TRANSFORMATION AND INVARIANCE

by: RUDOLF NEDVĚD,
Botanická 49,
CS-60200 Brno,
Czechoslovakia.

Introduction.

Piles of paper and forests of trees have already certainly fallen victims to discussions on the correctness of mathematical-physical transformations to which physical relations ought to be invariant. The stimulus given by Galileo to 16th and 17th century physics through his transformation should have opened the way to the right concept for the reference frame. The very meaning of his transformation, however, found its important application only 300 years later, when towards the end of the 19th century investigators concentrated on the laws of light propagation, and then, more generally on the propagation of electromagnetic actions.

The undulation theory, so successful in acoustics, obscured and misled the entire further development of the physics of propagation of these phenomena. For it, it was presumably necessary to suppose a medium similar to what the air provides in acoustics. It was named the luminiferous or light-carrying aether and it fatefully influenced thinking in physics even after it was convincingly refuted. § This influence is still felt.

The crucial point came with the Michelson & Morley experiment of 1881, to be referred to below as M 1881, which broke the logic of scientific thinking for the following century. It is almost incomprehensible how the unison of disastrous blunders could bring science into a clutter of paradoxes and irrational thinking.

The M 1881 experiment explored the reference frame aether, but its analysis, though correctly aimed, was not confirmed by its negative or null result. The consequences of the aether hypothesis were not rejected, however. On the contrary, it appeared that the transformation was misunderstood in erroneous concept of drawing three positions for the apparatus and different light paths resulting from them; a qualitative reversal followed in the way of transition to the paradoxes of the Lorentz transformation.

---

§. Editorial Comment: In what way has the existence of an aether been so convincingly refuted?

Author's Response: By M 1881 and M 1913 and by all other experiments; by the author's IP [3, 4, 7]; by accepting the double nature of light as a particle-wave; by the variable light velocity from stars; and now also by the right explanation of Silvertooth's experiment; etc.

The Toth-Maatian Review, 3101 20th Street, Lubbock, TX 79410, U.S.A.
Vol. 7, #4, January 1989, pp. 3883-94.

This confusion was added to by an effort to bring the Galilean transformation into accord with the postulate of invariance of Maxwell's equations of electromagnetism. The decision should have been resolute: either to reject the Galilean transformation, or to deny the correctness of Maxwell's equations. Due to such fumbling, without knowing a way out, the scientific world chose the first alternative.

All this is known; but we endeavour to present it here in another light. The decision of that time might be considered correct from the point of view of further comments to be made here, if it had been perceived, of course, where the cloven hoof lay hidden and if science had gone the right way, instead, free of the paradoxes and nonsenses of the Lorentz transformation.

The desperate effort in searching for truth, finally just trying to achieve any suitable solution at all, misled science into a blind alley where the contradictions and paradoxes accumulated. However, the paradoxes evoked protests and gave rise to polemics. Talk about transformations continued in terms of coordinates only. Nobody perceived its very sense. Discussions degenerated into a parrotting of empty concepts and into stereotyped copying of matrices of static transformations, while introducing the condition of orthogonality (of what, we may ask) and the 4th-dimension of space-time, etc.

It is necessary to state here unequivocally that it was the mathematics that fell short of expectation, as will be shown further below. But also physics has made a mistake in over-relyiance on mathematics. The author feels here the necessity to restate what he has already said once before in his introduction to [1]:

Mathematics always gives an answer to the consequences of an hypothesis; mathematics, of itself, however, can never resolve whether that hypothesis is correct. ¶

Mere polemics are not sufficient; the right solution must be provided as well. Mathematics alone cannot bring us to this goal. Δ

1. Galileo's Transformation - GT.

1.1 Although this transformation has been discussed frequently in the literature and is therefore well known, we review here its basic relations in order to stress those of them which we shall analyse further along.

With respect to our reference coordinate system (X, Y), a system (X', Y') may move at inertial velocity v in the direction of the axes +X ≡ +X', figure 1. Both systems are orthogonal and the axes Y ≡ Y' merge at time t = 0. The transforming relations are given by the equations:

$$x' = x - vt, \quad \text{and thus} \quad x = x' + vt \qquad (1.1\ a,\ b)$$

$$y' = y, \qquad (z' = z = 0). \qquad (1.2)$$

¶. Ed. Com.: This is not strictly true. Mathematics can frequently demonstrate error in a set of hypotheses by either proving them to be self-inconsistent or by showing by valid logical arguments that their consequences lead to absurdity. The Lorentz transformation is a case in point and has been proven to be not only self-contradictory, to lead to absurd consequence but also to be counter to experimental observation. See: pp. 2378-89, this J. The Lorentz transformation is not even entertained in this publication, except for any effort being made for its direct laboratory counterdemonstration experimentally, and the means to do so. Kindly adhere to this publication's policy and not return to Lorentz's scientific vomitings.

Δ. Ed. Com.: This goal has already been fairly well attained in respect to the invariance of Maxwell's equations. The neo-Hertzian form of them is accepted in this publication. However, now the entire Maxwellian scheme of equations has been cast into doubt by experimental counterdemonstration of Coulomb's law out of which they were developed.

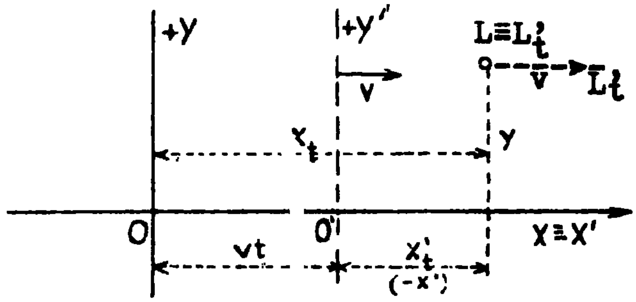

Figure 1.

The equations (1.1 a, b) make only one defining relationship, since they are merely an algebraic transfer of the same relation.

1.2 In [1, 7] the author mentioned that this transformation transforms only positional, i.e., motionless, localities of system (X, Y) into system (X', Y'). As they are, these equations determine only the relation of static point-events registered in system (X, Y), that are independent of time, as if nothing came to pass in system (X', Y'); or vice versa. The term vt determines namely only the mutual change of origins O, O' in instantaneous distance at time t, but not a second motion, i.e., the alteration of the defining coordinates x, y. In fact, the following concept of time sequence ought to be expressed: an event, occurring in any locality L(x, y) of system (X, Y) at time t, is registered in system (X', Y'), at the same time t in position $L_t' \equiv L_t$ of the coordinates $x_t' = x_t - vt$, $y' = y$, and is carried by system (X', Y') at velocity v parallel to the axis $X' \equiv X$ (fig. 1) so that its coordinates remain x_t = const., x_t' = const.

This transformation does not, and cannot, say more. It has always been confusing that the transformation makes use of symbols x, y to describe a position, but not variability, which is by no means defined. Namely, no functional relation of the values x, y is given; this leaves an absolute arbitrariness for choosing associated coordinates of positional localities in the whole range of the plane X, Y from $-\infty$ to $+\infty$ in any direction of x, y. This has, of course, nothing to do with mathematics. The coordinates should be denoted properly (x =) a, (y =) b to express generality; for x, x' and y, y' were only an arbitrary, instantaneous positional coincidence in time t in both systems, which does not, however, vary further in time in either of them.

In other words, Galilean transformations transform only localities of system but do not involve a motion process in them. Thereby, this transformation loses any physical sense, as has been explained in [5, 7] - of which, case A is significant here: notional relations of one of three systems from the point of view of comparative systems of two other observers. The third system, which would include any definition of its motion, is simply missing here.

1.3 Since the choice of any of the couples x and y is thus quite arbitrary, as these are not mutually bound by any functional definition, they are thus mutually independent and do not satisfy any of the functional conditions necessary for treatment in terms of the infinitesimal calculus.

The concept dx, dx', etc. can have here - hence, no mathematical sense of differential, for it is not joined by any functional dependence y = f(x), even a static one. § For such a description of localities, the position of which in the same system does not vary with time, in either of the systems it holds that

$$\frac{dx}{dt} = \frac{da}{dt} = 0, \quad \frac{dx'}{dt} = \frac{da'}{dt} = 0, \quad \frac{dy}{dt} = \frac{dy'}{dt} = \frac{db}{dt} = 0,$$

since also in system (X', Y') the registered position is at rest and only carried with the system. All further mathematical operations lose meaning. That is why also the criterion of correctness of physical relations, considered as invariance of the Galilean transformation, lacks all meaning.

Also, the equality $y = y'$ is no determining definition, (like $z = z'$) and the whole process should have been conceived of as straight-lined at $x = ct$ or $x' = ct$, $y - y' =$ const. The writing of any matrices was superfluous. Then, all the subsequent errors could have been avoided. From this transformation, but only in an inductive way, the addition theorem of velocities $c' = c \pm v$ was deduced, but under the influence of the basic definition in the direction of the axis X only, whereby the theorem lost its generality and the concept of aberration has escaped to it.

1.4 The human intellect turns with difficulty away from fixed notions, however. To make these explanations still clearer, let us imagine a regular, that is to say, square, net of point localities in system (X, Y). If in all of them some instantaneous events take place at the same time, t, their registration in system (X', Y') will be given also as precisely equal, i.e., as a regular net. If, however - being mutually bound not even by any law of time sequence - they take place at different times, their registration in system (X', Y') will be recorded entirely irregularly in a chaotic tangle of localities. In spite of that the relations of the Galilean transformation hold good in all of them, of course without any mathematical meaning.

These deductions will be evident still far more distinctly in the analysis of the aberration transformations given further along and for that purpose more in detail than in [1-7].

2. Lorentz's Transformation - LT.

The reasons that gave rise to this transformation were explained in the introduction. We presume that its paradoxes arose because of the erroneous conclusions of the M 1881 experiment, where mathematics, speaking continually about transformations, did not perceive their physical meaning and plotting 3 positions of the interferometer with respect to the presumably motionless aether did not even perceive the necessary change over from the aether to ballistics. But mathematics did, tragically, not even perceive the missing link in the GT.

But a mere comparison of GT and LT shows that it was Lorentz who first perceived that there is some motion process missing in GT, i.e., some second velocity that was not included there. His LT can be in no logical way graphically plotted, but a mere bit of thinking is sufficient to see that the whole derivation was close to an understanding of the whole.

---

§. Ed. Com.: The author is here in error. Even if a point $x = a$, $y = b$ remains static in the (X, Y) system, it does acquire velocity and is displaced in the (X', Y') system. The relative motion of the reference frames induces such velocity through the valid relations $x' = x - vt$, $y' = y$ so that $\frac{dx'}{dt} = \frac{dx}{dt} - v = -v$, $\frac{dy'}{dt} = \frac{dy}{dt} = 0$. There is no gainsaying this elementary fact.

Aut. Res.: The velocity v concerns the relative motion of the systems as a whole, so of all their localities, which are static, at rest for both observers, however; but have nothing to do with transformation - of what, one must ask. Such a differentiation lacks any sense here and this comment would mislead the reader to the same thinking which has misled physics a century. The answer is given by all that is said in the paper.

The time was not sufficiently mature, however. Moreover, the transformation is brought down by the abstract concept of a different time flowing in rest and in moving systems. As a consequence of relativity, that is to say interchangeability, of motion, these states cannot be distinguished, i.e., defined at all. Time ceases to be a physical reality, being a mere artificial mathematical concept for comparing the velocities and sequence of processes.

It thus remains to conclude by fateful thinking that LT adopted the second, non-relative velocity, c isotropic, whereby the general motion of the 3rd system has not been introduced. Instead, the abstract concept of time was rendered relative; and as it is structurally adequate with GT, all that has been deduced in the preceding analysis holds for LT with all consequences. Hence, this transformation will remain only a fateful memorial of the 20th century science.

3. Aberration Transformation - AT.

The derivation of this transformation has been given already in [1] and repeated in different variations in [3, 4, 7]. Its meaning as a substitute for GT has not been perceived, however, although just lately a considerable effort is being made to

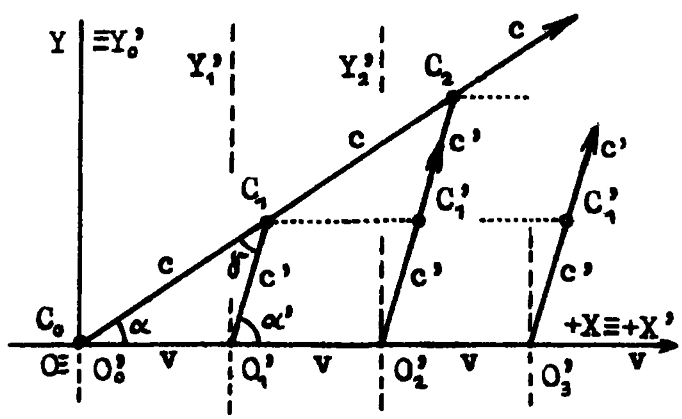

Figure 2.

modify Maxwell's equations to achieve their invariance under GT. That is why the author subjects it to a deeper analysis with regard to the analysis of GT given above.

To simplify the description, it is sufficient to limit it only to plane relations like GT, where the 3rd coordinate, Z, was introduced only to enable the transition to space curvature.

3.1 We repeat here the derivation of this transformation in abbreviated form, so that the reader is not forced to look up the previous sources for linking considerations.

The system C (a particle - not just only light) moves, figure 2, in system (X, Y) at inertial velocity c in a given direction α from axis +X. We find its image transformation C' in system (X', Y') moving with respect to system (X, Y) also at inertial velocity v in the direction +X' = +X so that the origins O', O fuse at time $t = 0$. The straight lines C and C' are the registered paths of this motion in both comparative systems; this image of motion C in both systems is at rest, only the system O' brings along the image C'.

The path of motion C' in system (X', Y') has another slope α' from the axis X', and the angle $\gamma = \alpha' - \alpha$ of directions C and C' is the general aberration angle by which differs the direction of each motion in two different, i.e. mutually moving, systems and which turns always against vector v just as it is with light, but not only with light. This general concept of aberration was missing in both previous transformations; it was not perceived, mostly due to the vector calculus which took no account of angle relations, although just these represent in physics of motion a quite decisive factor that must be considered.

The difference in the motion direction in both systems by the aberration angle is namely inseparably joined even with the change of motion velocity and thus even of its path in the same time, as it was explained in detail in [1-7]; moreover, the concept of aberration already by itself excludes c = isotropic. This is what is so surprising in the outcome of M 1881 and has given rise to the paradoxes of LT and ERT and has brought physics into fatal confusion.

3.2 In [1-7] the author has given only the basic transformation relations determining the relative vectors and resulting, without any coordinate system, directly from the vector triangle cvc'

$$c' = \pm\sqrt{(c^2 + v^2 - 2cv \cos \alpha)}, \quad (3.1\ a)$$

or in the opposite direction

$$c = \pm\sqrt{(c'^2 + v^2 - 2c'v \cos (\pi - \alpha'))}, \quad (3.1\ b)$$

or

$$v = \pm\sqrt{(c'^2 + c^2 - 2c'c \cos \gamma)}; \quad (3.1\ c)$$

and

$$\sin \gamma = \frac{v}{c'} \sin \alpha = \frac{v}{c} \sin \alpha' \quad (3.2\ a,\ b)$$

where $\alpha' = \alpha + \gamma$, the angles α, α' being measured from vector v, and the motion path

$$s = ct, \qquad s' = c't \quad (3.3\ a,\ b)$$

Only from these relations the addition theorem of velocities directly results; to repeat the deeper analysis of the theorem for our further deductions is needless here.

These relations determine, however - in contrast to GT - the mutual relations of the really dependent magnitudes whose repetition in t-units of time defines then the motion of system C in both systems:

$$x = ct \cos \alpha, \qquad y = ct \sin \alpha \quad (3.4\ a,\ b)$$

$$x' = c't \cos \alpha', \quad y' = c't \sin \alpha' \quad (3.5\ a,\ b)$$

Each instantaneous state of motion is certainly also a locality in both systems and thus also the relations GT (1.1 a, b) and (1.2) must hold for it. But again, those relations render nothing more than a transformation of localities, not of motion.

From fig. 2 it is possible to deduce many other dependencies that produce conditions of mathematical analysis [1, 4], from which, for our present purpose, we introduce newly only

$$x' = x \frac{c'}{c} \frac{\cos \alpha'}{\cos \alpha}, \qquad y' = y \frac{c'}{c} \frac{\sin \alpha'}{\sin \alpha}, \quad (3.6\ a,\ b)$$

and since the motion O'(v) is running in the direction of the axis $X' \equiv X$, it is $y' = y$, and from this equality or directly from figure 2, results

$$c' \sin \alpha' / c \sin \alpha = 1,$$

and further

$$y = x \tan \alpha = y' = x' \tan \alpha' \qquad (3.7\ a,\ b)$$

3.3 Here we have got to the root of the matter: while the relations (3.4) and (3.5) determine the instantaneous position at each time t, i.e., the time course of motion in both comparative systems, the relations (3.7) determine only a straight-line or registered path, of the same motion, but not a motion along the straight line.

In both systems this straight-line is at rest, only in system (X', Y') it is carried along with the system. It is something quite else to express the motion of a straight-line as a geometrical formation than to express the time-motion along that straight line. The equation (3.7) is thus the equation of the registered path regardless of where or whether the system C still finds itself on this path at all. The motion relations are thus expressed only by equations (3.4, .5), whereas the equation (3.7) defines only a static function of a rigid formation. Also such a function was missing in GT and LT.

It is certainly evident that for a given case of rectilinear motion, v, c, α and thus also c', α' are constant. For α in the range 0 to 2π, the relations embrace the whole field. For $\alpha = 0$ or π the aberrational angle is $\gamma = 0$. For the light coming to us from extra-terrestrial sources, it is necessary to analyse for the direction $|\alpha| = \alpha + \pi$ in the phase of approaching; the $c' > c$ then, of course.

The further errors of GT and LT that made their use as criteria for the correctness of motion relations worthless, are perhaps evident now.

4. Invariance.

4.1 In order to consider the correctness of the motion relations, the classical physics went out from the basic postulate of motion interchangeability, i.e., from the relative concept of the rest and motion of systems whose mutual motion is always only relative. In [1-7] the author added to this postulate deductions from which the following axioms result:

1) for each observer his comparative system or reference frame, to which he refers all motions, is at rest;
2) each motion vector, defined relative to some comparative system, bears in itself in physical relations the instantaneous motion of that system towards all other systems of the universe - hence even the motion of a source;
3) the phenomenon of the same motion is thus different in all mutually moving systems, and finding the course of that motion in another system is just the purpose of a transformation;
4) the motion is then passing in each system as its internal rest process;
5) two moving point systems meet always in the direction and magnitude of the relative vector lying in their common axis.

In the preceding section 3 we have derived three forms of mathematical dependence for one and the same motion:
a) equations (3.1, .3) determine the transformation of the fundamental magnitudes of motion without relation to any coordinate system (for further relations, vide [1-7]);
b) equations (3.4, .5) of the time-course of motion in the coordinate systems (X, Y) and (X', Y');
c) equation (3.7) of the registered paths in the same systems.

4.2 The interchangeability of action, i.e., of the rest and motion systems (X, Y) and (X', Y') is here given by a mere reversion of the sense of the axes X, X' and attributing the motion at velocity v to system (X, Y), so that the relation of receding or approaching remains conserved for both observers, so that there is no negative velocity. For the motion C' in system (X', Y') we derive much in the same way its image C in system (X, Y). Hence, whichever system we consider as being at rest, all derived relations hold without any change and in either direction.

According to (3, 7) only the paths of motion as straight-lines were transformed, but not the course of the motion. Only the equations (3.4, .5) are thus the real time equations of motion in the observers' own systems and relations to another extraneous system, i.e., in mutual motion, are given by relations or definitions (3.1, .3) of the variability of the relative vector of the motion phenomenon. All the hitherto executed transformations were static transformations assumed from the known relations of transforming matrices in which always the condition of orthogonality was applied, i.e., of the orthogonality of the comparative systems X" ≡ X, Y' || Y, which in matrix notation corresponds to having ones on the principal diagonal. However, these transformations never included at all the motion of the third system. What, then, did they actually transform? Nothing but relations of a new coordinate system in the same comparative, though static, system of the same observer.

It is thus evident that the consequent concept of the motion interchange makes up for any transformation and only the correctness of relations in the rest system of the observer is decisive, and only when the relativity of velocity and direction of extraneous relations are respected, i.e., of relations coming from another system and vice versa. Relations valid for the system of observer hold thus absolutely, relations to other systems, and vice versa, can then be derived only by including the relativity of motion. In other words:

> Only the motion direction and its velocity, and thus also its path, are transformed and otherwise nothing else changes in the motion relations. Any evidence of invariance is thus needless; the image of motion course in both systems being different, according to 4.1, axiom 3, it is running in both according to the same laws, axiom 4.

4.3 The general invariance is thus given by the mere interchange or transformation of the motion velocity in relations of the process, however, and whatever further transformation of a comparative, but always only subsidiary, system has no sense. The proof of the correctness of each theory is thus given already by the fact, whether that theory satisfies this condition: i.e., whether in the theory's relations is included the generally relative velocity according to relation (3.1 - .5); these relations thus determine already the full transformation in place of GT, being just its invariants.

On the contrary, however, the velocity must be transformable as to direction and greatness; otherwise the physical relations cannot hold good. Thus no velocity can be c = isotropic.

It is thus evident that also invariance and motion interchangeability are identical concepts and relations in which the motion velocity is comprehended as relative are then valid in any systems. This is thus a necessary and sufficient condition. Even when under the concepts of transformation, interchangeability and invariance we comprehend different correlations which are not identical as to their meaning, they are nevertheless physically equivalent. It is hence possible to write:

Transformation = Motion Interchangeability = Invariance,

since all these three concepts define a correlation of the identical process for which each system, to which the process is related either directly or by transformation, is at rest.

In general motion relations the invariance is thus satisfied - unlike static formations - by the validity of the same law of variability, the cosine theorem, for all determining magnitudes: three velocities and three directions or angles.

4.4 This applies to each relation, thus also to Maxwell's equations. The invariance, even to AT, is thus not necessary to be proved and the search of transformation for invariance of the Maxwell's equations was superfluous. After all the invariance by itself is no guarantee of rightness of a theory; for just as much as the LT does not prove the rightness of ETR, so, on the contrary, the invariance of the Newton's equations does not prove the rightness of GT.

On the contrary, even the inertial transformation of non-inertial motions transforms a rectilinear motion into a curvilinear one, which, of course, cannot be manifested in GT.

To the confusion contributed even the mingling of the concept of transformation with the principle of relativity and inertiality; the latter should have been presumably included in the transformation by the postulate of invariance. Also, this was the consequence of GT as well as of the fact that nobody made a drawing of motion of a third system.

In [11, first paragraph of the fifth part] it is stated:

If we should suppose that the light velocity compounds with source velocity, then Maxwell's equations will be invariant towards Galileo's transformation and the optical phenomena will satisfy the mechanical principle of relativity.

This is certainly equivalent to our concept that light bears in itself the motion of the source. The derived AT implies the motion of source by mere including the generally relative velocity according to paragraph 3.2 and there is thus nothing more to be proved - respecting all the mentioned above, of course.

5. Michelson & Morley Experiment M 1881.

5.1 It is possible now to give an even more comprehensible explanation of the M 1881 experiment than was given in the author's previous works. Figure 3 is to be considered.

In a cabin M which corresponds to the M & M interferometer, a stationary vibration between points A, B may take place at velocity c' (e.g., c' = c_0 = basic velocity of light). If the cabin moves with respect to the Earth or with the Earth towards the aether at velocity $v \perp c'$, the vibratory motion carried along with the cabin appears in those comparative systems as a progressive vibration at relative velocity

$$c = \sqrt{(c'^2 + v^2)} = c'\sqrt{(1 + v^2/c^2)} > c' \qquad (5.1\ a,\ b)$$

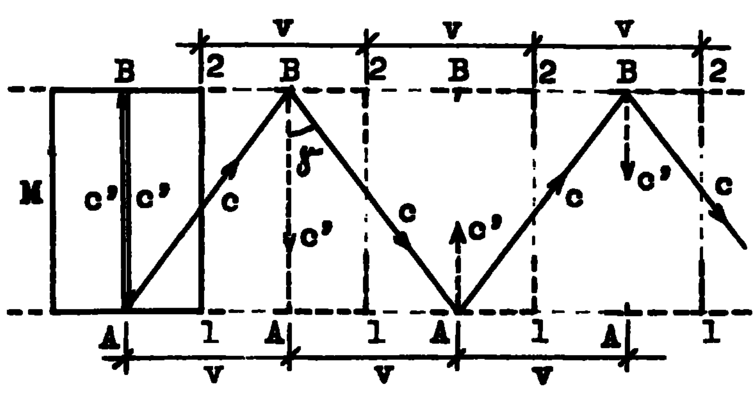

Figure 3.

dependent on velocity v, whereas the velocity of the stationary vibration in the cabin remains, in keeping with ¶ 3.2 and ¶ 4.1, for $\alpha = \pi/2$:

$$c' = \sqrt{(c^2 - v^2)} = c\sqrt{(1 - v^2/c^2)} = \text{const.}, \qquad (5.2\ a,\ b)$$

which follows from the same Δcc'v as it was analysed by Michelson and also directly from the same, only reversed relation (5.1) where c' is also constant and is independent of the motion v.

The term v^2/c^2 being just a mere consequence of two perpendicular motions only, does not create any limiting factor for c'; the reason is obvious from (5.1.a) where it is always $c > v$, too, and thus it is always $v/c < 1$, may v increase arbitrarily. Only c or c' can never be isotropic and determines no limiting factor for v.

The confusion resulted thus from the misapplied proceeding:
1) after factoring out c, the first term under the radical, the unity, has lost its generality or variability, which caused the erroneous deductions consisting in·
2) treating v and c in ratio v/c as mutually independent
3) and limiting then urgently v by c;
the limitation of c by c = isotropic was then redundant.

In the same manner, each stationary process, or any other, in the cabin, in any direction, appears in another, real or fictitious system as unfolded into the direction of motion v.

The angle γ in figure 3 is again the aberration angle having here the reversed sense than that of figure 2; we have here intentionally reversed the direction of transformation in that we have chosen as moving the cabin, i.e., the system from which we transform, and at rest the system into which we transform, in order to make conspicuous the concept of the aberration angle even from the point of view of the transformation direction, i.e., whether the observer or the source is moving; for example: vertical rain, a moving train, or train at rest, or oblique rain at the same direction v.

5.2 The null-effect of M 1881 proved thus conclusively that the light process was not mediated, i.e., was not at rest with respect to some aether; it was a ballistic process instead carried by the Earth as the Earth's internal rest, one for which the transformation into system aether loses any sense, merely drawing three positions of the apparatus. Here, namely, the matter was not even the transformation in the concept of a process of identical quality; the matter was just the change of the quality of process, instead of a mediated one, now of a ballistic process. The question was here thus not only a transformative but also a qualitative transition back to the real, stationary process in the rest system apparatus consisting of the interferometer and Earth; for this process the relative motion at velocity v does not exist, $v \neq 0$. This means, hence, that any transformation is here invalid.

After all, the M 1881 was a solitary interferential experiment pretending aether was the mediating substance and wrong conclusions were drawn from it. No other experiment took such an improper and inconsistent transformation into account; on the contrary, each explored its process irrespective of any medium only as an internal rest one in our system apparatus, i.e., the Earth (mutual $v = 0$) according to axiom 4.1-.4 above. It is thus incomprehensible that this contradiction remained unperceived and the wrong conclusions from M 1881 kept as valid further on, although the whole lapse resulted from a merely improper adjustment and faulty reading the simplest algebraic equation.

The wrong analysis went thus out of just a reverse interchange of motion than it should have been done. The ETR does eliminate the erroneous concept by introducing such conditions that paralyse to a certain extent the worng consequences in applications. These conditions lead, however, to absurd conclusions that are a dangerous hinderance to development.

We wish to add a concluding remark. In [9] the author has designed an experiment for the verification of the relative velocity of light wrongly deduced as isotropic from M 1881 and M 1913 experiments. Since we are not able to synchronize the exactness of measuring in fractions of a wave-length, the proposed experiment excludes the condition of that exactness by measuring the phenomenon on a path between two fixed interferometers.

The wave theory slowed down the development of light theory. The light's wave nature - even as that of a ballistic action - results from light's particle characteristic as of a multi- bisystem which produces by rotation closed wave-like cycloids, besides spin also playing a role: vide [4].

Conclusions.

The foregoing analysis shows certainly convincingly the deficiency of the GT and LT transformations. Moreover, it shows the emptiness of the criterion for the correctness of theories based on these transformations. Motion has namely no other correlations but velocity and direction, and each system carries along each process arisen in it and being at rest for it - including the omnidirectional propagation - towards all other systems of the universe (¶ 4.1, ax. 2). This follows from the consequent motion relativity or interchangeability, and it is only the simplicity of mathematical formulation that makes us accept a criterion, what we should regard as moving and what as being at rest. Then those and only those relations can be right that satisfy (3.1 to .5).

It is not possible, however, to disregard the fact that the motion relations are, besides relative velocity, inseparably joined with the concept of aberration whose omitting was consequent upon the vector calculus. It is almost unbelievable how primitive faults, resulting from the lack of understanding the very sense of transformation, have gained control of and distorted physical thinking, starting with the explanation of M 1881, for more than 100 years.

The correctness of the author's remark at the end of the introduction is perhaps more obvious now that it was mathematics that failed, in spite of having already at disposal the infinitesimal calculus which had not been known in Galileo's time. It is ironical that mathematics failed just in this calculus, where the simple algebra was sufficient. Since Newton's and Leibniz' times mathematics has gone the way of developing known concepts without giving anything new, subsequently went over into abstractness and formalism and becomes self-purposeful as the author has it in [9].

In the applications of GT, there was not distinguished the difference between the free choice of independently coupled coordinates and the mathematical dependence of variables. The effort to define the general relation system in the way of mathematical transformations, lacks any sense, however, just so as the sluggish controversy about the evolutionary contrasts 'geocentric' or 'heliocentric', i.e., Ptolemy-Copernicus, Galileo-Einstein, etc.

The relations deduced in [2, 4, 6, 8) hold good namely quite generally for any motions and any systems in the relations of bisystems or multi-bisystems, in which no member is physically superior even when its prevalent mass more affects the motion of other members, the Sun and planets, but always only in the limited sphere, and none of the members can lie directly in the mass center of system which is always a mere imaginary point; no member can thus form a fixed center of gravity and each is thus equally justified to be considered as a center of the system. It depends only on the cumulative concept, whether the Sun with its satellite planets orbits the imaginary center of gravity of the whole solar system like the other planets with their satellites, or around the Earth like the Moon. Only the mathematical simplicity is effectual here, as mentioned above.

Summary.

In [1 - 7] the author derived the aberration transformation (AT) replacing Galileo's (GT) and Lorentz's (LT) transformations that have not included the motion of the third system and were thus only static, position transformations not satisfying the functual conditions of the infinitesimal calculus. In this paper the author shows in the way of more detailed analysis that the AT is a sufficient criterion for rightness of physical relations without needing further proof of any invariance. This holds for all physical relations of motion, thus also for the Maxwell's equations. The work closes then the sluggish issue about the universal relation system, as well as the groundless dispute about the geocentric or heliocentric concept of astronomical relations.

Bibliography

[1] Nedvěd, R.: **Relativitätstheorie auf der Basis der klassischen Physik**, 1A (1964).
[2] Ibid., 1B (1966).
[3] Ibid.: **Classical Theory of Relativity**, Scientific Idea, 14/15 (1978/9), Zagreb, Yugoslavia.
[4] Ibid.: **Physik der Bewegung**, (1983) - Physics of Motion.
[5] Ibid.: **Relativität der Bewegung**, Toth-Maatian Review, V. 3, #4 (1985).
[6] Ibid.: **Die Gezeitendeformationen**, mit Zusatz: **Gezeitenphenomena**, von Nedved, R. Jr., T-M. R., V. 4, pp. 2263-80 (1986).
[7] Ibid.: **Die Aberrationstransformation, Registration und Interferenz**, T-M. R., V. 5, pp. 2421-30 (1986).
[8] Ibid.: **Die Merkuranomalie**, T-M. R., V. 5, pp. 2459-74 (1986).
[9] Ibid.: **Das 2v-Gesetz, Michelsons Experiment 1913 und das entscheidende Experiment**, T-M. R., V. 5, pp. 2681-96 (1986).
[10] Ibid.: The Light of Binary Stars, T-M. R., V. 6, pp. 3355-9, (1988).
[11] Karjakin, N. I., Bystrov, K. N. & Kirejev, P. S.: **Краткий справочник по физике**, Высшая школа, Москва 1964.

Remark: For [4] the author has found no publisher until now. A copy of it (in English and German) was registered on 27. July 1983 at the Eidgenössische Technische Hochschul-Bibliothek in Zurich, Switzerland, Sign. 733 584 q.