \frac{1.70148214}{z}$$
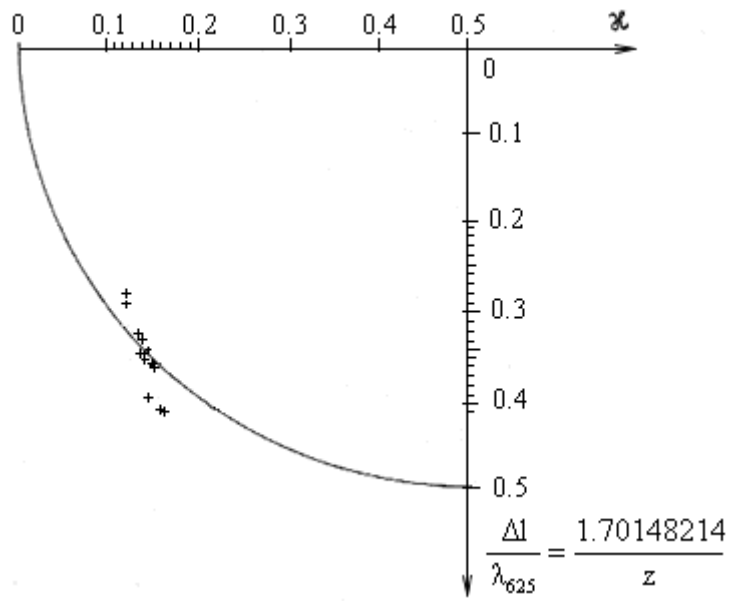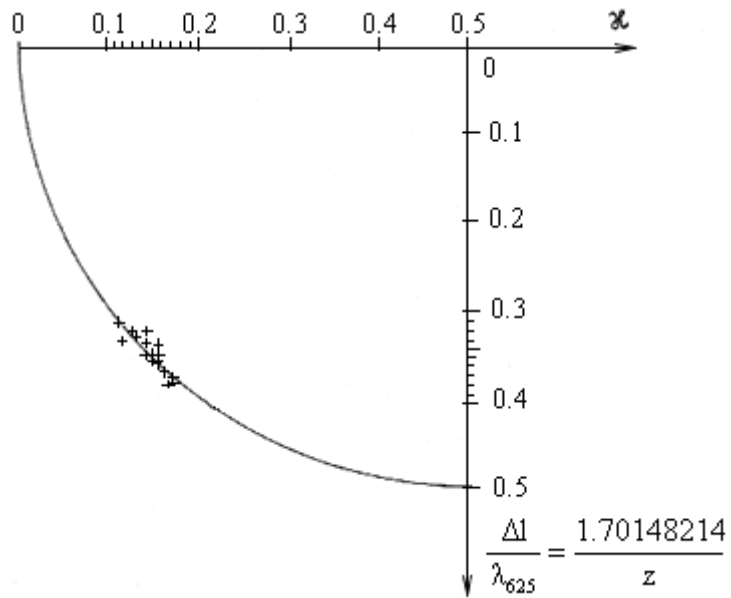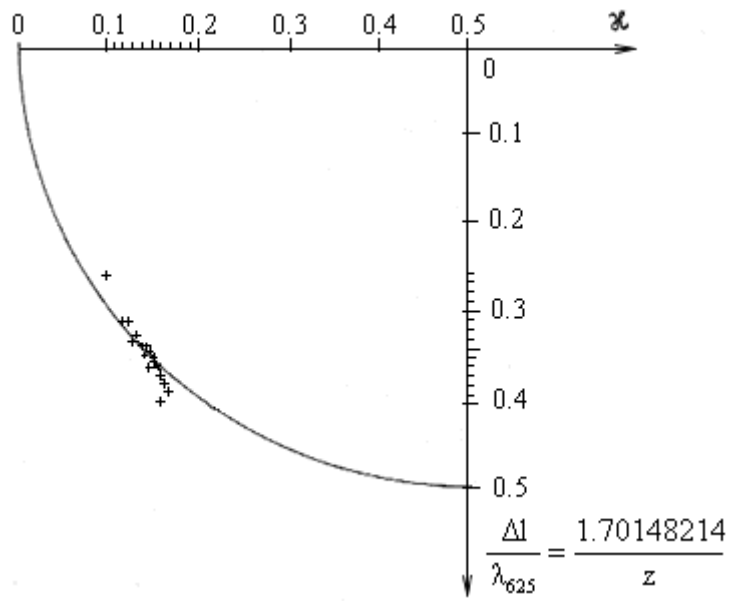
Fig. 2.18. [4] Tab. 1., 4. Reihe

$$\frac{\Delta l}{\lambda_{535}} = \frac{2.00028242}{z}$$
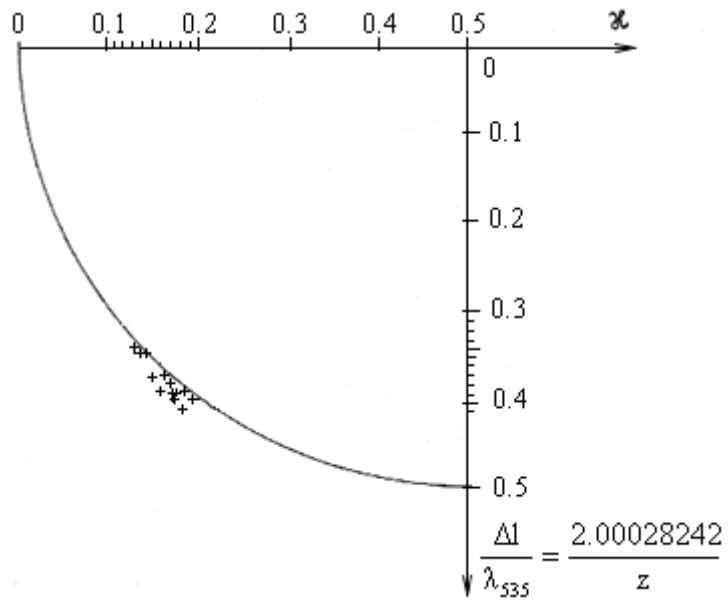
Fig. 2.19. [4] Tab. 2., 1. Reihe
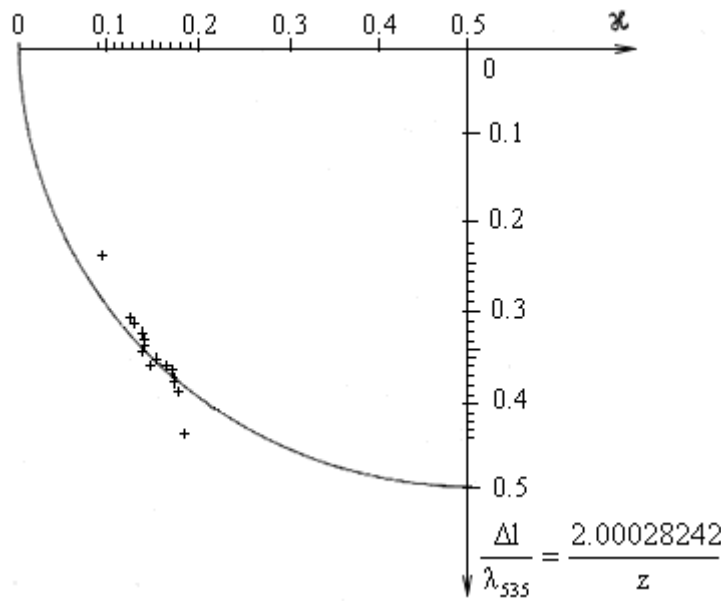
Fig. 2.20. [4] Tab. 2., 2. Reihe
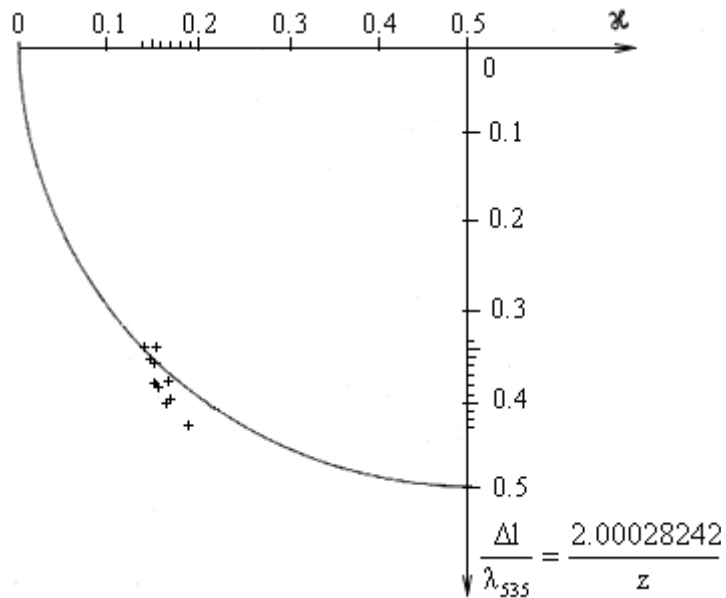
Fig. 2.21. [4] Tab. 2., 3. Reihe

This is simultaneously proves that the drag coefficient always equals one and the interference field has a non-linear form. Consequently, the interference fields are identical only for the shift of the interference fringes about 0 and/or 100 and 50 divisions.

2.3. Doppler's principle - correct relations

In one second a standing source will emit *n* oscillations of the wavelength

$$\lambda = \frac{c}{n}$$

c - the speed of light in the standing medium

During the time of

Δt , the oscillations will be distributed in the distance of

$$\frac{\lambda \Delta t}{T} = \frac{c \Delta t}{nT}$$

When the source moves away from the observer at speed *u* the oscillations would "expand" in the distance of

$$\frac{(c + u)\Delta t}{nT}$$

a) When the source approaches to the observer at speed *u* (sign-*u*), the oscillations would be compressed in the distance of

$$\frac{(c - u)\Delta t}{nT}$$

Let the observer move against the oscillation at speed *v* (sign-*v*).

During the period

Δt , the oscillations would be compressed in the distance of $\quad \dfrac{(c - v - u)\Delta t}{nT} = \dfrac{\lambda_1 \Delta t}{T}$

From which

$$\lambda_1 = \frac{c - v - u}{n} = \frac{c}{N}$$

The frequency would thus be heightened from *n* to *N* and it is valid

$$\frac{c - v - u}{n} = \frac{c}{N}$$

From which

$$N = n\frac{c}{c - v - u} \tag{2.50}$$

This is the case of
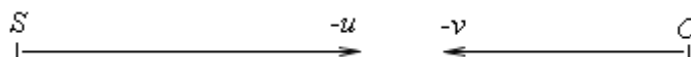
b) If they both (*S* and *O*) move away with regard to the medium, i.e. the case is +*v* and +*u*. We get "the expansion" of the wave length both by the source and observer. That is why

$$\lambda_2 = \frac{c + v + u}{n} = \frac{c}{N}$$

from which

$$N = n\frac{c}{c+v+u} \tag{2.51}$$

c) The case when the source is "expanding" the wavelength (+*u*) and the observer is "compressing" it (-*v*)

$$\lambda_3 = \frac{c-v+u}{n} = \frac{c}{N}$$

Where from

$$N = n\frac{c}{c-v+u} \tag{2.52}$$

d) The source is "compressing" the wavelength (-*u*) the observer is "expanding" is (+*v*).

$$\lambda_4 = \frac{c+v-u}{n} = \frac{c}{N}$$

$$N = n\frac{c}{c+v-u} \tag{2.53}$$

Through combination of the equations (2.50) through (2.53) we get

$$N = n\frac{c}{c\pm v\pm u} \tag{2.54}$$
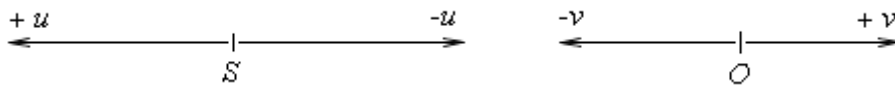
Generally

$$N = n\frac{c}{c-u\cos\vartheta-v\cos\psi} \tag{2.55}$$
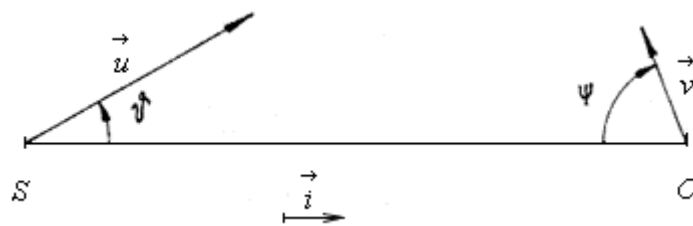
Fig. 2.22. Doppler's principle - generally
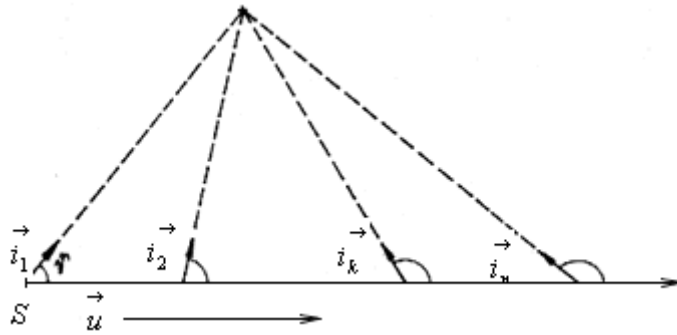
Fig. 2.23. The transversal Doppler's phenomenon - incorrectly interpreted

see fig. 2.22. (2.55) can be transcribed as

$$N = n \frac{c}{c - i(u - v)} = n \frac{c}{c - w}$$
(2.56)

where w is the relative speed in direction of connecting line SO. i is the unit vector in direction of the connecting line SO, beginning at S.

The transversal Doppler's phenomenon is incorrectly interpreted in the existing theories - see fig. 2.23.
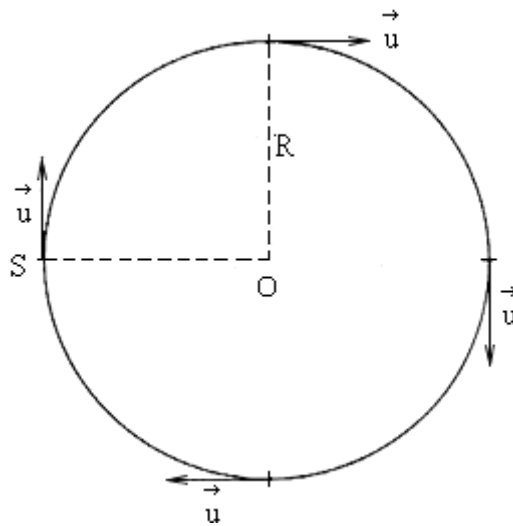
Fig. 2.24. The source (S) motion along the circle with the observer (O)
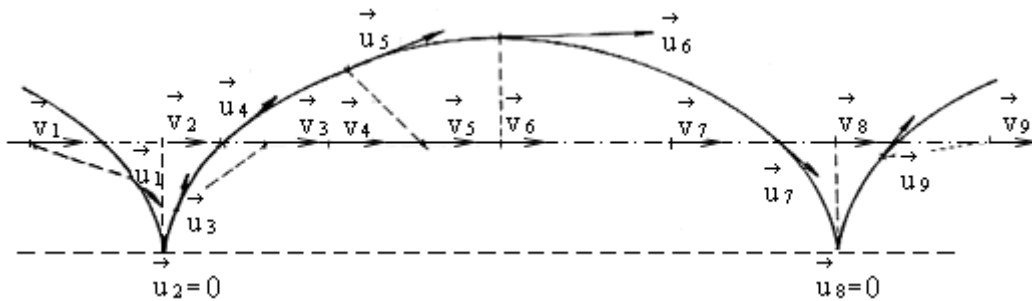
Fig. 2.25. Alternately accelerated and decelerated motion along a normal cycloid

The angle between the connecting ine SO(i_k) and the direction of motion S(u) is permanently changing in range from several degrees up to $180°$. The pure transversal Doppler's phenomenon should occur with the constant angle of $\vartheta = 90°$, i.e. the source motion along the circle with the observer in its centre (see fig. 2.24). Alternately,

accelerated and decelerated motion can occur, along a normal cycloid where it always holds that $\vartheta = 0$ so that the source speed is not decisive, while is valid,

$$N = n\frac{c}{c - v\cos\psi}$$ (see fig. 2.25)

It is possible to materialize this case in such a way that the source will be fastened on the circumference of the circle, the observer will be placed in its centre, while the circle will roll along the straight line and the centre of circle (the observer) will move at speed v.
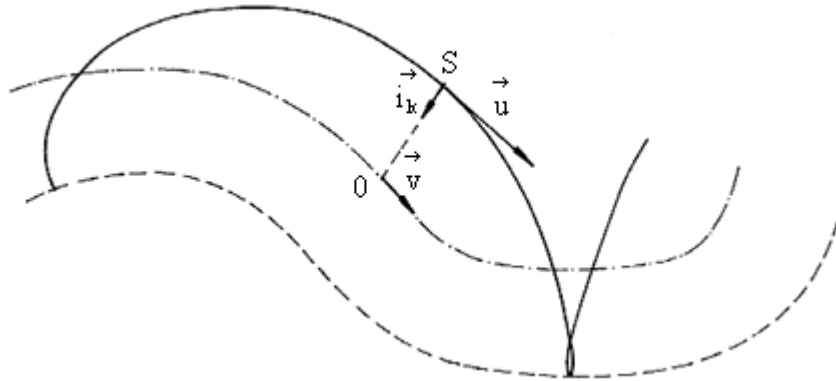
Fig. 2.26. The transversal Doppler's phenomenon - general
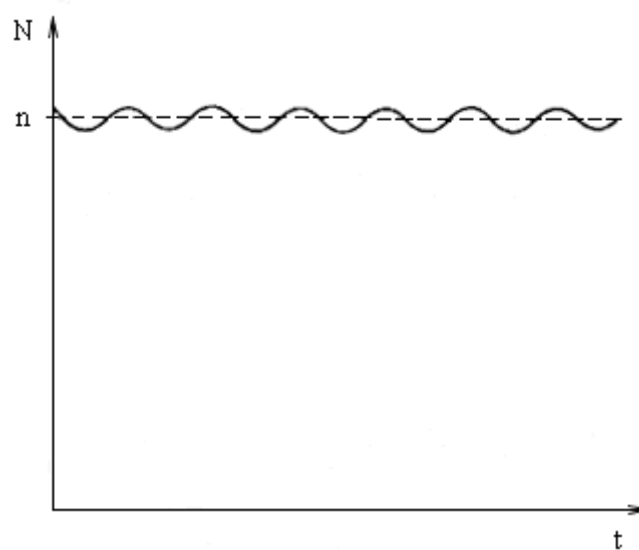
Fig. 2.27. The frequency N - as perceived by the observer, "pulsates" around the source frequency n

Analogically, if S (source) and O (observer) are interchanged, then it holds

$$N = n\frac{c}{c - u\cos\vartheta}$$

Should any such circle roll along any curve (with the source on its circumference and the observer in its centre), the result would be the generally known case pictured in fig. 2.26 and it holds

$$N = n \frac{c}{c + (\boldsymbol{v} \cdot \boldsymbol{i}_k)}$$

Analogically, if S and O are interchanged, then it holds

$$N = n \frac{c}{c - (\boldsymbol{u} \cdot \boldsymbol{i}_k)}$$

In this way the change of frequency N occurs permanently. The frequency N as perceived by the observer - "pulsates" around the frequency of source *n*, see fig. 2.27.

3. CONSEQUENCES 1

3.1. Possible generalization of the theory for all fields (gravitational, nuclear, etc.) where the speed of propagation is finite and equals *c*.

For the sake of simplicity let us consider for instance the gravitational field of the Earth. Analogically to (2.20), for the intensity of the gravitational field one could write:

$$g_{mov} = g_{still} \left(1 - \frac{v}{c} \cos \vartheta \right)^2 \tag{3.1}$$
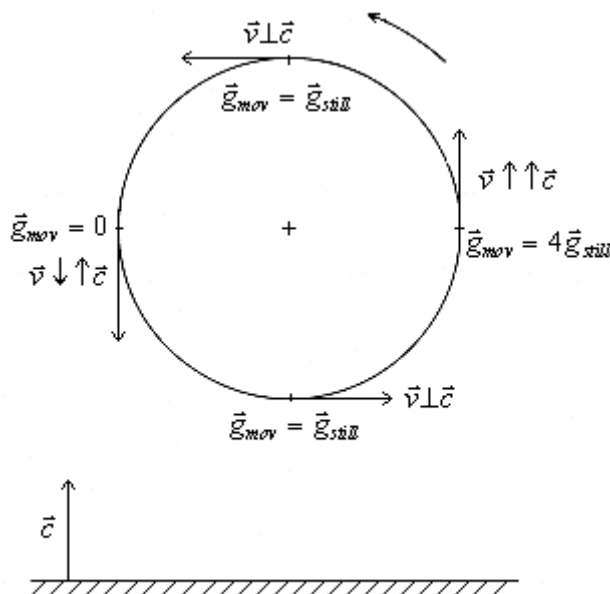
Fig. 3.1. The body is rotating at vertical level

Should we want to withdraw from the gravitational field of the Earth, it will be necessary to aim at $g_{mov} \to 0$.

Then the weight of bodies will be falling down $G = m g_{mov} \to 0$.

However, the mass of bodies remains unchanged. Individual material particles of the body will move in a prevailing measure in direction to the Earth at the highest possible speed (in ideal case $v \cos \vartheta \to (-c)$), but

the center of gravity should at the same time move away from the Earth. This is possible only with the special rotation of body around the axis passing trough the center of gravity, while the body rotates at vertical level (see fig. 3.1).

c - the speed and direction of propagation of the gravitational waves of the Earth. The points moving at speed of *c* towards the Earth ($v \cos \vartheta = -c$) are of no weight. The points moving at the speed of c away from the Earth weight 4x more than is standstill (see fig. 3.2).

In consequence of rotation, the center of gravity will be shifted to the part departing from the Earth. This means that the body should depart from the Earth as a consequence of rotation (since the shifted center of gravity is situated in the half emerging during the rotation, i. e. departing from the Earth).
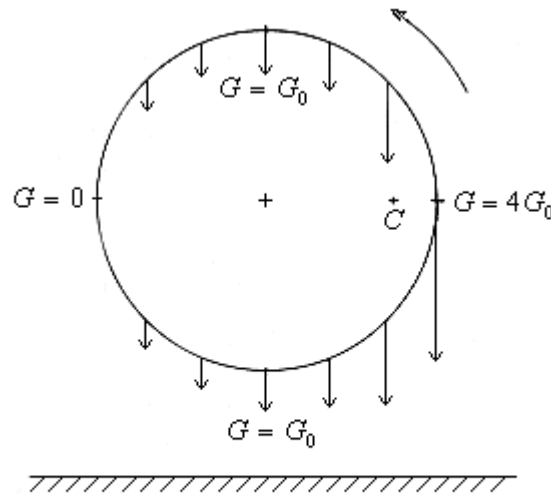
Fig. 3.2. The point moving at speed c away from the Earth weight 4x more then standstill

For the sake of simplicity, let us consider the rotating body whose mass is evenly distributed on the circle with radius *r*.
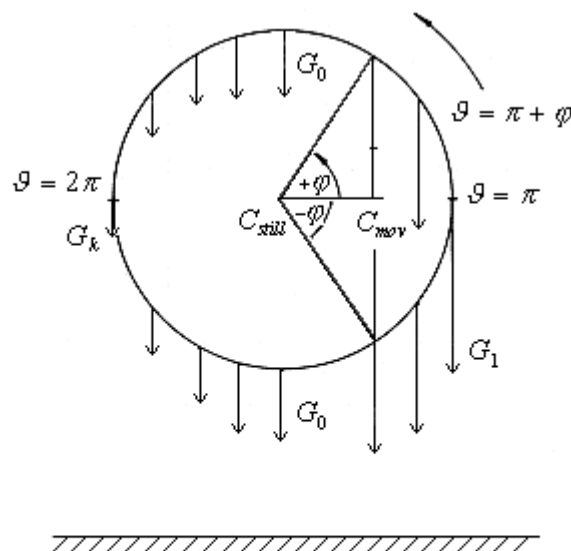
Fig. 3.3. Once it starts rotating at the circumference speed v the center of gravity will be shifted in the distance r_c

In case such a body does not rotate, its center of gravity is in the center. Once it starts rotating at the circumference speed of v, the center of gravity will be shifted in the distance of r_c, which will be calculated as in

$$G_i = G_0\left(1 - \frac{v}{c}\cos\vartheta\right)^2$$

fig. 3.3. Each point of weight G_0 will, in result of rotation, weight

There is a certain angle φ for which

$$\cos\varphi = \frac{r_c}{r} \tag{3.2}$$

The weight of points to the right from C_{mov} must be equal to the weight of points to the left from C_{mov} which will be written as follows:

$$\int_{\pi-\varphi}^{\pi} G_0\left(1 - \frac{v}{c}\cos\vartheta\right)^2 d\vartheta + \int_{\pi}^{\pi+\varphi} G_0\left(1 - \frac{v}{c}\cos\vartheta\right)^2 d\vartheta =$$

$$= \int_{\pi+\varphi}^{2\pi} G_0\left(1 - \frac{v}{c}\cos\vartheta\right)^2 d\vartheta + \int_{0}^{\pi-\varphi} G_0\left(1 - \frac{v}{c}\cos\vartheta\right)^2 d\vartheta \tag{3.3}$$

Where from

$$\frac{v}{c} = \frac{-8\sin\varphi + \sqrt{\left(64\sin^2\varphi + 8(\pi - 2\varphi)\left[\sin 2\varphi - (\pi - 2\varphi)\right]\right)}}{2\left[\sin 2\varphi - (\pi - 2\varphi)\right]} \tag{3.4}$$

Substituting for φ we get the Table 2 which represents the dependency of $\frac{r_c}{r}$ on $\frac{v}{c}$, see fig. 3.4.

Table 2.

$\varphi°$	$\cos = \dfrac{r_c}{r}$	v/c
89.9999999	0	0.00000000000
80	0.1736	0.0886197118
60	0.5	0.30472815857
40	0.7660	0.765471182633
37	0.7986	0.927252176745
36	0.8090	1.00053925635
32.123	0.847	1.89550406058
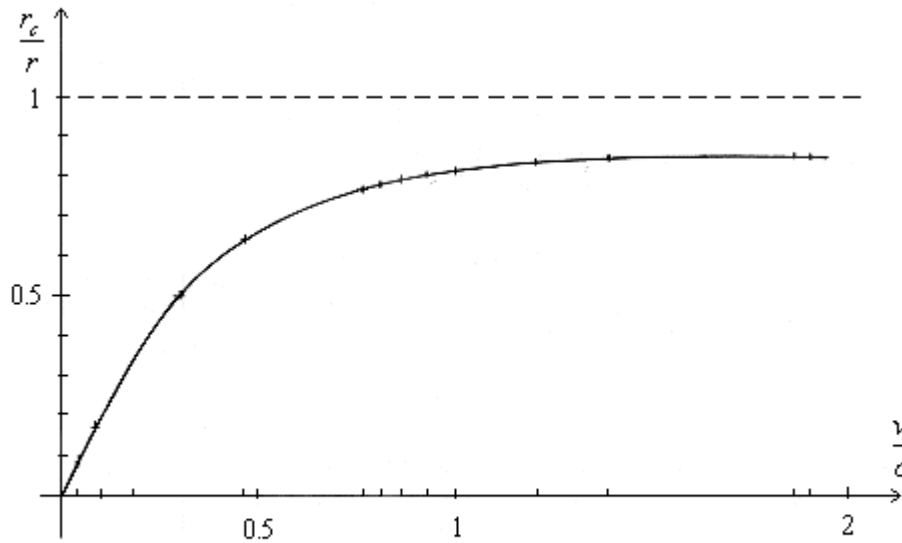
Fig. 3.4. The dependence of $\frac{r_c}{r}$ on $\frac{v}{c}$

Two forces act on shifted center of gravity

a) gravitational force of the Earth = the weight of body

b) the accelerated rotation of body upwards.

Note:

$$a = \frac{dv_c}{dt} = \frac{d(r_c\omega)}{dt} \qquad (3.5)$$

For $v_c = const \Rightarrow a = 0$

In order to compensate the weight of body we must have the accelerated rotation. Let the angle acceleration be

$$\varepsilon = \frac{d\omega}{dt} \qquad (3.6)$$

Then with the accelerated rotation is $\varepsilon = \frac{d\omega}{dt} > 0$ $\varepsilon \uparrow \uparrow \omega$

Immediate acceleration of the shifted center of gravity will be calculated as follows:

$$a = \frac{dv_c}{dt} = \frac{d}{dt}(\omega \times r_c) = \varepsilon \times r_c + \omega \times v_c = a_t + a_n \qquad (3.7)$$

a_t - tangential, rotational acceleration
a_n - normal, centripetal acceleration which is compensated by stiffness of system, by rigidity of the rotation axis.
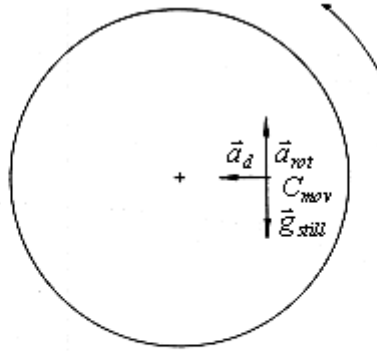
Fig. 3. 5. For the motion upwards it is necessary that $g_{still} < \varepsilon \times r_c$

For the motion upwards it is necessary that

$$g_{still} < \varepsilon \times r_c \qquad\qquad (3.8)$$

see fig. 3.5.

The periods are calculated in Table 3, in which the circle points will reach the relevant circumferential speed for various values of the angle accelerations.

Table 3.

	$\varepsilon = 1/s^2$	$\varepsilon = 10/s^2$	$\varepsilon = 100/s^2$	$\varepsilon = 10^3/s^2$	$\varepsilon = 10^4/s^2$
$v = 10^{-4}c$	$t = 3.10^4 s$	$t = 3.10^3 s$	$t = 3.10^2 s$	$t = 30s$	$t = 3s$
$v = 10^{-3}c$	$3.10^5 s$	$3.10^4 s$	$3.10^3 s$	$300s$	$30s$
$v = 10^{-2}c$	$3.10^6 s$	$3.10^5 s$	$3.10^4 s$	$3.10^3 s$	$300s$
$v = 0.1c$	$3.10^7 s$	$3.10^6 s$	$3.10^5 s$	$3.10^4 s$	$3.10^3 s$
$v = c$	$3.10^8 s$	$3.10^7 s$	$3.10^6 s$	$3.10^5 s$	$3.10^4 s$

Table 4.

	$r = 1m$	$r = 10m$	$r = 100m$
$v = c$	$r_c = 0.8m$	$r_c = 8m$	$r_c = 80m$
$v = 0.1c$	$r_c = 0.2m$	$r_c = 2m$	$r_c = 20m$
$v = 0.01c$	$r_c = 0.018m$	$r_c = 0.18m$	$r_c = 1.8m$
$v = 0.001c$	$r_c \sim 0.0014m$	$r_c \sim 0.014m$	$r_c \sim 0.14m$

Values r_c are calculated in Table 4 for various r and $\dfrac{v}{c}$

Several examples: $\left|\varepsilon \times r_c\right| = 10^3/s^2 \cdot 0.014m = 14m/s^2 > 9.81m/s^2$

i.e. at the acceleration of 10^3 rev / s^2 and the circle diameter of 20 m, "the circle" should get off the Earth in less than five minutes. At the acceleration of 100 rev / s^2 and diameter of 20 m, the circle should get off the Earth in less than 50 minutes.
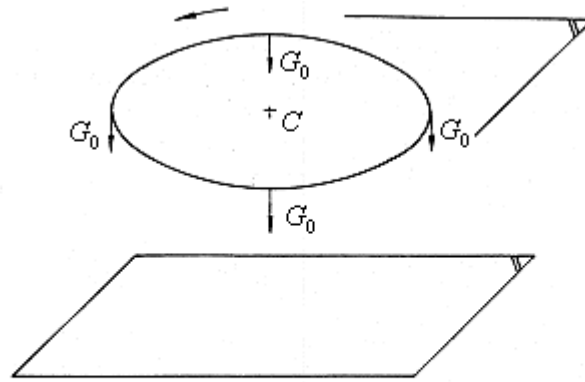
Fig. 3. 6. Should the body rotat in the horizontal level the center
of gravity remains on the spot

At the acceleration 10^5 revolutions / s^2 and diameter of 20 m the "circle" of mass points should get off the Earth in less than 3 sec. Other values for diameters, accelerations may be acquired by using the Tables 2, 3, 4. For the sake of comparison, "Auswuchtzentrum mit Vakuumkessel", Schenck, FRG, reaches maximum 30 000 revol./min.= 500 revolutions/sec with the rotor diameter of 900 mm. Should the body rotate in the horizontal level (i. e.the level parallel to the Earth), the center of gravity remains on the spot (fig. 3.6).
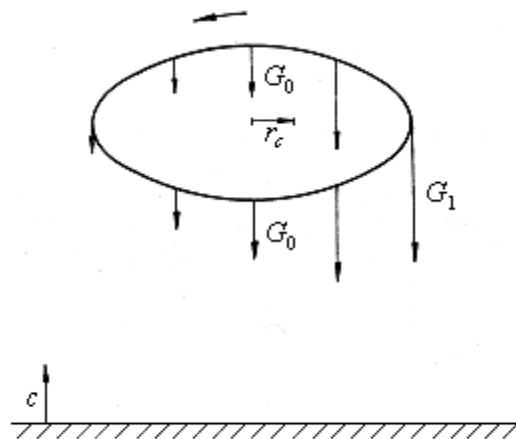
Fig. 3. 7. The rotating "circle" may be getting off the Earth

Any inclination of the circle from the horizontal level when projected at the vertical level results in ellipse. The shift of center of gravity increases in line with the inclination of the „circle" from the horizontal to vertical level. It means that the more the rotating "circle" may be getting off the Earth (see fig. 3.7). Conversely, if we want to stop the getting off the Earth, it is enough to level the "circle" into the horizontal level. It is evident that the highest speed of getting away from the Earth will be achieved in the rotation in vertical level. If the rotation level of the "circle" forms with the horizontal level an angle of 45°, the "circle" acquires the average speed of getting off the Earth i. e. by deceleration of the rotating "circle" needs straightening more in the horizontal level. During acceleration it is necessary to swing out the rotating "circle" so that it rotates closer to the vertical level. The real rotating body will qualitatively behave in a way similar to our "circle".

3.2. Calculation of the kinetic energy of a body moving at the velocity of *v*

Let us consider the physical processes in which kinetic energy is transformed into potential one and potential energy is transformed into kinetic one. There is a state in which the potential energy equals total energy of the body (while the kinetic energy equals zero) and the state in which kinetic energy equals the total energy of the body (while the potential energy equals zero). These extreme will help us to calculate the kinetic energy of body. For the potential energy we have

$$dW_p = mg_{still}\, dh \tag{3.9}$$

By integrating and utilizing of the relation (3.1) we have

$$T_{kin} = \int dW_p = \int_0^h mg_{still}\, dh = \int_0^h m\frac{g_{mov}}{\left(1 - \dfrac{v}{c}\cos\vartheta\right)^2}\, dh$$

By substituting $g_{mov} = \dfrac{dv}{dt}$, $\dfrac{dh}{dt} = v$

we get

$$T_{kin} = m\int_0^v \frac{v\, dv}{\left(1 - \dfrac{v}{c}\cos\vartheta\right)^2} \tag{3.10}$$

Solving by substitution $1 - \dfrac{v}{c}\cos\vartheta = z$

we get

$$T_{kin} = \frac{mc^2}{\cos^2\vartheta}\left[\ln\left|1 - \frac{v}{c}\cos\vartheta\right| + \frac{\dfrac{v}{c}\cos\vartheta}{1 - \dfrac{v}{c}\cos\vartheta}\right] \tag{3.11}$$

while ϑ isn't $\dfrac{\pi}{2}$, $\dfrac{3\pi}{2}$

For $\vartheta = 0°$ we have the kinetic energy in the direction of motion

$$T_{kin_d} = mc^2\left[\ln\left|1 - \frac{v}{c}\right| + \frac{\dfrac{v}{c}}{1 - \dfrac{v}{c}}\right] \tag{3.12}$$

For $\vartheta = 180°$ we have the kinetic energy against the direction of motion

$$T_{kin_d} = mc^2\left[\ln\left|1 + \frac{v}{c}\right| - \frac{\dfrac{v}{c}}{1 + \dfrac{v}{c}}\right] \tag{3.13}$$

If $0 < \dfrac{v}{c} = x \ll 1$ (i.e. $v \ll c$)

$$\ln(1 \pm x)$$

utilizing the series $(1 \pm x)^{-1}$

the equations (3.12) and (3.13) will be changed in the equation $T_{kin_{sd}} = T_{kin_{sd}} = \dfrac{1}{2}mv^2$

Table 5.

$x = v/c$	$T_{kin_{sd}}$	$T_{kin_{sd}}$	$\dfrac{1}{2}\left(T_{kin_{sd}} + T_{kin_{sd}}\right)$	A. Einstein $\dfrac{m_0 c^2}{\sqrt{1-\dfrac{v^2}{c^2}}}$
0.1	$0.00439\,mc^2$	$0.0057\,mc^2$	$0.0050\,mc^2$	$1.005\,m_0 c^2$
0.2	$0.0156\,mc^2$	$0.0268\,mc^2$	$0.0212\,mc^2$	$1.020\,m_0 c^2$
0.3	$0.0316\,mc^2$	$0.0719\,mc^2$	$0.0517\,mc^2$	$1.048\,m_0 c^2$
0.4	$0.0508\,mc^2$	$0.1558\,mc^2$	$0.1033\,mc^2$	$1.091\,m_0 c^2$
0.5	$0.0722\,mc^2$	$0.3068\,mc^2$	$0.1895\,mc^2$	$1.155\,m_0 c^2$
0.6	$0.0950\,mc^2$	$0.5837\,mc^2$	$0.3393\,mc^2$	$1.250\,m_0 c^2$
0.7	$0.1174\,mc^2$	$1.1293\,mc^2$	$0.6233\,mc^2$	$1.401\,m_0 c^2$
0.8	$0.1434\,mc^2$	$2.3905\,mc^2$	$1.2669\,mc^2$	$1.667\,m_0 c^2$
0.9	$0.1680\,mc^2$	$6.6974\,mc^2$	$3.4327\,mc^2$	$2.293\,m_0 c^2$
0.99	$0.1906\,mc^2$	$94.3948\,mc^2$	$47.294\,mc^2$	$7.920\,m_0 c^2$
1.0	$0.1931\,mc^2$	∞	∞	∞

complying with the Newton's mechanics. In Table 5 the values of the kinetic energy are $T_{kin_{sd}}$, $T_{kin_{sd}}$ as well as

the total energy according to Einstein $\dfrac{m_0 c^2}{\sqrt{1-\dfrac{v^2}{c^2}}}$. for the speeds of $0.1c$ to c.

3.3. Nuclear field

In nuclear physics, the energy of particles is usually given in units of eV, MeV, GeV, TeV, ... We get it from the product of unit charge of electron 1e and the accelerating voltage U (V). Taking into consideration that this is the movement of charges at the speeds of $v \sim c$, we have re-calculate the currently given energies of particles $W_{curr} = eU_{still}$ with regard to real energies of particles given in equation

$$W = eU_{mov} = eU_{still}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2 = W_{curr}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2 \tag{3.14}$$

There the real speed v_1 is taken for which it holds

$$\frac{1}{v_1} = \frac{1}{v_{classic}} + \frac{1}{c} \qquad (3.15)$$

or

$$v_1 = \frac{\sqrt{(2W_{curr})}}{\sqrt{(2W_{curr})} + c\sqrt{m}} c \qquad (3.16)$$

respectively. Let us derive the relations. For the classical speed

$$v_{classic} = \sqrt{\left(\frac{2eU_{still}}{m}\right)} = \sqrt{\left(\frac{2W_{curr}}{m}\right)} \qquad (3.17)$$

m - mass of particle
e - charge of particle

KIRCHNER (1932) and DUNNINGTON (1933) found out that the relation (3.17) does not hold for classical velocities comparable with the speed of light (for high voltages). Now it is known that for the charge moving at the speed of $v_1 \sim c$ we must take

$$U_{mov} = U_{still}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2 \qquad (3.18)$$

instead of U_{still}. The equation (3.18) is analogical to the equation (2.20). The real speed of the charged particle then is

$$v_1 = \sqrt{\left(\frac{2e}{m}U_{still}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2\right)} \qquad (3.19)$$
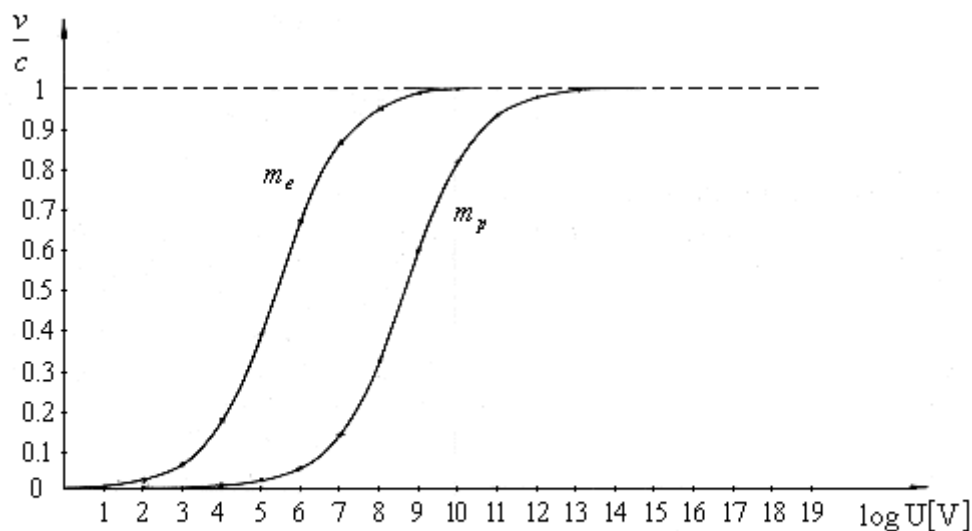
Fig. 3.8. Graphic dependence of $\frac{v_1}{c}$ on U[V] for the electron (m_e) and proton (m_p)

Fig. 3. 9. The comparsion of the "standstill" energy of the particle W of the proton mass (m_p) or electron mass (m_e) respectively with the energy so far recognized W_{curr}

from which we get the relations (3.15) or (3.16) respectively.
($\cos\vartheta = 1$, velocity is only in the direction of motion)

Graphic dependence of $\dfrac{v_1}{c}$ on U[V] for the electron (m_e) and proton (m_p) is shown in fig. 3.8.
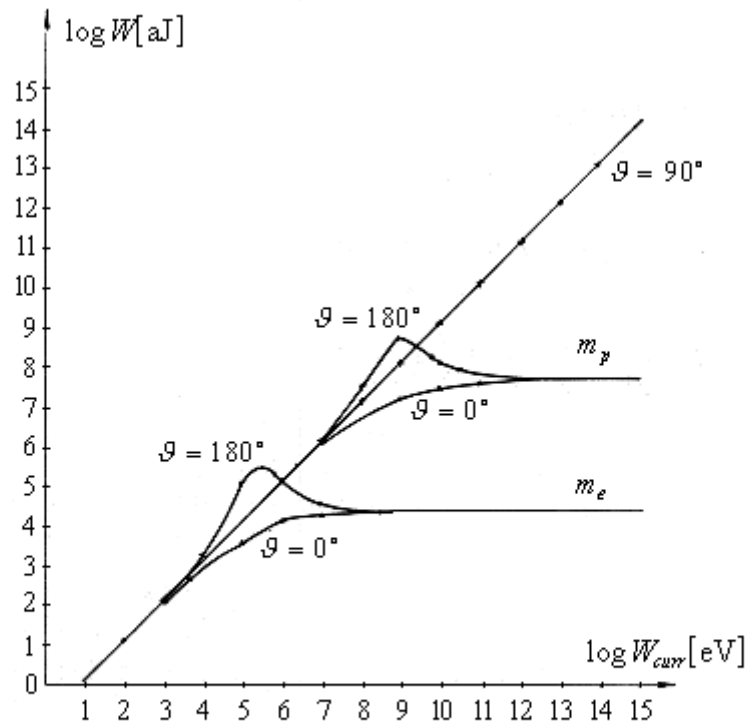
The comparison of the "standstill" energy of the particle W of the proton mass (m_p) or electron mass (m_e) respectively with the energy so far recognized is given in fig. 3.9. The dependence of the "standstill" (Einstein's terminology) energy of the particle W on ϑ . is represented, similarly as the intensity of the electric field, by Pascal's screw stocks, analogy of figs. 2.7.-2.10. It is necessary to distinguish the kinetic energy of the particle T_{kin} according to equation (3.11) from the "standstill" energy of the particle W according to equation (3.14) and the total energy of the particle

$$T_T = T_{kin} + W \tag{3.20}$$

Total energy of the particle T_T corresponds to the total energy defined by Einstein

$$E = \frac{m_0}{\sqrt{\left(1 - \dfrac{v^2}{c^2}\right)}} c^2 \tag{3.21}$$

while W according to (3.14) corresponds to

$$W_{curr} = e\, U_{still} \tag{3.22}$$

The difference between the total energy as defined by Einstein (3.21) and W_{curr} according to (3.22) equals the difference between T_T according to (3.20) and W according to (3.14).

The dependence of T_{kin} on W_{curr} is shown in fig. 3.10.

The dependence of T_{kin} on ϑ, W on ϑ, and $T_T = T_{kin} + W$ on ϑ is shown in fig. 3.11.

3.4. Radius of force reach of particles, calculation of velocities, frequencies, and mass of particles, "mass defect" notion

The electron radius can be determined provided the whole electron mass m_e has electromagnetic nature, i.e. potential energy W_p is determined by charge e distributed on the surface of a ball of the radius of r_e, see [7]. In contemporary physics for the electric potential energy on the surface of the ball the following equation is valid

$$W_{curr} = \frac{1}{4\pi\varepsilon_0} \frac{e^2}{r}$$

(see [8])
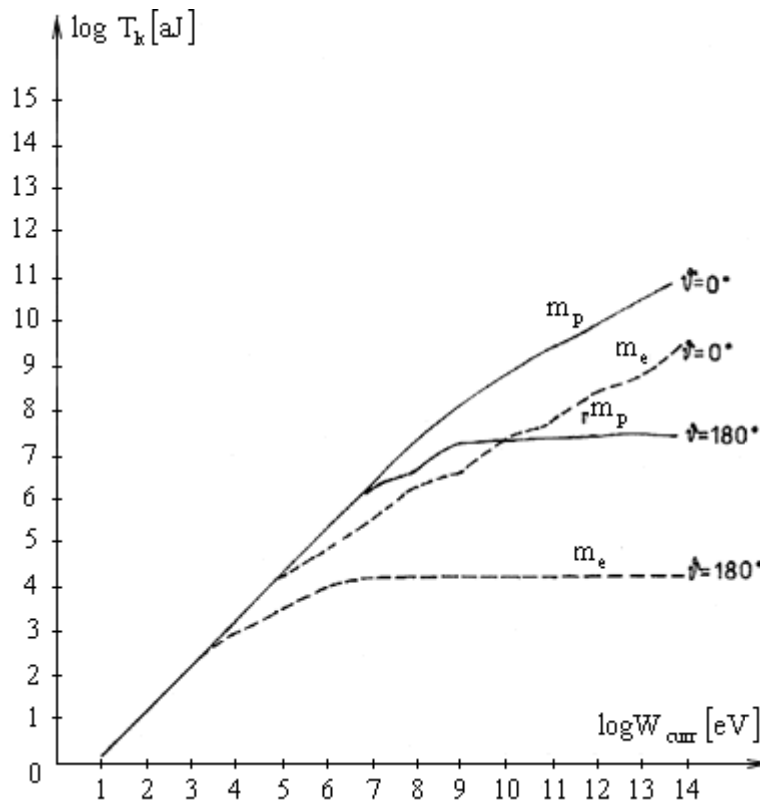
Fig. 3.10. The dependence of T_{kin} on W_{curr}
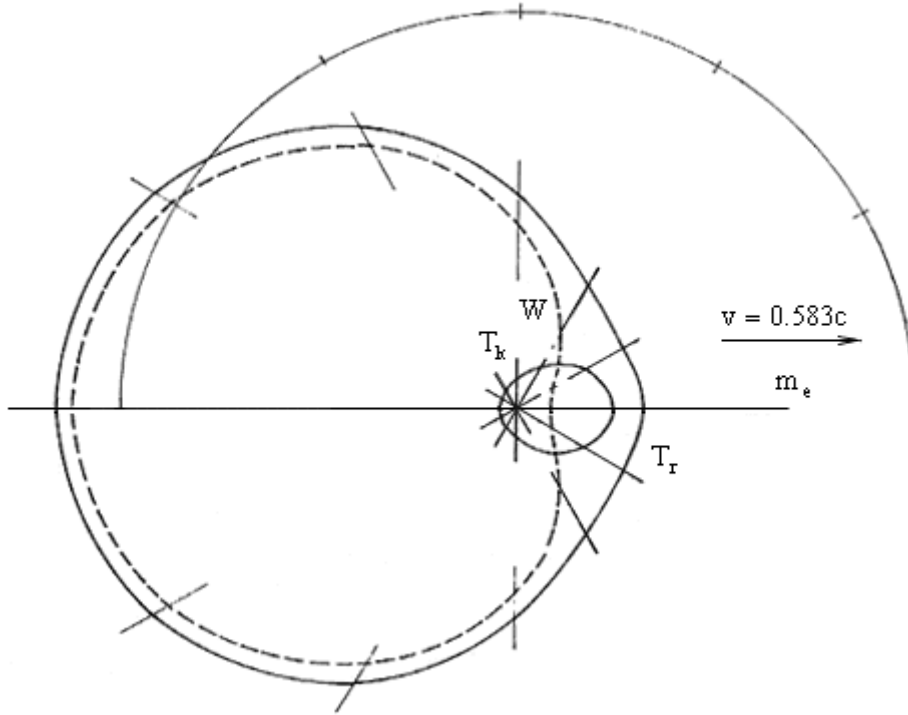
Fig. 3.11. The dependence of T_{kin} on ϑ, W on ϑ and T_c on ϑ

which according to the present theory - see part. 3.3 will be substitued by

$$W = W_{curr}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2 = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{r}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2 \qquad (3.23)$$

From the derivation T_{kin} in part 3.2 it follows at the same time

$$W = T_{kin} = \int dW_p = \frac{m_e c^2}{\cos^2\vartheta}\left[\ln\left|1 - \frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1 - \frac{v}{c}\cos\vartheta}\right] \qquad (3.24)$$

By comparison (3.23) and (3.24) we get

$$r_e = \frac{1}{4\pi\varepsilon_0}\frac{e^2}{m_e c^2}\frac{\left(1 - \frac{v}{c}\cos\vartheta\right)^2\cos^2\vartheta}{\left[\ln\left|1 - \frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1 - \frac{v}{c}\cos\vartheta}\right]} \qquad (3.25)$$

$(v_1=v)$.

Analogically for proton

$$r_{\mathrm{p}} = \frac{1}{4\pi\varepsilon_0} \frac{e^2}{m_{\mathrm{p}}c^2} \frac{\left(1-\frac{v}{c}\cos\vartheta\right)^2 \cos^2\vartheta}{\left[\ln\left|1-\frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1-\frac{v}{c}\cos\vartheta}\right]} \tag{3.26}$$

m_{p} - the proton mass

Similarly for quark, prequark, or α - particle we get

$$r_{\mathrm{i}} = \frac{1}{4\pi\varepsilon_0} \frac{e_{\mathrm{i}}^2}{m_{\mathrm{i}}c^2} \frac{\left(1-\frac{v}{c}\cos\vartheta\right)^2 \cos^2\vartheta}{\left[\ln\left|1-\frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1-\frac{v}{c}\cos\vartheta}\right]} \tag{3.27}$$

where m_{i} - is the mass of prequark, quark, proton, α - particle, or electron respectively, e_{i} - is the charge of prequark, quark, proton, α - particle, electron.

Table 6 of the dependence of $r(\vartheta)$ or respectively d on $\frac{v}{c}$ and ϑ gives possible radii and diameters of subparticles, and particles, calculated according to the equation (3.27) for speeds from the interval $10^{-11}c$ trough c and the value $\vartheta = 0°$, $\vartheta = 180°$.

Table 6.

v/c	$r(0°)[fm]$	$r(180°)[fm]$	d_{p} [fm]
10^{-11}			$3.06.10^{19}$
10^{-10}			$3.06.10^{17}$
10^{-9}			$3.06.10^{15}$
10^{-8}			$3.06.10^{13}$
10^{-7}			$3.06.10^{11}$
10^{-6}			$3.06.10^{9}$
10^{-4}			$6.12.10^{5}$
10^{-3}			$6.12.10^{3}$
0.03	3.0719	3.75224	6.824
0.04	1.66934	2.1798	3.8491
0.06	0.6917	1.0324	1.7241
0.07	0.49045	0.78267	1.27312
0.1			0.6361
0.11	0.1716	0.35832	0.5299
0.19	0.0421	0.1516	0.1937
0.2			0.17719
0.3			0.09223
0.4			0.06261
0.5			0.04895
0.6			0.04165
0.7			0.0373
0.8			0.03458
0.9			0.0328
1			0.03168

For the diameter of the particle d_{i} it holds approximately true:

$$d_i = r_i(0°) + r_i(180°)$$

<div align="right">(3.28)</div>

see fig. 3.12.
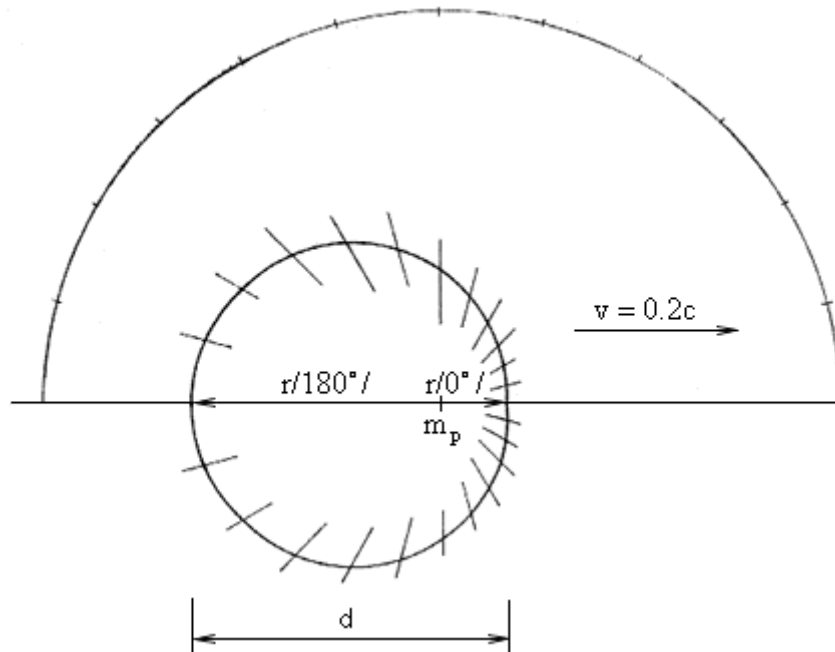
Fig. 3.12. The diameter of the particle d_i

Fig. 3.13 gives the dependence of d_i on $\dfrac{v}{c}$ while the "comb" ...is shown for one of the possible values of the relation of the particle and subparticle diameters: $d_{part} = \left(1 + \sqrt{3}\right)d_{subp}$

d[fm]

$1+\sqrt{3}$

4
3.8
3.6
3.4
3.2
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0

α

p

q

pq

0.2   0.4   0.6   0.8   1 $\dfrac{v}{c}$
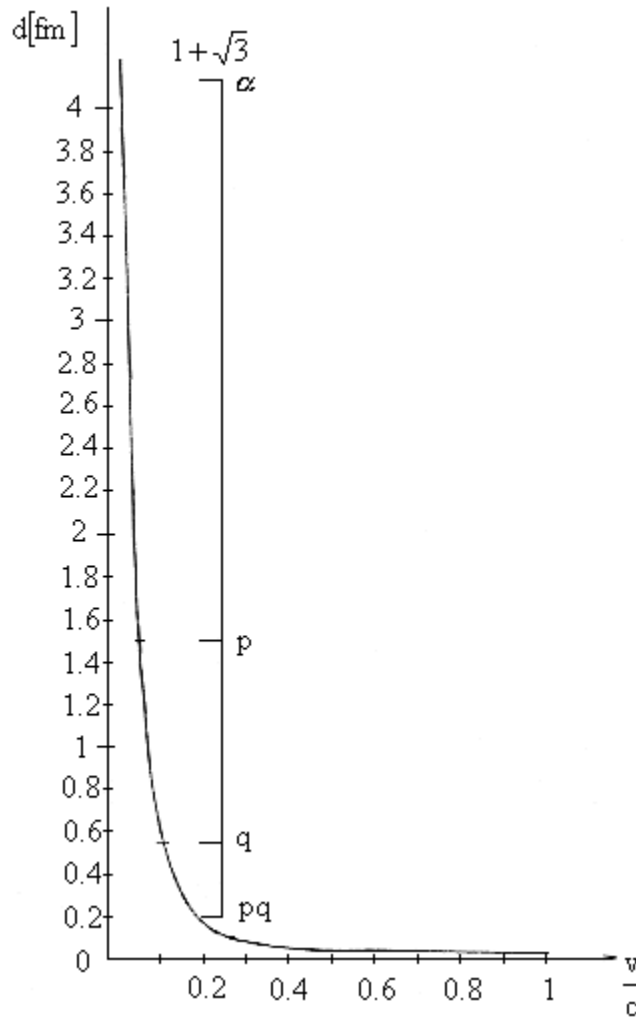
Fig. 3.13. The dependence of d_i on $\dfrac{v}{c}$

Table 7.

	α	p	k	pk
d	4.1262 fm	1.5103 fm	0.552 fm	0.2023 fm
v	0.04c	0.065c	0.11c	0.19c
d_{circle}	7.149 fm	2.6168 fm	0.958 fm	0.35 fm
V_{edge}	$5.34.10^{20}$ Hz	$2.37.10^{21}$ Hz	$1.1.10^{22}$ Hz	$4.91.10^{22}$ Hz
	$7360 m_e$	$1840 m_e$	$460 m_e$	$115 m_e$

For the sake of simplicity we shall assume the closest possible arrangement of particles with less mass in the ones with more mass i.e. α- particle is formed by four nucleons forming the disfenoid, a proton (nucleon) is formed by four quarks forming the disfenoid, a quark is formed by four prequarks forming the disfenoid. Table 7 gives the mass, frequency, diameter estimations of force reach according to 3.27, speed estimations of relevant particles existing one in the other, i.e. of prequarks in quarks, quarks in proton (nucleon), nucleons in α- particle. More coherent and detailed evaluations and computations will be given in some future article.

The notion of "mass defect" (energetic defect) loses its sense, if we consider that the particles in the nucleus are compressed under high pressure into almost ball-like formations. That is the case of revolvement of subparticles around approximatelly circular path (the edges of the series), and vice versa. Free particles are characterized by low pressure, i.e. by the ellipticallity of the particles paths (ever more of spectral lines including the series heads).

From Table 6 we can find such speeds of circulation of subparticles which enable that 4 subparticles (forming the disfenoid) to be situated in the particle at the same time, i.e. they are smaller than the particles:
4 nucleons in α - particle
4 quarks in a proton
4 prequarks in a quark

Naturally, the subparticles must have higher speeds of circulation (i.e. and energy). The energy of a particle is smaller than the sum of energies of the corresponding subparticles:

a) the energy of the α - particle is smaller than the sum total of the energies of 4 nucleons forming the α - particle

b) the proton energy is smaller than the sum of energies of four quarks forming the proton

c) the quark energy is smaller than the sum of the energies of four prequarks forming the quark.

According to (3.11) and Table 7 for α - particle:
$$7360 m_e c^2 \left[\ln |1 \pm 0.04| \mp \frac{0.04}{1 \pm 0.04} \right] <$$

for 4 protons:
$$< 4.1840 m_e c^2 \left[\ln |1 \pm 0.065| \mp \frac{0.065}{1 \pm 0.065} \right] <$$

for 4 x 4 quarks:
$$< 16.460 m_e c^2 \left[\ln |1 \pm 0.11| \mp \frac{0.11}{1 \pm 0.11} \right] <$$

for 4 x 4 x 4 prequarks:
$$< 64.115 m_e c^2 \left[\ln |1 \pm 0.19| \mp \frac{0.19}{1 \pm 0.19} \right]$$

see tab.8.

Table 8.

α	p	k	pk
v=0.04c	v=0.065c	v=0.11c	v=0.19c
[]$_{ad}$=0.0007	< 0.0019	< 0.0053	< 0.014
[]$_{id}$=0.0008	< 0.0023	< 0.0071	< 0.024
$\sum = 0.0015$	< 0.0042	< 0.0124	< 0.038

$$[]_{ad} = \left[\ln \left| 1 + \frac{v}{c} \right| - \frac{\frac{v}{c}}{1 + \frac{v}{c}} \right] \quad []_{id} = \left[\ln \left| 1 - \frac{v}{c} \right| + \frac{\frac{v}{c}}{1 - \frac{v}{c}} \right] \quad \sum = []_{as} + []_{id}$$

It is evident taht the energies of subparticles are bigger than the energy of particle (even through the mass of particle equals the sum of the mass of subparticles). We have thus outlined the way to explain the "mass defect".

3.5. Unified theory of field

The Hitherto presented results of our considerations should be used to form of foundations for the unified theory of field. Let us take the equation (3.20)

$$T_r = T_{kin} + W = \frac{mc^2}{\cos^2 \vartheta}\left[\ln\left|1 - \frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1 - \frac{v}{c}\cos\vartheta}\right] + W_{curr}\left(1 - \frac{v}{c}\cos\vartheta\right)^2$$

When we shall substitue this general equation with

a) $m=m_e$, $W_{curr}=eU_{still}$, v - velocity of the electron in atom, we get total energy of the electromagnetic field in the atom

b) e.g. $m=k.m_e$, W_{curr} - contemporary, current energies of particles, v - velocity of electron in neutron (or of the subparticle in the particle), we get total energy of the nuclear field (or elementary particles respectively)

c) $m=m_e$, $\overset{m}{\varkappa}$, m_r, W_{curr} - contemporary, current energies of leptons, v - velocity of lepton subparticles in the particle, we get total energy of the lepton field

d) $m=M$ (the mass of the Sun, the Earth, planets, rockets, etc.), W_{curr} - contemporary energies of planets circulated around the central body or the centre of the galaxy respectively, v - velocity of circulation the planets (the average) around the central body. We get the total energy of the gravitational field.

4. CONSEQUENCES 2

Let us sum up the opinions of the physicists of previous generations and, with the use of our theory, let us try to develop a common view to the processes coursed in atom, nucleus and in the Universe.

1. In accordance with Hertz, 1 circulation of electron around nucleus gives us 1 oscillation or 1 wave with a top and a bottom or one elementary quantum of energy respectively, which equals to Planck's constant.

2. An electron moving at the accelerated speed radiates an electromagnetic wave motion (electrodynamics).

3. An electron moves along the ellipse, with the nucleus in the focus (Bohr's planetary model).

4. An electron moves at the accelerated speed when approaching the nucleus. When departing, it moves at the decelerated speed (Keppler-Bohr).

5. If an electron moves uniformly along the circle, it does not radiate - series edge.

If the electron moves along the most elongated ellipse, it radiates the series head - there are major changes in acceleration and deceleration.

Other spectral lines of series between these two extremes are the more or less deformed ellipses in dependence on the line thickness.

6. The thicker the line, the more deformed the ellipse.

7. The thinner the line, the more approximate the circle, the orbit of the electron.

8. The invisible "line" represents the motion of electron along the ideal circle. It is the inertial motion.

9. The electron does not move along the same ellipse, but it occurs the coiling of perinucleum i. e. it moves along the rosette in plane (Sommerfeld explained this through equations for the theory of relativity. We explain it through E_{mov} according to equation 2.20). At the same time it is the idea of a "superfine structure" and a "plane quantization".

10. "The space quantization" can be explained according to our theory by means of pushing the center of gravity and the rotating electron getting off the orbit plane, like it is shown in 3.1. - the rotating circle getting off in the gravitation field of the Earth.

11. The radius of force reach of the electron decreases with the increasing translational speed - see relation (3.25). It increases with the decreasing translational speed.

12. The radius of force reach of the electron analogically decreases with the increasing angular (rotating) speed. It increases with the decreasing angle speed of the rotating electron around its axis of revolution.

13. The effective cross-section of oscillating nuclei is decreases with the increase of the particle speed around balanced position of nucleus.

14. The effective cross-section of incident particle decreases with the increase of particle translational speed (e. g. electron, proton) and is inversely proportional to the square of the particle mass.

$$\sigma \sim \pi r_i^2 \qquad \left(r_i \sim \frac{1}{m_i} \right)$$

15. In the center-of-mass coordinates system the electron and also the nucleus (of hydrogen atom) revolve at the same frequency but at different circumferential velocity, whereby it is valid that $m_e R_e^2 = m_p R_p^2$

$$R_e = \sqrt{\left(\frac{m_p}{m_e} \right)} \cdot R_p = 42.8503386217 R_p$$

R_e - radius of electron revolving

R_p - radius of proton revolving around the common center of gravity (Currently used equation $m_e R_e = m_p R_p$ see Beiser [9] page 151 is not valid)

16. The relation $m_e R_e^2 = m_p R_p^2$ results meanwhile also from the law of moment conservation ...
$mvR = m\omega R^2 = \text{const}$ and the definition and calculation of the moment of inertia $J = mR^2$

for the sphere ... $\frac{2}{5} mR^2$

for the cylinder ... $\frac{1}{2}mR^2$ see Steiner's theorem, too.

17. That is why it is also valid (for the hydrogen atom)

$$v_e = v_p \sqrt{1836.13} = 42.8503386217 v_p$$

since $v_e = \omega R_e$, $v_p = \omega R_p$ whereby the frequency in center-of-mass system is the same for electron as well as for proton (nucleus).

18. The electron velocity $\dfrac{v_1}{c} = \dfrac{1}{137} = 0.00733$ is at the same time the constant of fine structure whereby according to Wichman p. 65 (Quantum physics - Berkeley course of physics IV.) and our theory it is valid that

$$-13.6\,\text{eV} = -R_\infty = T_{\text{kin}} - \frac{1}{4\pi\varepsilon_0}\frac{e^2}{R_{\text{orbit}}}\left(1 - \frac{v_1}{c}\cos\vartheta\right)^2$$

Substituting for T_{kin} according to (3.24) for $\alpha = \dfrac{v_1}{c} = 0.00733$ we have

$$T_{\text{kin}} = 27.455 \ \text{eV} \ \text{that is} -13.6 \ \text{eV} = -R_\infty = 27.455 - 13.863$$
$$-13.6 = -13.59_{25}$$

19. The speed of $\dfrac{v_1}{c} = \dfrac{\alpha}{2} = 0.00366$ corresponds to the wavelength of electron $\lambda = 0.3664\,\mu m$, one revolvement of which can be coordinated to the Planck's constant h.

20. Alternately, acceleratively and deceleratively moving electron at the speed from $v_{min}=0.0029970729c$ to $v_{max}=0.0030012425c$ ($8.9975 \cdot 10^5$m/s) i. e. the electron moves along the rosette radiating electromagnetic wave (and absorbing energy during deceleration) it will not fell down on the nucleus as Beiser affirms [9] p. 132. In any case, the electron moving alternately acceleratively and deceleratively along the rose orbit of the rosette radiate the electromagnetic wave. If we picture a concrete most deformed ellipse belonging mainly to the head of Balmer's series $H_\alpha = 6563 \pm 14 \ \overset{\circ}{A}$ as a rosette in the circular ring of the radii of

$R_{max} = 3.169 \ \overset{\circ}{A}, \ R_{min} = 3.166 \ \overset{\circ}{A}, \ R_{max} - R_{min} = 0.003 \overset{\circ}{A}$, as the circle of the radius of 31cm of the line thickness of 0,3 mm, then the whole rosette is pressed into this "circle" i. e. into the circle ring of the thickness of 0,3 mm!

We therefore draw the entire circle ring, it seems outwardly, that it is the motion along the circle (ideal one) - only at the depth view to the circle thickness ("through microscope") we can see that in fact it is the rosette - the system of coiling ellipses.

$R = 31\text{cm}$

0.3mm
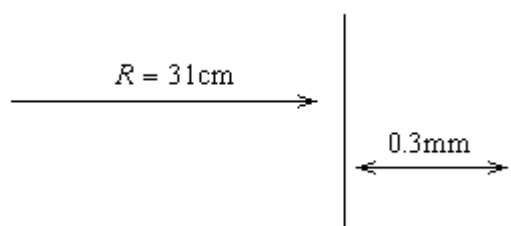
The lower temperature, the lower frequency of revolution of electrons (protons). At the absolute zero $f_{orbit} \to 0$.

As the temperature decreases, the revolvement of the electron and the nucleus around the common center of gravity are impeded. The rotation of electron around its axis nearly stops as well first. The orbital motion stops first, this allowed by the rotational stop.

Conversely: If we start to warm up the electrons and nucleus from the absolute zero, the rotational motion will increase first (the superfluid component HeII.) and only if this rotational motion is saturated to a certain degree, it will also start increasing the orbital motion (as it is in the case of the rotating circle in the gravitational field of the Earth - the electron begins its getting off the nucleus). Therefore the normal component HeII contains also the orbital motion of electron. The superfluid component (=not containing friction) would be characterized only by the rotating electrons around their axes in HeII atoms, whereby the motion along the orbit does not yet begin (our it could be very slow respectively).

The normal component would be also characterized by the motion of electrons along the orbits around the nuclei (more exactly, around the centers of gravity of atoms). But this normal component contains friction like the result of the revolution of electrons and protons along the orbits around the center of gravity of atom.

$$\boxed{\begin{array}{l}\text{Orbits}\\ \text{(QUASI - circle orbits)}\end{array}} \Leftrightarrow \boxed{\begin{array}{l}\text{FRICTION}\\ \text{VISCOSITY}\\ \text{THERMAL CONTENT}\\ \text{ENTHALPY}\end{array}}$$
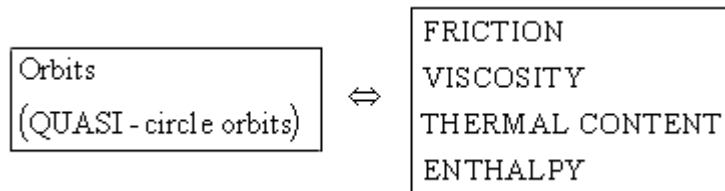
All these quantities (friction, viscosity,...) start up only with the registration of the orbital motion beginning as the result of high accelerated rotation around its axis $g < \varepsilon \cdot t$.

The superfluid state is exactly the state, in which the mass is least willing to express its properties.

$$\boxed{\begin{array}{l}\text{normal component}\\[4pt] \rho_n = \dfrac{1}{10}\,\rho\\[4pt] \text{superfluid component}\\[4pt] \rho_s = \dfrac{9}{10}\,\rho = 9\,\rho_n\end{array}}$$
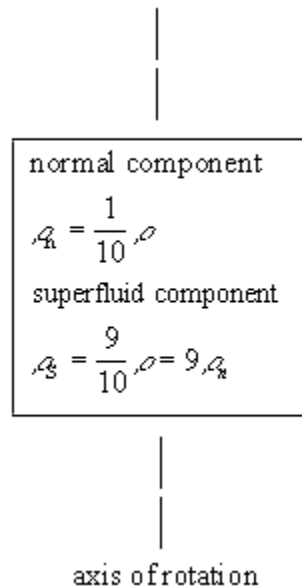
axis of rotation

During the rotation we get two circular paraboloids, the big one of height h is normal component HeII and a smaller one under the big one of height $\dfrac{1}{10}h$ in the superfluid component representing the mixture of rotating electrons and nuclei around their own axis.

The thermal content is made dependent upon the exclusive existence of the atom electron envelope.

If I have not the thermal content	====>	I have not even the electron envelope.
Thermal content exist	<===>	if the electron envelope exist
I have no friction I have no viscosity I have no termal content	<===>	I have no electron envelope

The high thermal conductivity is caused by loss or partial loss at least of the electron envelope or by its influence suppression.

THE SUPERFLUID COMPONENT and the (high-temperature or low-temperature) PLASMA have something in common with each other. In both cases we have no electron envelope.

22. Superconductivity

The conducting electrons in metals transfer the electric charge and heat well. How it is then possible, that they do not contribute practically to the heat capacity at room temperature? (S. Janos, The Low Temperature Physics, p. 102 - SPN Bratislava, 1979).

The conducting electrons also rotating around their own axes, like the electrons in superfluid or superconductive state.

The electric current is then the flow of conducting electrons ripped out of the valence shells of atoms envelopes rotating around their own axes.

We can gain the high-temperature superconductivity by breaking of the orbits of electrons increasing their velocity (i. e. by the reduction of their force reach radii for $v \to c$ $r \to 0$ and reducing the motion of atoms nuclei (or ions) increasing the volume for the electrons transition (what is in fact indirectly the decrease of temperature).

We will increase the volume for transition of the electrons through maximum solid breaking of orbits of the electrons. This will decrease the "size of atoms" of ~ 10^5 fm to the "size of nuclei" ~ $1 fm$ i. e. it will decrease $(10^5)^3 = 10^{15}$ times (!!!) the "volume of obstacles for electrons". Will not the grid structure of metal disintegrate moreover as in plasma?

Evidently it will be necessary to freeze the nuclei motion in order to keep the grid structure of "superconductor" i. e. to remain the real nuclei of atoms (or ions) in neutral points of grid not to gain a chaotic motion. That can probably only be achieved in strong magnetic fields, or at low temperature. Increasing the speed of electrons to the speed close to the one of light, we decrease the radius of force range of electrons. It means, that for $v \sim c$ the electrons could perhaps transit also through the nuclei (ions) like through the screen. Then it would no matter whether or not it is the low temperature, or if the conductor grid is kept or not. It is a matter of not disintegrate the "conductor" to plasma or keeping in within the "space of the conductor". The electric current in the circuit of superconductive material flows almost for the infinite time, since it is the motion of free electrons rotating around their axes in almost free medium. There are no atoms in the neutral points of grid, just nuclei or ions and they are almost frozen, i. e. they do not oscillate thermally, chaotically around the equilibrium positions almost at all. They probably just rotate, so their effective cross-section is also small. At the same time the effective cross-section of electrons is smaller, for they move along the circle at the high speed. In which way their radius of force range is also decreased. By the accelerating voltage $U=10^{10}$ V for electrons and voltage $U=10^{13}$ V for protons (see fig. 3.8) it should originate superconductivity at room temperature.

23. The wavelength according to Broglie $\lambda = \dfrac{h}{mv}$

according to Compton $\lambda = \dfrac{h}{mc}$

$$\lambda = \frac{h}{mc} \frac{\cos^2 \varepsilon}{\left[\ln\left|1 - \frac{v}{c}\cos\vartheta\right| + \frac{\frac{v}{c}\cos\vartheta}{1 - \frac{v}{c}\cos\vartheta} \right]}$$

according to Vlček

24. The moment of momentum is kept - it is constant (it results from the generalized law of inertia)

$$m_1 v_1 R_1 = m_2 v_2 R_2 \quad \text{because the moment of inertia is kept}$$
$$m_1 R_1^2 \omega = m_2 R_2^2 \omega \quad \text{in the center-of-mass coordinate system}$$

but the momentum is not kept in general $m_1 v_1$ does not equal $m_2 v_2$

because R_1 does not equal R_2 the radius of electron and nucleus revolve around, the common center of gravity is different.

Only in a special case e. g. on the Earth surface, when $R_1=R_2=R_Z$ it is valid that $m_1 v_1 R_Z = m_2 v_2 R_Z$

i. e. $m_1 v_1 = m_2 v_2$ (a boat on a water level)

25. The orbit radius $\quad R_{orbit} = \frac{1}{4\pi\varepsilon_0} \frac{e^2}{mc^2}\left[\frac{c}{v_1} - \cos\vartheta\right]$

26. The force range radius - see relations (3.25) to (3.27) and Fig. 3.13. The experimental evidence: a trace of particle in Wilkinson's chamber. High speed, low density of ionization.

27. From the wavelength of the spectral line and from its thickness we can even calculate the speed of electron

by its circular motion around nucleus $\left(\frac{v_1}{c}\right)$) also the radius of orbit R_{orbit} for all spectral lines. We just need a spectroscope tables of wave- lengths ($\lambda_{max} - \lambda_{min}$) to find out all proportions in atoms.

$$R_{orbit}^{at} \doteq \frac{1}{4\pi\varepsilon_0} \frac{e^2}{mc^2}\left[\frac{c}{v_1} - 1\right]^2 \quad \text{because } \dot{\vartheta} = 90° \text{ quasicircle}$$

Substituting

$$\frac{c}{v_1} = \sqrt[3]{\left(\frac{\lambda c}{5.308013131 \cdot 10^{-6}}\right)} - \frac{1}{3}$$

$$R_{orbit} \doteq 2.82117460565 \cdot 10^{-15}\left[\sqrt[3]{\left(\frac{\lambda c}{5.308013131 \cdot 10^{-6}}\right)} - \frac{4}{3}\right]^2$$

$$\lambda_{max} = 6577 \, \overset{\circ}{A}$$

$$\lambda_{min} = 6549 \, \overset{\circ}{A} \qquad\qquad R_{max} = 3.11575361 \, \overset{\circ}{A}$$

For $R_{max} - R_{min} = 0.00888482 \, \overset{\circ}{A}$ $R_{min} = 3.10686879 \, \overset{\circ}{A}$

28. The ratio of the mass of two bodies rotating around the common center of gravity e. g. in atom of hydrogen is essential:

$$\frac{m_p}{m_e} = 1836.13$$

then

$$\frac{v_e}{v_p} = \frac{R_e}{R_p} = \sqrt{\left(\frac{m_p}{m_e}\right)} = 42.8503386$$

For the solar system in our GALAXY

$$\frac{M_G}{M_{S_s}} \cdot \frac{M_{milkyway}}{M_S} \stackrel{\cdot}{=} 9 \cdot 10^{10} \ldots ?$$

$$\sqrt{\left(\frac{M_G}{M_{S_s}}\right)} = 3 \cdot 10^5 = \frac{v_S}{v_G}$$

29. The higher the speed of particle, the shorter radius of its own force range (it is significant for $v > 0,05c$). At the same time it is the explanation of the short radius of force range of the particles of strong fields.

Conversely, the particles in electromagnetic, gravitational and weak fields have long radius of force range i. e. the particles of these fields move at low speed of $v < 0,05c$. We have the effective cross-section of $r = 10^{-15}$ m if it is defined that $\sigma = \pi r^2$ where r is the radius of force range of the particle for $\frac{v_1}{c} = 0.05$ and $\sigma = 0.03$ up to 0,06 barn. According to Vanovic the experiment for example gives for the scattering of $\sigma_r = 0.037$ barn at $^{239}_{92}Pu$.

30. Heisenberg's uncertainty principle and our theory are in absolute agreement: "The bigger the impulse (i. e. the higher speed, too) the shorter force range radius."

"The smaller the impulse (the slower speed) the longer force range radius."

High speed is accompanied by the short radius of force range. Slow speed is accompanied by the long radius of force range.

5. PHYSICIST'S CONSCIENCE - EPILOGUE

Has an ordinary physicist the right to criticize the "giants of physics"?
Has he the right not to criticize them?

The author submits an absolutely new theory, that represents a revolution in physics. In general knowledge he brings a new view on safety of atomic power stations, other calculations of energy and speed of elementary particles, their radii of force range, other relations for the construction of atomic power stations, the nuclear reactions.

This theory is the product of 25 years of work.

The author remembers the documentary film about the Bikini Island. The naiveté whith which the soldiers, officers, scientists expected the A-bomb explosion, the expressions of grandiosity, the feelings of pride that they were there, the carelessness of the radiation, the swimming after the explosion, and the results putting out of countenance ending with cancer, the immense growth of extremities, their rupture - the consequent amputation of the legs, the high growth of arms, until death, also a certainty of scientists, that nothing could happen (signatures of scientists, the agreement with the production of bombs and their experimental test in presence of a large number of soldiers) - all these facts witness that it was an ignorance of people, of regular soldiers as well as scientists (including A. Einstein), the ignorance originating in a wrong or inconsequent theory, which made a qualitative point to the justice though, but did not give the quantitative point to it as is shown in Table 5 of this work. It clearly shows that the values of total energy calculated by Einstein are substantially lower as those calculated in our theory for all particle velocities, even for the lower ones.

At the speed of $0,1c = v$, there are the differences even by $0,0007mc^2$, which keep on increasing.

For $v = 0,5c$ this difference in the direction of motion is $(0.3068 - 0.155)m_0c^2 = 0.1518m_0c^2$

and for $v = 0.99c$ even $(94.3948 - 6.92)m_0c^2 = 87.4748m_0c^2$

so that in fact the energies in nuclear reactions have been substantially higher than the current theory of A. Einstein assumes.

It results in the incorrect determination of energies even in nuclear reactors and thus in the insufficient protection design, what leads to breakdowns of atom power stations (USA, FRG, UKRAINE, RUSSIA) and risky, often caraless behaviour of highly educated people of former AS of USSR, enormous impacts caused by irradiation of population because of the ignorance of people in high positions and the consequent disinformation of population. To be able to avoid the breakdowns, it is necessary to consider our equation for energy calculation and not the Einstein's one. It involves all activities concerning calculation of energy of particles (accelerators, reactors,...). We will thus help substantially to prevent tragedies of the human race caused by ignorance.

REFERENCES

[1]   KAUFMANN, W.: Annalen der Physik, Vierte Folge, Band 19, Leipzig, 1906 Verlag von Johann Ambrosius Barth p. 487-552

[2]   EINSTEIN, A.: Sobranie naučnych trudov v četyrech tomach pod redakciej I. E. TAMMA, Ja. A. SMORODINSKOGO, B. G. KUZNECOVA, Izdateľstvo "Nauka", Moskva 1966

[3]   FIZEAU, M. H.: Sur les hypothéses relatives a l'éther lumineux. Ann. de Chim. et de Phys., 3e série, T. LVII. (Décembre 1859) Présente á l'Academie des Sciences dans sa séance du 29 septembre 1851.

[4]   KNOPF, O.: Annalen der Physik, Vierte folge, Band 62, 1920 :"Die Versuche von F. Harress uber die Geschwindigkeit des Lichtes in bewegten Korpern, von O. Knopf. p. 391 - 447

[5]   PURCELL, E. M.: Electricity and magnetism. In: Berkley physics courses (Russian translation). Moskva, Nauka 1971.

[6]   FEYNMAN, R. P. - LEIGHTON, R. B. - SANDS, M.: The Feynman lectures on physics (Russian translation) Moskva, Mir 1965-1966.

[7]   CABÁK, I.: Základné pojmy jadrovej fyziky, Bratislava, SPN, 1975

[8]   FUKA, J.- HAVELKA, B.: Elektřina a magnetismus, Praha, SPN, 1965

[9]   BEISER, A.: Perspectives of Modern Physics (Czech translation) Academia, Praha 1975

[10] FRIŠ, S. E. - TIMOREVA, A.V.: Kurs obščej fiziky III. (Czech translation) Praha, NČSAV, 1954

[11] BECKMANN P., "Einstein Plus Two", The Golem Press, Boulder, Colorado (1987).

THE NEW COORDINATE SYSTEMS IN PHYSICS AND MAGIC NUMBERS

This paper presents two new coordinate systems (*s, t, u, v*) and (*s*, t*, u*, v**). There is a transformation of relations between (*s, t, u, v*) and (*x, y, z*) - cartesian between (*s*, t*, u*, v**) and (*x, y, z*), between (*s, t, u, v*) and (*s*, t*, u*, v**). The theory is an attempt to account for the existence of magic numbers in terms of interactions between an individual nucleon and a force field produced by all the other nucleons. Combination of the cartesian coordinate system with our news coordinates arise as very firmly fastening structure for description of nuclear spheres (shells).

INTRODUCTION

Nuclei with equal numbers of protons and neutrons are especially stable, as are nuclei with even numbers of protons and neutrons. Thus such nuclei as $_2He^4$, $_6C^{12}$, and $_8O^{16}$ appear as peaks on the on the empirical binding energy per nucleon curve. Nuclei with 2, 8, 20, 28, 50, 82, 126, and 152 neutrons or protons are more abundant than other nuclei of similar mass numbers, suggesting that their structures are more stable.

Other evidence also points out to significance of numbers 2, 8, 20, 28, 50, 82, 126, and 152 which have become known as magic numbers, in nuclear structure. An example is the observed pattern of nuclear electric quadrupole moments, which are measures of the departures of nuclear charge distribution from sphericity. A spherical nucleus has no quadrupole moment. Nuclei of magic N and Z are found to have zero quadrupole moments, hence, are spherical. Theory "THE NEW COORDINATE SYSTEMS IN PHYSICS" is an attempt to account for the existence of magic numbers in terms of interactions between an individual nucleon and a force field produced by all the other nucleons.

THE NEW COORDINATE SYSTEMS IN PHYSICS

Take the minimal number of identical particles with a globe-like form and forming the nearest organized configuration. This configuration is a disfenoid at the vertices with four particles (the α - particle has 4 nucleons). The origin of our new coordinate system is put into the center of gravity of the configuration. This origin and the centres of the particles determine the semi-lines-semi-axes of the coordinate system. This coordinate system divides the space into four quartespaces. The pairs of semi-lines (*s,t*), (*s,u*), (*s,v*), (*t, u*), (*t,v*), (*u,v*) determine angles $\alpha = 109°28'16,3942824 ...''$

For angle α it precisely holds:

$$\cos\alpha = -\frac{1}{3}$$

$$tg\alpha = -2\sqrt{2}$$

$$\sin\alpha = \frac{2\sqrt{2}}{3}$$

$$\cos\frac{\alpha}{2} = \frac{1}{\sqrt{3}}$$

$$tg\frac{\alpha}{2} = \sqrt{2}$$

$$\sin\ = \frac{\alpha}{2} = \frac{\sqrt{6}}{3} = \sqrt{\left(\frac{2}{3}\right)}$$

To imagine better the coordinate system *(s,t,u,v)*, we can use the cube. The centre of the cube is the center of gravity of the disfenoid and also the origin of the coordinate system (see fig. 1).

In order to facilitate the transformation to the cartesian coordinate system, this will be somewhat re-arranged:

semi-axes *x,y,z* will have the same marks, semi-axes *(-x),(-y),(-z)* will be marked ξ, η, ζ and so cartesian

coordinate system *(x,y,z)* in the new marking will be revealed as a system ($x, y, z, \xi, \eta, \zeta$) formed by semi-axes

$x, y, z, \xi, \eta, \zeta$. These, regarding to the coordinate system *(s,t,u,v)*, will be determined as follows:

semi-axis *x* is the symmetral of the angle α (see fig. 2)

semi-axis *y* is the symmetral of the angle α in " α - plane" *(t,u)*

semi-axis *z* is the symmetral of the angle α in " α - plane" *(u,v)*

semi-axis ξ is the symmetral of the angle α in " α - plane" *(t,v)*

semi-axis η is the symmetral of the angle α in " α - plane" *(s,v)*

semi-axis ζ is the symmetral of the angle α in " α - plane" *(s,t)*.
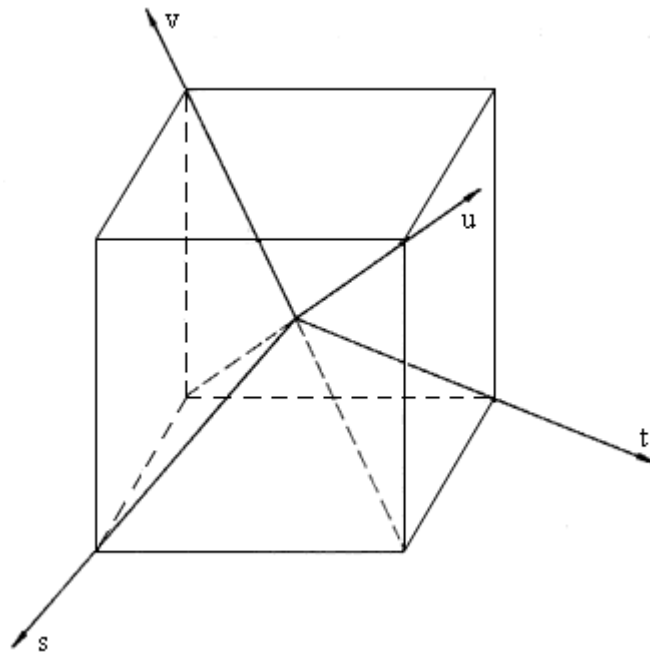
Fig. 1. The coordinate system *(s,t,u,v)*
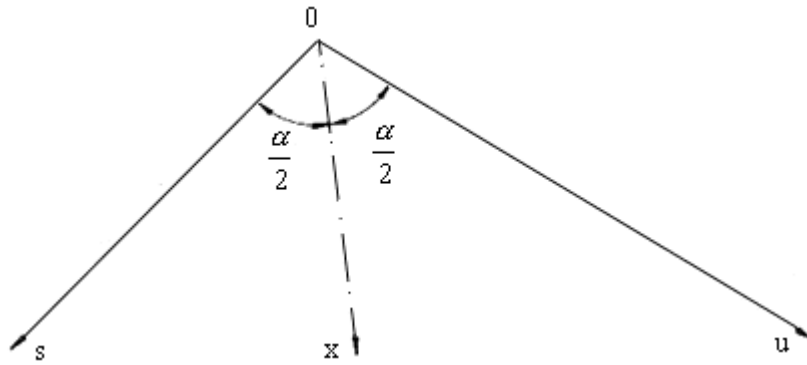
Fig. 2. The semi - axis x is the symmetral of the angle α

After drawing both coordinate system we will achieve fig. 3.

The cartesian coordinate system divides the space into 8 octants:

$$(x,y,z)(\xi,y,z),(\xi,\eta,z),(x,\eta,z),(x,y,\zeta),(\xi,y,\zeta),(\xi,\eta,\zeta),(x,\eta,\zeta)$$

The trinities of " α - planes" determine four equal quarter-spaces: (s,t,u), (s,t,v), (s,u,v), (t,u,v). It is impossible to divide the space into equal parts using less than 4 semi-axes. It means that these quarter-spaces are the largest possible parts of the space formed by the minimal number of semi-axes.
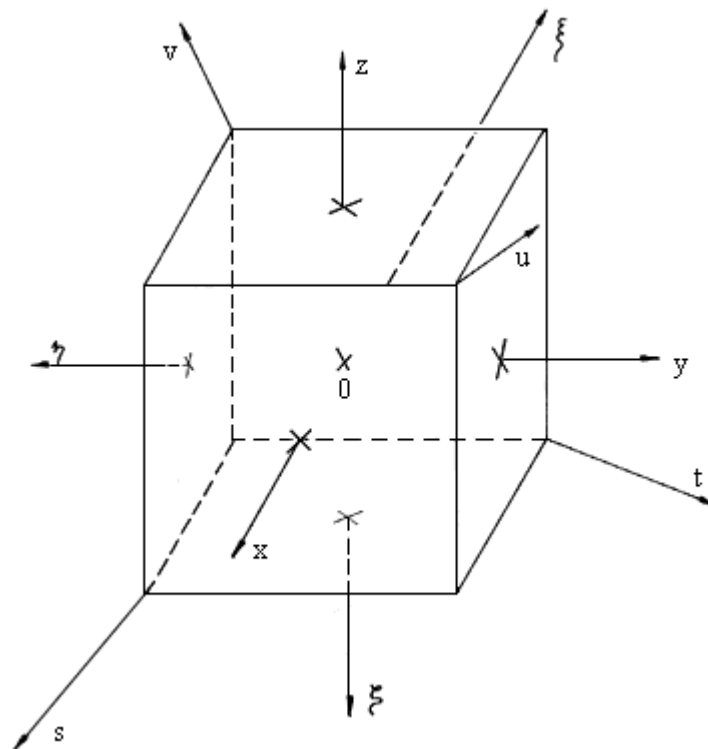
Fig. 3. Both coordinate system (s,t,u,v) and (x,y,z,ξ,η,ζ)

The values of coordinates will be read in two ways:

a) The straight lines placed from an arbitrary point parallel to the axes s,t,u,v determine coordinates s,t,u,v, fig. 4.

Zero in the contained coordinate means that the point is placed in the quarter space determined by coordinates other than zero.

See the following transformation equation between (s,t,u,v) and ($x, y, z, \xi, \eta, \zeta$):

(s,t,u)

$$x = \frac{\sqrt{3}}{3}(s+u-t) \quad y = \frac{\sqrt{3}}{3}(t+u-s) \quad \zeta = \frac{\sqrt{3}}{3}(s+t-u)$$

(s,u,v)

$$x = \frac{\sqrt{3}}{3}(s+u-v) \quad z = \frac{\sqrt{3}}{3}(u+v-s) \quad \eta = \frac{\sqrt{3}}{3}(s+v-u)$$

(s,t,v)

$$\xi = \frac{\sqrt{3}}{3}(t+v-s) \quad \eta = \frac{\sqrt{3}}{3}(s+v-t) \quad \zeta = \frac{\sqrt{3}}{3}(s+t-v)$$

(t,u,v)

$$\xi = \frac{\sqrt{3}}{3}(v+t-u) \quad y = \frac{\sqrt{3}}{3}(t+u-v) \quad z = \frac{\sqrt{3}}{3}(u+v-t)$$
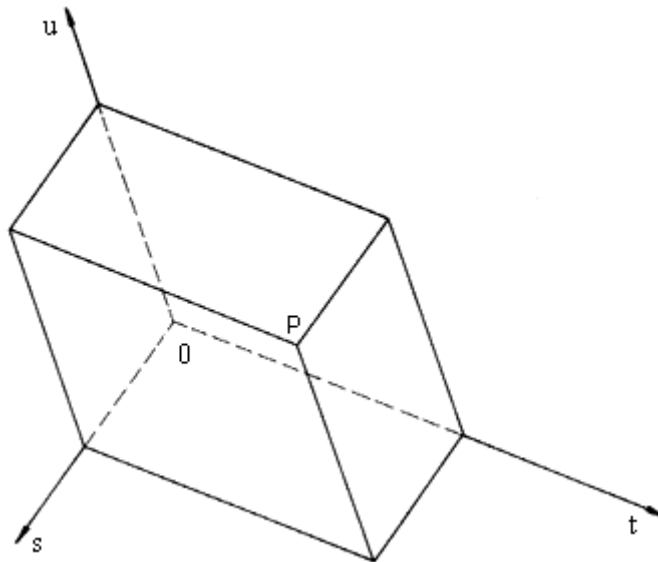
Fig. 4. The coordinates (s,t,u,v)

(s,t,u): $\qquad\qquad\qquad\qquad$ (s,u,v):

$$s = \frac{\sqrt{3}}{2}(x+\zeta)$$

$$s = \frac{\sqrt{3}}{2}(x+\eta)$$

$$t = \frac{\sqrt{3}}{2}(y+\zeta)$$

$$u = \frac{\sqrt{3}}{2}(x+z)$$

$$u = \frac{\sqrt{3}}{2}(x+y)$$

$$v = \frac{\sqrt{3}}{2}(\eta+z)$$

(s,t,v): $\qquad\qquad\qquad\qquad$ (t,u,v):

$$s = \frac{\sqrt{3}}{2}(\eta+\zeta)$$

$$t = \frac{\sqrt{3}}{2}(\xi+y)$$

$$t = \frac{\sqrt{3}}{2}(\xi+\zeta)$$

$$u = \frac{\sqrt{3}}{2}(y+z)$$

$$v = \frac{\sqrt{3}}{2}(\xi+\eta)$$

$$v = \frac{\sqrt{3}}{2}(\xi+z)$$

The distance between two points (s_1,t_1,u_1,v_1) and (s_2,t_2,u_2,v_2) is determined as follows:

$$d_{12} = \{(s_1-s_2)^2 + (t_1-t_2)^2 + (u_1-u_2)^2 + (v_1-v_2)^2 -$$

$$- \frac{2}{3}[(s_1-s_2)(t_1-t_2) + (s_1-s_2)(u_1-u_2) +$$

$$+ (s_1-s_2)(v_1-v_2) + (t_1-t_2)(u_1-u_2) +$$

$$+ (t_1-t_2)(v_1-v_2) + (u_1-u_2)(v_1-v_2)]\}^{1/2}$$

b) The planes placed from an arbitrary point perpendicular to the axis s,t,u,v determine coordinates s^*,t^*,u^*,v^*, see fig. 5.

Fig. 5. The coordinates s^*,t^*,u^*,v^*

See the following transformation equations between s^*,t^*,u^*,v^*, and x,y,z,ξ,η,ζ :

$$x = \frac{\sqrt{3}}{2}\left(s^{\bullet} + u^{\bullet}\right) \quad y = \frac{\sqrt{3}}{2}\left(t^{\bullet} + u^{\bullet}\right) \quad z = \frac{\sqrt{3}}{2}\left(u^{\bullet} + v^{\bullet}\right)$$

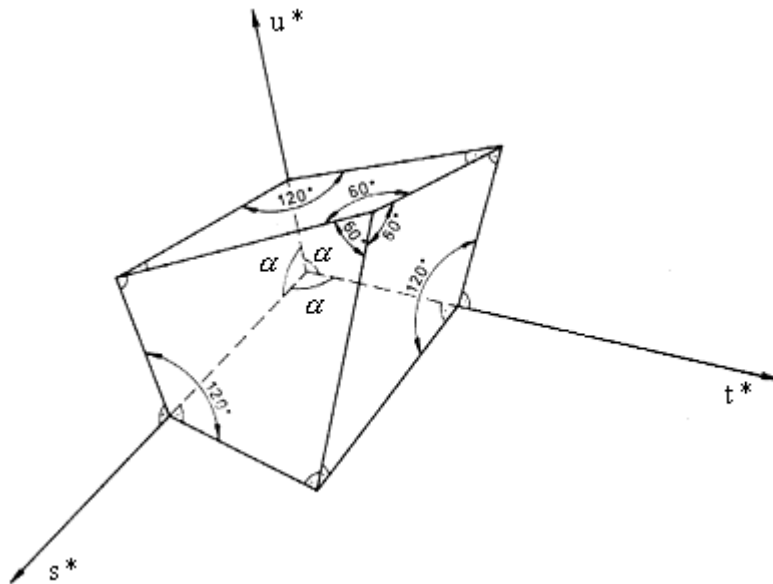$$\xi = \frac{\sqrt{3}}{2}\left(t^{\bullet} + v^{\bullet}\right) \quad \eta = \frac{\sqrt{3}}{2}\left(s^{\bullet} + v^{\bullet}\right) \quad \zeta = \frac{\sqrt{3}}{2}\left(s^{\bullet} + t^{\bullet}\right)$$

$(s^{\bullet}, t^{\bullet}, u^{\bullet})$:

$$s^{\bullet} = \frac{\sqrt{3}}{3}\left(x - y + \zeta\right)$$

$$t^{\bullet} = \frac{\sqrt{3}}{3}\left(-x + y + \zeta\right)$$

$$u^{\bullet} = \frac{\sqrt{3}}{3}\left(x + y - \zeta\right)$$

$(s^{\bullet}, u^{\bullet}, v^{\bullet})$:

$$s^{\bullet} = \frac{\sqrt{3}}{3}\left(x + \eta - z\right)$$

$$u^{\bullet} = \frac{\sqrt{3}}{3}\left(x - \eta + z\right)$$

$$v^{\bullet} = \frac{\sqrt{3}}{3}\left(-x + y + z\right)$$

$(s^{\bullet}, t^{\bullet}, v^{\bullet})$:

$$s^{\bullet} = \frac{\sqrt{3}}{3}\left(-\xi + \eta + \zeta\right)$$

$$t^{\bullet} = \frac{\sqrt{3}}{3}\left(\xi - \eta + \zeta\right)$$

$$v^{\bullet} = \frac{\sqrt{3}}{3}\left(\xi + \eta - \zeta\right)$$

$(t^{\bullet}, u^{\bullet}, v^{\bullet})$:

$$t^{\bullet} = \frac{\sqrt{3}}{3}\left(\xi + y - z\right)$$

$$u^{\bullet} = \frac{\sqrt{3}}{3}\left(-\xi + y + z\right)$$

$$v^{\bullet} = \frac{\sqrt{3}}{3}\left(\xi - y + z\right)$$

Quadrate of distance between two points $(s_1^{\bullet}, t_1^{\bullet}, u_1^{\bullet}, v_1^{\bullet})$ and $(s_2^{\bullet}, t_2^{\bullet}, u_2^{\bullet}, v_2^{\bullet})$ is determined by this equation:

$$d_{12}^2 = \frac{3}{2}\Big[\left(s_1^{\bullet} - s_2^{\bullet}\right)^2 + \left(t_1^{\bullet} - t_2^{\bullet}\right)^2 + \left(u_1^{\bullet} - u_2^{\bullet}\right)^2 + \left(v_1^{\bullet} - v_2^{\bullet}\right)^2 +$$

$$+ \left(s_1^{\bullet} - s_2^{\bullet}\right)\left(t_1^{\bullet} - t_2^{\bullet}\right) + \left(s_1^{\bullet} - s_2^{\bullet}\right)\left(u_1^{\bullet} - u_2^{\bullet}\right) +$$

$$+ \left(s_1^{\bullet} - s_2^{\bullet}\right)\left(v_1^{\bullet} - v_2^{\bullet}\right) + \left(t_1^{\bullet} - t_2^{\bullet}\right)\left(u_1^{\bullet} - u_2^{\bullet}\right) +$$

$$+ \left(t_1^{\bullet} - t_2^{\bullet}\right)\left(v_1^{\bullet} - v_2^{\bullet}\right) + \left(u_1^{\bullet} - u_2^{\bullet}\right)\left(v_1^{\bullet} - v_2^{\bullet}\right)\Big]$$

See the following transformation equation between (s,t,u,v) and $(s^{\bullet}, t^{\bullet}, u^{\bullet}, v^{\bullet})$:

(s,t,u):

$$s^{\bullet} = s + \left(t + u\right)\cos\alpha$$

resp. $s^{\bullet} = s - \frac{1}{3}\left(t + u\right)$

$$t^{\bullet} = t - \frac{1}{3}\left(s + u\right)$$

$$u^{\bullet} = u - \frac{1}{3}\left(s + t\right)$$

(s,t,v):

$$s^{\bullet} = s + \left(t + v\right)\cos\alpha$$

resp. $s^{\bullet} = s - \frac{1}{3}\left(t + v\right)$

$$t^{\bullet} = t - \frac{1}{3}\left(s + v\right)$$

$$v^{\bullet} = v - \frac{1}{3}\left(s + t\right)$$

(s,u,v):

(t,u,v):

$$s^{\bullet} = s - \frac{1}{3}(u+v) \qquad\qquad t^{\bullet} = t - \frac{1}{3}(u+v)$$

$$u^{\bullet} = u - \frac{1}{3}(s+v) \qquad\qquad u^{\bullet} = u - \frac{1}{3}(t+v)$$

$$v^{\bullet} = v - \frac{1}{3}(s+u) \qquad\qquad v^{\bullet} = v - \frac{1}{3}(t+u)$$

(s,t,u): (s,t,v):

$$s = \frac{3}{2}s^{\bullet} + \frac{3}{4}(t^{\bullet}+u^{\bullet}) \qquad\qquad s = \frac{3}{2}s^{\bullet} + \frac{3}{4}(t^{\bullet}+v^{\bullet})$$

$$t = \frac{3}{2}t^{\bullet} + \frac{3}{4}(s^{\bullet}+u^{\bullet}) \qquad\qquad t = \frac{3}{2}t^{\bullet} + \frac{3}{4}(s^{\bullet}+v^{\bullet})$$

$$u = \frac{3}{2}u^{\bullet} + \frac{3}{4}(t^{\bullet}+s^{\bullet}) \qquad\qquad v = \frac{3}{2}v^{\bullet} + \frac{3}{4}(s^{\bullet}+t^{\bullet})$$

(s,u,v): (t,u,v):

$$s = \frac{3}{2}s^{\bullet} + \frac{3}{4}(u^{\bullet}+v^{\bullet}) \qquad\qquad t = \frac{3}{2}t^{\bullet} + \frac{3}{4}(u^{\bullet}+v^{\bullet})$$

$$u = \frac{3}{2}u^{\bullet} + \frac{3}{4}(s^{\bullet}+v^{\bullet}) \qquad\qquad u = \frac{3}{2}u^{\bullet} + \frac{3}{4}(t^{\bullet}+v^{\bullet})$$

$$v = \frac{3}{2}v^{\bullet} + \frac{3}{4}(s^{\bullet}+u^{\bullet}) \qquad\qquad v = \frac{3}{2}v^{\bullet} + \frac{3}{4}(t^{\bullet}+u^{\bullet})$$

Rotation around axis x,y,z - the angle of rotation is 180° - are invariant. They perform the disfenoid into equivalent positions. The rotations around the axis s,t,u,v - the angle of rotation is 120° - are the invariant ones. $E, s, s^{-1}, t, t^{-1}, x, u, u^{-1}, y, v, v^{-1}, z$ form the group of rotation, see Tab. 1.

Table 1.

columns - Acts as the first, rows - Acts as the second

|	E	s	s^{-1}	t	t^{-1}	u	u^{-1}	v	v^{-1}	x	y	z
E	E	s	s^{-1}	t	t^{-1}	u	u^{-1}	v	v^{-1}	x	y	z
s^{-1}	s^{-1}	E	s	z	u	y	v	x	t	u^{-1}	t^{-1}	v^{-1}
s	s	s^{-1}	E	v^{-1}	y	t^{-1}	x	u^{-1}	z	v	u	t
t^{-1}	t^{-1}	z	v	E	t	x	s	y	u	v^{-1}	s^{-1}	u^{-1}
t	t	u^{-1}	y	t^{-1}	E	v^{-1}	z	s^{-1}	x	u	v	s
u^{-1}	u^{-1}	y	t	x	v	E	u	z	s	s^{-1}	v^{-1}	t^{-1}
u	u	v^{-1}	x	s^{-1}	z	u^{-1}	E	t^{-1}	y	t	s	v
v^{-1}	v^{-1}	x	u	y	s	z	t	E	v	t^{-1}	u^{-1}	s^{-1}
v	v	t^{-1}	z	u^{-1}	x	s^{-1}	y	v^{-1}	E	s	t	u
x	x	u	v^{-1}	v	u^{-1}	s	t^{-1}	t	s^{-1}	E	z	y
y	y	t	u^{-1}	s	v^{-1}	v	s^{-1}	u	t^{-1}	z	E	x
z	z	v	t^{-1}	u	s^{-1}	t	v^{-1}	s	u^{-1}	y	x	E

NUCLEAR SHELLS

A nucleus, whose constituent nucleons are arranged to occupy the least possible sphere, is said to have a close-packed structure. Close-packed structures occur when the bonding forces are spherically symmetric. If the force between two nucleons is *f*, then total force impacting each nucleon in disfenoid and aiming into center of mass of disfenoid is 2.449 *f*. The total force on each nucleon impacting two interleaved disfenoids (i.e. into cube) is 3.2896 *f*, i.e. bigger than by disfenoid. Therefore by two interleaved disfenoids each nucleon is attracted into center of mass of cube by greater force as into center of mass of disfenoid.
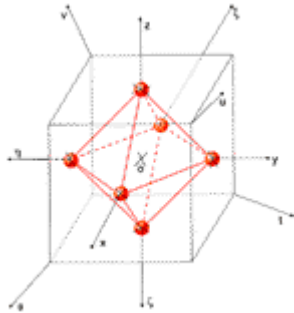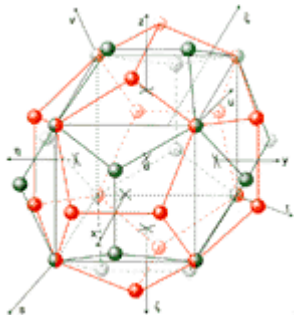

Fig. 6. Sphere 6
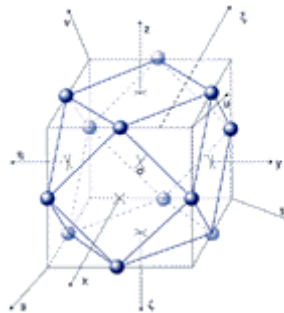
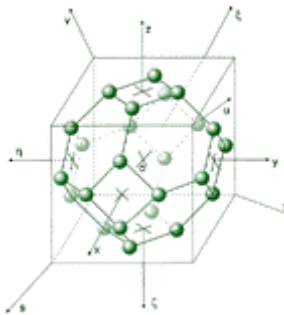
Fig. 7. Sphere 12
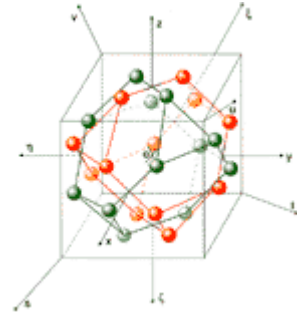
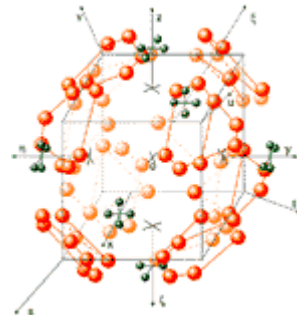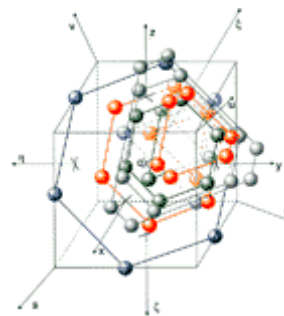Fig. 8. Sphere 24

Fig. 9. Sphere 32

Fig. 10. Sphere 24 which with sphere 24 from fig. 8 give sphere 48

Fig. 11. Sphere 96

Fig. 12. Nucleons by axis *u* from all spheres 6, 8, 12, 24, 32, 48, 96
(Nucleons are at perpendicular levels to axis "*u*")

Similarly it is at shell 12 (see fig. 7) also at shell 24 see fig. 8 (two interleaved disfenoids + and - in which nucleons are 1/3 and 2/3 of the length of the diagonals of any face of cube). The advantage of the new coordinate systems (s,t,u,v) and (s^*,t^*,u^*,v^*) is that the nucleons in nuclei can be on axes s,t,u,v respectively at perpendicular level to these axes, while axes s,t,u,v pass through center of mass 3 or 6 neighbouring nucleons see fig. 12.

By the combination of the cartesian coordinate system with our new coordinates arise a very firm fastening structure for description of nuclear spheres (shells, subshells). All nucleons from shells can be on sphere and simultaneously on axes $x, y, z, \xi, \eta, \zeta$ see fig. 6 - red dipyramid 6 nucleons, respectively on axes s,t,u,v - cube 8 nucleons see fig. 5, (coordinate see Table 2), respectively in the middle of each edge of cube-blue sphere 12 nucleons, respectively in 1/3 and 2/3 of the length of the diagonals of any face of cube (see fig. 8) sphere 24 nucleons while axes s,t,u,v pass through centres of mass 3 or 6 nucleons, respectively fig. 9 shows sphere 32 nucleons (two interleaved pentagonal dodecaeders + and -), in fig. 10 shows sphere 24 which, with sphere 24 from fig. 8, gives sphere 48 nucleons, and in fig. 11 is sphere 96 nucleons (two interleaved pentagonal and hexagonal 32-eders) whereby axes s,t,u,v pass through centres of mass 3 and 6 neighbouring nucleons situated in the mutually parallel and perpendicular level to these axes. Respectively, axes $x, y, z, \xi, \eta, \zeta$ pass through center of mass 4 neighbouring nucleons at perpendicular level to these axes - see fig. 11. Two interleaved spheres 8 and 12 give us sphere 20 - the magical number.

Four interleaved spheres 6,12,24 and 8 give us sphere 50 - magical number. Four interleaved spheres 8,24,24 and 96 give us sphere 152 - magical number. Three interleaved spheres 6,24 and 96 give us sphere 126 - magical number. Five interleaved spheres 6,8,12,24 and 32 give us sphere 82 - magical number. If it is assumed that the nucleons in an elementar spherical nucleus are spheres in contact, it is easy to calculate their radii of force reach from a knowledge of the spherical nucleus structure and the sphere parameters. The latter information can be obtained by "gamma" ray diffraction analysis.

Table 2.

Sphere 6:

$x, y, z, \xi, \eta, \zeta$	(s,t,u,v)	(s^*,t^*,u^*,v^*)
$(a,0,0,0,0,0)$	$\left(\dfrac{\sqrt{3}}{2}a,0,\dfrac{\sqrt{3}}{2}a,0\right)$	$\left(\dfrac{a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}},\dfrac{a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}}\right)$
$(0,a,0,0,0,0)$	$\left(0,\dfrac{\sqrt{3}}{2}a,\dfrac{\sqrt{3}}{2}a,0\right)$	$\left(\dfrac{-a}{\sqrt{3}},\dfrac{a}{\sqrt{3}},\dfrac{a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}}\right)$
$(0,0,a,0,0,0)$	$\left(0,0,\dfrac{\sqrt{3}}{2}a,\dfrac{\sqrt{3}}{2}a\right)$	$\left(\dfrac{-a}{\sqrt{3}},\dfrac{a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}},\dfrac{a}{\sqrt{3}}\right)$

etc.

Sphere 8:

$(a,0,0,0,a,a)$	$\left(a\sqrt{3},0,0,0\right)$	$\left(a\sqrt{3},\dfrac{-a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}}\right)$
$(0,a,0,a,0,a)$	$\left(0,a\sqrt{3},0,0\right)$	$\left(\dfrac{-a}{\sqrt{3}},a\sqrt{3},\dfrac{-a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}}\right)$

$(a,a,a,0,0,0)$ $\quad\left(0,0,a\sqrt{3},0\right)$ $\quad\left(\dfrac{-a}{\sqrt{3}},\dfrac{-a}{\sqrt{3}},a\sqrt{3},\dfrac{-a}{\sqrt{3}}\right)$

etc.

Sphere 12:

$(a,a,0,0,0,0)$ $\quad\left(\dfrac{\sqrt{3}}{2}a,\dfrac{\sqrt{3}}{2}a,\sqrt{3}a,0\right)$ $\quad\left(0,0,\dfrac{2a}{\sqrt{3}},0\right)$

$(a,0,a,0,0,0)$ $\quad\left(\dfrac{\sqrt{3}}{2}a,0,\sqrt{3}a,\dfrac{\sqrt{3}}{2}a\right)$ $\quad\left(0,0,\dfrac{2a}{\sqrt{3}},0\right)$

$(0,a,a,0,0,0)$ $\quad\left(0,\dfrac{\sqrt{3}}{2}a,\sqrt{3}a,\dfrac{\sqrt{3}}{2}a\right)$ $\quad\left(0,0,\dfrac{2a}{\sqrt{3}},0\right)$

etc.

Sphere 24:

$\left(\dfrac{a}{6},0,a,0,\dfrac{a}{6},0\right)$ $\quad\left(\dfrac{\sqrt{3}a}{6},0,\dfrac{7\sqrt{3}a}{12},\dfrac{7\sqrt{3}a}{12}\right)$ $\quad\left(\dfrac{-2a}{3\sqrt{3}},0,\dfrac{a}{\sqrt{3}},\dfrac{a}{\sqrt{3}}\right)$

$\left(0,\dfrac{a}{6},a,\dfrac{a}{6},0,0\right)$ $\quad\left(0,\dfrac{\sqrt{3}a}{6},\dfrac{7\sqrt{3}a}{12},\dfrac{7\sqrt{3}a}{12}\right)$ $\quad\left(0,\dfrac{-2a}{3\sqrt{3}},\dfrac{a}{\sqrt{3}},\dfrac{a}{\sqrt{3}}\right)$

$\left(\dfrac{a}{6},\dfrac{a}{6},0,0,0,a\right)$ $\quad\left(\dfrac{7\sqrt{3}a}{12},\dfrac{7\sqrt{3}a}{12},\dfrac{a}{2\sqrt{3}},0\right)$ $\quad\left(\dfrac{a}{\sqrt{3}},\dfrac{a}{\sqrt{3}},\dfrac{-2a}{3\sqrt{3}},0\right)$

etc.

REFERENCES

[1] MAYER, M. G.: Phys. Rev. *74*, 235, (1948)

[2] FEJES Tóth, L.: Am. Math. Month. *56*, 330 (1949)

[3] HABICHT W., van der WAERDEN, B. L.: Math. Ann. *123*, 223 (1951)

[4] WHYTE, L. L.: Am. Math. Month. *59*, 606 (1952)

[5] LEECH, J.: Math. Gaz. *41*, 81 (1957)

[6] BEREZIN, A. A.: Nature (London) *317*, 208 (1985)

[7] BEREZIN, A. A.: J. Math. Phys. *27(6)*, 1533 (1986)