The Unification of the Basic Units Meter, Kilogram and Second and the Essence of the Phenomenon Time

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It is shown by experimental data that a causal connection between the categories mass and time, as well as between the categories electric current and time is given. The equation of the mass–time relation, valuated together with the constant of the velocity of light c and the length–mass relation of Planck L_E/M_E, results in a specific, single number related equation of the units mass, length and time without any dimension, thus representing unreality. It is made evident that the unified equation of the basic units, which reflects the not explicable experimental findings of the Quantum-Hall-Effect (QHE, i.e. KE), the findings of the physical description of vision and sound and also the third law of Kepler, yields the possibility to describe the essence of time. It is shown that the Hubble time $T_{U,E}$ and the Earth-related time t_E should be considered to be the fundamental factor of realization of masses between unreality and reality. Based on the presented description of the essence of the phenomenon time, the difference between time and frequency is disclosed.

1 Introduction

The MOS transistors as an amplifier of electric signals was developed after the second world war in the USA by W. Shockley, W. H. Brattain and J. Bardeen. Its economic importance is given by its extraordinary ability of miniaturization. This fact was the start of a world-wide rapid technical development at all areas of economy. The extensive studies of the specific properties of these MOS transistors led to the observation of the Quantum-Hall-Effect (QHE) in 1980 by K. von Klitzing, thus named Klitzing-Effect (KE) [1]. This effect, observed at low temperatures, disclosed on the one hand the existence of a macroscopic quantization at discrete states, given by the quantization of resistivity of the MOS module in form of $R_{xx} = h/ie^2$ (here, h is the Planck-constant, e the charge of electron, and i the quantum-number), and on the other hand the existence of a simultaneous, i.e. contemporaneous condition of an unresistance $R_{xx} = 0$ ohm. Both these effects, especially the contemporaneity of $R_{xx} = h/ie^2$ and $R_{xx} = 0$ ohm, was at that time not foreseen by the given theory, i.e. also quantum mechanical theory.

The exceptional importance of the QHE is given not only by the observation of a macroscopical quantization, described by the $R_{xx} = h/ie^2$, but also by the unexpected finding of the simultaneously given independence $R_{xx} = 0$ ohm at any integral and fractional quantum number. Evidently, the observed $R_{xx} = h/ie^2$ effect yields the possibility to find a connection to the state of physics before the year 1980, the year of the observation of the QHE by K. von Klitzing (KE) [1], but the $R_{xx} = 0$ ohm effect is a quite new observation within the whole scientific field of being, showing the existence of a state of space–mass–time independence. This finding has been observed after a world-wide extensive experimental investigation of the QHE. This spectacular observation allows

to postulate that due to the independence of the $R_{xx} = 0$ ohm effect on the integral as well as fractional quantum number that especially this $R_{xx} = 0$ ohm effect represents the fundamental background of the QHE. This assumption will be confirmed in the following by the description of the essence of time, especially by the unforeseen formulation of an equation of space–mass–time independence.

The surprising observation of the existence of a state without length, mass and time suggests a reform of the *International System of Units* (SI). It should be pointed out that a reform of the SI was recently highly recommended by F. W. Hehl and C. Lämmerzahl [2] with reference to physical results observed in the last centuries, and thus also to the experimentally observed dependence of the value of the velocity of light c on gravity. In [2] it was not borne in mind that the value of c is given by a free choice [3], i.e. the numerical value of c was determined by man, and "not by nature". Thus the free choice of the numerical value of c determines in the last consequence the numerical value of the fundamental physical constants. Moreover, when describing the effect of gravitation on the number of velocity of light c we have to assume that in agreement with the physical interpretation of vision and sound [4, 5] the light-related distance refers to the localized wavy 2D-state, thus including no gravity effects, whereas the length-, i.e. mass-related distance, according to the third law of Kepler, i.e. due to the three-dimensionality, includes also the gravitational effects: Thus the different background of the light-related distance and the gravity, i.e. mass-related distance shows that the variability of the number of the velocity of light c, caused by gravity, cannot influence the numerical values of basic units. Furthermore, as will be demonstrated in sections 4 and 5, these discoveries result in the general validity of the following discussed equations and shows

that this finding reveals the applicability of all explored fundamental constants at any place of the cosmos.

Unfortunately, also the weighty problem of the phenomenon time was not incorporated in the extensive analysis of [2], though Lee Smolin [6] has shown in *The Trouble with Physics* that the main open question of the existing physics refers to not knowing of the essence of the phenomenon time. Therefore, in the presented analysis of the curious experimental effect of an existence of a state, being independent of a mass, space and time, as well as of the lack of a basic interpretation of the phenomenon time, it will be demonstrated that both these problems of physics can be solved only together. It will be shown in the next sections that the description of these phenomena does not become possible before the demonstration of the unexpectedly given causal connection between the category mass and frequency, as well as also between the category electric current and frequency.

2 The background for the basic interpretation of time

To find a physical answer to the fundamental problems of physics, we start with the analysis of the phenomenon time. It will be shown that the physical description of the process of vision and sound [4,5], which demonstrates the existence of a differentiation of the three-dimensional space DSS into the two-dimensionality 2D, i.e. electromagnetism, and the one-dimensionality 1D, i.e. length, i.e. gravitation, is extremely helpful for the analysis of the phenomenon time. It has become aware that the description of time is not dependent on the wavelength of the used light, but solely on the frequency, reflecting the electromagnetism. Based on the DSS-model, in fact the source of the phenomenon time must refer to dynamics, i.e. to the electromagnetism, which is an effect of the 2D-state. The unit time is always noticeable merely in connection with the category length [6]. This finding suggests that the perception of the phenomenon time must be a result of the connection of the wave related 2D-state with the real, i.e. 1D-state, which represents the state of observable facts. The analysis of the process of vision has shown [4] that the 1D-state, representing the gravity and thus also the category length, relates to the effect of the gravitational constant $G_E = c^2(L_E/M_E)$, where L_E is the Planck-length and M_E the Planck-mass and c the velocity of light. It is generally assumed that the gravitational constant G_E is valid at the whole cosmos. From this decisive supposition follows that the relation L_E/M_E, i.e. the fundamental connection between the three-dimensionally related mass and the category length, is describable in an extended form, given by

$$\frac{L_E}{M_E} = \frac{\lambda_C}{M_{0,E}} = \frac{\lambda_{G,E}}{M_{G,E}} = \frac{L_{U,E}}{M_{U,E}} \,. \tag{1}$$

Here λ_C is the Compton wave-length and $M_{0,E}$ the corresponding to this length related mass, $\lambda_{G,E}$ is the so-called reference length of the earth and $M_{G,E}$ the corresponding mass

of the earth, and finally $L_{U,E}$ the length of the cosmos and $M_{U,E}$ its mass. The index E indicates that the explorations are performed from an earth-related place.

It should be emphasized that (1) and thus also the relation $\lambda_C/M_{0,E}$ represent the particular state of identity of the observable electromagnetism with gravitation. Considering the model of the differentiated structure of space DSS [4,5], this state is given by the non-possibility to distinguish between the 2D-state and the 1D-state. But this specific condition does not exist at the surface of the earth. The third law of Kepler [4], which is related to the spatial three-dimensionality of the cosmos, shows that the relation between the square velocity of light c^2 and the square of the orbital speed at the surface of the earth v_E^2 (which reflects the difference between the electromagnetism and gravitation) is given by $c^2/v_E^2 = a_{G,E}$. This number $a_{G,E}$, related to the surface of the earth, in [4] described by (8) and (9) and formulated in agreement with (1), is given by

$$a_{G,E} = \frac{M_E R_{G,E}}{L_E M_{G,E}} = \frac{M_{0,E} R_{G,E}}{\lambda_C M_{G,E}} = \frac{R_{G,E}}{\lambda_{G,E}} \,, \tag{2}$$

where $R_{G,E}$ is the radius of the earth and $M_{G,E}$ its mass.

It should be pointed out that according to the DSS-model we have to proceed from the 1D, i.e. from the noticeable, i.e real state. In the next sections, it is demonstrated that, according to the spatial three-dimensionality, the 2D-state is valued in a "square" relation to the 1D-state. Thus the frequency f_C, being related to the 2D-state, must be modified on the surface of earth by $(a_{G,E})^{1/2}$, resulting in a real value, given by $f_E = f_C(a_{G,E})^{-1/2}$. When we take the value $f_C = 1.235589964 \times 10^{20}$ Hz for the velocity of light related frequency, the value $M_{G,E} = 5.974 \times 10^{24}$ kg for the mass of the earth and the approximate value $R_{G,E} = 6.36 \times 10^6$ m [7] for its radius $R_{G,E}$, then, according to (2), we obtain for f_E the real value

$$f_E = f_C \,(a_{G,E})^{-1/2} = 3.26321(64) \times 10^{15} \,\text{Hz} \,. \tag{3a}$$

It is of great importance for our further analysis to compare this experimentally established numerical value of f_E with the numerical value $M_{0,E} = \lambda_C(M_E/L_E)$, which refers to (1). As known, the Compton-wavelength is given by

$$\lambda_C = 2.4263102389 \times 10^{-12} \,\text{m} \,,$$

and for the relation L_E/M_E we have the value

$$L_E/M_E = 7.42565(74) \times 10^{-28} \,\text{m kg}^{-1} \,.$$

This value of L_E/M_E was determined from the analysis of the cosmos generally used, experimentally observed gravitation constant $G_E = c^2(L_E/M_E) = 6.67384(80) \times 10^{-11}$ m³/(kg s²) [7]. Based on (1) and using these values, we obtain for $M_{0,E}$ a 1D related value, given by

$$M_{0,E} = \lambda_C \,(M_E/L_E) = 3.26746(86) \times 10^{15} \,\text{kg} \,. \tag{3b}$$

The comparison of the "numerical" value f_E, given by (3a), with the "numerical" value $M_{0,E}$, given by (3b), "astonishingly" reveals a near identity of their numbers. This exceptional finding leads us to the dared assumption that a causal connection between mass and frequency, i.e. time, seems to be possible in being. This exceptional assumption can be formulated by means of the spectacular equation

$$M_{0,E} = f_E . \tag{4}$$

The comparison of the values of $M_{0,E}$ with f_E shows that the experimental value of f_E is a little higher, but only about 0.13 %. This relatively small deviation is necessarily a consequence of the fact that according to vision and sound the effect of $M_{G,E}$ on the value of $a_{G,E}$ is a little lower, caused by the reduced earth density at the surface. Therefore, indeed, it is physically allowed to postulate that on the surface of the earth an absolute numerical identity of $M_{0,E}$ with f_E is given, as proposed by (4).

It should be pointed out that the careful analysis of (4), given in sections 3–5, shows that the proposed identity of the limits of mass with frequency has to be valid not only on the surface of the earth, but generally valid at the whole cosmos. Thus, it should be considered that beside the physical constants c and L_E/M_E, a third important, generally valid constant should be effective, representing a connection of mass with frequency. Due to the importance of this exceptional postulate, experimental findings will be presented in the next section to substantiate the validity of the extraordinary (4).

3 Experimental verifications of the identity of the mass–time connection

3.1 The analysis of the limiting current of the Quantum-Hall-Effect (QHE)

The limiting current of the QHE, obtained by the experimental investigation of W. Wittmann [8], is presented in Fig. 2.1 of [9], page 37. Assessing these data with respect to the process of seeing and hearing, we have to conclude that the investigated electric current of the sample, the so-called source-drain current I_{SD}, being a real effect, must be related to the 1D-state, i.e. to frequency being in the real form of time, and not to the 2D wave state. Therefore it must be concluded that the factor of modification $(a_{G,E})^{1/2}$ has to be in relation solely to the source-drain frequency f_{SD} and not also to the charge of the electron e of the electric current, as former assumed in [9]. This shows, formulated in a general form, that the limiting frequency on the surface of the earth f_E must be given by (3a) and thus the limiting current $I_{0,E}$ by

$$I_{0,E} = e f_E = 5.23510(29) \times 10^{-4} \text{ A} . \tag{5}$$

This theoretical value of the limiting current really agrees on the whole with the experimental data of the QHE, as shown and discussed on pages 39–40 of [9], together with the results of the extension of the time-analysis, given in [10], part II, pages 37–50. This particular finding demonstrates that the basic unit ampere of the MKSA- or SI-system of basic units must be considered to be a fix relation to the basic unit time, and that by means of the electron charge e. From this follows that the limit voltage of the QHE $V_{0,QHE}$ is at the limit resistivity $R_{0,QHE} = 2.581281 \times 10^4$ ohm given by $V_{0,QHE} = 13.51316(38)$ V and that the relation between the mass and the charge of the electron results in $m_e/e = (a_{G,E})^{1/2} V_{0,QHE}/c^2$, which agrees with the experimental experience. These experimental results suggest the striking conclusions that, on the one side, the equation of the frequency indeed should be given by $f_E = f_C (a_{G,E})^{-1/2}$, as proposed in section 2 and thus supporting the assumption of (4), and, on the other side, only a reduced MKS basic system of units, i.e. without the category "electric current", should be taken into account in the physical science, being a far-reaching conclusion of the QHE.

3.2 The comparison of the mass–time relation effect with the Hubble time $T_{U,E}$

An indirect experimental confirmation of (4) can be obtained when we interpret the connection between the mass $M_{0,E}$ and the frequency f_E as a fundamental coupling number, and that seen in similarity to the speed of light c, and when we consider the relation L_E/M_E also as a fundamental coupling number. The numerical value of the relation L_E/M_E is given by the constant of gravity G_E [7], where the factor c^2 is based on the value $c = 2.99792458 \times 10^8$ m s^{-1} [9]. The fundamentality of the numerical value of L_E/M_E was demonstrated by the equation of the Hubble-effect [4]. Therefore, describing the velocity of light as a fundamental coupling number between the categories length and time, given by the number 2.99792458×10^8, and the relation L_E/M_E as a fundamental coupling number between categories length and mass, given by the number $7.42565(74) \times 10^{-28}$, thus the connection between the mass $M_{0,E}$ and the frequency f_E, i.e. time, given by (3a), (3b) and (4), has according to our analysis to be assessed as a general valid fundamental coupling number between the relation of the categories mass and time, describable by the number 1.

Summarizing these propositions, a general valid fundamental connection between the categories length, time and mass can be achieved by

$$\begin{aligned} 1 \text{ m} = 1/c &= (1/2.99792458 \times 10^8) \text{ s} \\ &= 3.335640952 \times 10^{-9} \text{ s} , \end{aligned} \tag{6a}$$

$$\begin{aligned} 1 \text{ m} = 1/(L_E/M_E) \\ &= (1/7.42565(74) \times 10^{-28}) \text{ kg} \\ &= 1.346682(11) \times 10^{27} \text{ kg} \end{aligned} \tag{6b}$$

$$\text{and} \quad 1 \text{ kg} = 1/(1 \text{ s})^* , \tag{6c}$$

where we introduce a fundamental time $(1 \text{ s})^*$ in (6c), a consequence of the assumption of the existence of a general valid fundamental connection between the categories length, mass and time. Thus (6a)–(6c) yield

$$(1 \text{ s}^2)^* = (M_\text{E}/L_\text{E}) \, c = 4.03725(14) \times 10^{35} \text{ s}^2 \, , \qquad (7)$$

being a square of the fundamental time. Thus the unit of time, representing the fundamental coupling number, therefore must be given by

$$(1 \text{ s})^* = 6.35393(69) \times 10^{17} \text{ s} \, , \qquad (8)$$

which must be considered to be a result, related to the freely chosen value of c.

To get a further possibility to confirm the correctness of our analysis and thus of (4), we start from the idea that this specific time of (8), deduced from the numerical values c, L_E/M_E and (4), correspond with the Hubble time $T_\text{U,E}$. Throughout the scientific literature, the Hubble time $T_\text{U,E}$ is determined by means of the Hubble constant H_0, determined by telescopes. The value of the time of (8) corresponds with the Hubble-value $H_0 = 48.564 \text{ km s}^{-1} \text{ Mpc}^{-1}$. Thus it is interesting that the experimentally detected H_0 values show the Hubble constant, found in the last decades, to be between $H_0 = 40 \text{ km s}^{-1} \text{ Mpc}^{-1}$ and $H_0 = 100 \text{ km s}^{-1} \text{ Mpc}^{-1}$ [11], and the recently determined value shows to be [4]

$$H_0 = 72.1 \text{ km s}^{-1} \text{ Mpc}^{-1} .$$

It is now clear that the values of the experimental findings of H_0, according to the size, are identical with the size of the theoretical value given by (8). Thus we can state that the size-related agreement of the telescopes given $T_\text{U,E}$ values with the theoretical value, given by (8), additionally proves that the postulated identity of the category mass with the category time, expressed by (4), indeed can be considered to be experimentally verified.

4 The formulation of an equation of transformed basic units without dimensions

As has been manifested in subsection 3.2, it is very interesting that the generally valid limit values c and L_E/M_E yield in (7) the square of the category time. As will be discussed in detail in section 5, this odd finding can be solved when we take into consideration both the experimental data of the QHE [1] and the physical description of vision and sound [4,5].

The KE shows the $R_{xx} = 0 \text{ ohm}$ effect, which manifests the existence of an extraordinary state without any difference between mass, length and time. To reflect this mysterious experimental finding, a transformation of (6a)–(6c) is necessary to achieve the basic units given simply by numbers. This

spectacular goal is attained by

$$1 \text{ m}^* = 2.11944(52) \times 10^{9} \, , \qquad (9a)$$

$$1 \text{ kg}^* = 1.573827(44) \times 10^{-18} \, , \qquad (9b)$$

$$1 \text{ s}^* = 6.35393(69) \times 10^{17} \, . \qquad (9c)$$

The numbers of (9a)–(9c) are obtained, when we use $1/c$ and $1/(L_\text{E}/M_\text{E})$ as fundamental coupling numbers and when we suppose that the time of (8) is identical with the limit time of the cosmos $T_\text{U,E}$. Thus the numbers of (9a)–(9c) are given by

$$1 \text{ m}^* = \frac{1}{c} \, (1 \text{ s})^* \, , \qquad (10a)$$

$$1 \text{ kg}^* = \frac{L}{M \, c} \, (1 \text{ s})^* \, , \qquad (10b)$$

$$1 \text{ kg}^* = \frac{1}{(1 \text{ s})^*} \, . \qquad (10c)$$

When starting from the cosmic length, given by $L_\text{U,E} = c \, T_\text{U,E} = 1.90486(24) \times 10^{26} \text{ m}$ and from the cosmic mass, given according to (1) by

$$M_\text{U,E} = (M_\text{E}/L_\text{E}) \, L_\text{U,E} = (M_\text{E}/L_\text{E}) \, c \, T_\text{U,E}$$
$$= 2.56524(41) \times 10^{53} \text{ kg} \, ,$$

and multiplying these values with the transformed basic units 1 m^* and 1 kg^* of (9a) and (9b), evidently we obtain the transformed values of length $L_\text{U,E}{}^*$ and of mass $M_\text{U,E}{}^*$. Moreover, when the square of the time of (8) is taken as the expression of the transformed cosmic time $T_\text{U,E}{}^{*2}$, then we obtain – *fully unexpected* – for $M_\text{U,E}{}^*$, $L_\text{U,E}{}^*$ and $T_\text{U,E}{}^{*2}$ one and the same number. This extremely spectacular observation results in the possibility to connect the transformed expressions of mass $M_\text{U,E}{}^*$, length $L_\text{U,E}{}^*$ and time $T_\text{U,E}{}^{*2}$ simply into one equation, given by

$$M_\text{U,E}{}^* = L_\text{U,E}{}^* = T_\text{U,E}{}^{*2} = 4.03725(14) \times 10^{35} \, . \qquad (11)$$

It is evident that the spectacular non-dimensionality of (11) represents a particular state of unreality, which indicates the existence of an extraordinary state, seen in comparison to the in reality given basic units mass, length and time. It should be emphasized that this peculiar observation indeed reflects the experimental finding of the Klitzing-Effect (KE). The unexpected observation of the same number, resulting in (11), suggests the general validity of unification of basic units for the whole cosmos.

Besides, it should be emphasized that the disclosed possibility in this section 4 to describe each basic unit only by the same number can hardly be substantiated by the given physical argumentation in our times. Evidently, (11) is based on

the proposed identity in section 2 of the category mass with frequency, i.e. with the category time. But, in an extensive manner valued, the reasoning of (11) can be indirectly supported by both the cosmological principle as well as by the mathematically unsolvable three-body-problem, which supports the DSS-model [4, 5], and which are generally valid. Moreover, a comprehensive analysis of (4) and (11) shows that the used constancy of the velocity of light c in the whole cosmos (reflecting the independence on the place of investigation) is only possible, when a universal validity of unification of the basic units is given. This statement is discussed in the next section.

5 The far-reaching findings about the category time

Based on all the data, shown in the preceding section 4, a comprehensive interpretation of the category time is possible by further analyzing the substance of (11). In fact, (8) together with (6a)–(6c), (9a)–(9c) and (11) yields a noticeable, far-reaching expression, given by

$$M_{U,E} = T_{U,E} T_{U,E}^{*2} = T_{U,E} M_{U,E}^* . \qquad (12)$$

Considering (8), (9c) and (10a)–(10c), then (11) and (12), as well as the discussion of the results of the Hubble time $T_{U,E}$ become more understandable for the interpretation of the essence of time, when we further postulate that the cosmic time $T_{U,E}$ complies the remarkable "numerical" identity

$$T_{U,E} = T_{U,E}^* . \qquad (13)$$

The identity of the limit numbers of the real and unreal cosmic times, given by $T_{U,E}$ and $T_{U,E}^*$, can be confirmed, when analyzing (7) and (8) with respect to the results of vision and sound. According to (11) and (12), and especially to (13), the Hubble time $T_{U,E}$ should be considered to be a particular magnitude, being numerically quite different to both $M_{U,E}$ and $L_{U,E}$ (the values of them are given in section 4) as well as to $M_{U,E}^*$ and $L_{U,E}^*$. Moreover, it must be pointed out that this specific exclusiveness of the cosmic time is also given in (11), where the real time $T_{U,E}$, being in unreal state, appears in a "square". This important fact is a consequence of the specific circumstance that $T_{U,E}$, in contrast to $M_{U,E}^*$ and $L_{U,E}^*$, is in this state used as a "real" magnitude, and that in form of $(1\,\text{s})^*$. Thus, when we consider (12), it becomes evident that the circumstance of $T_{U,E}$ can be in agreement with the DSS-model about the square relation of the 2D-state to the 1D-state "only", when the in (13) proposed numerical identity of the real and unreal cosmic time is given for the whole cosmos. It is obvious that this disclosure is confirmed by the existence of the Hubble effect [4].

Moreover, it should be pointed out that (11) and its general validity is based solely on the proposition of the validity of (4). It is given by the possibility to express the connection of the mass with the frequency, given in the reality related form by $f_C(a_{G,E})^{-1/2}$. The used rooty form of the gravitational value $a_{G,E}$ is in full agreement with both the physical description of vision and sound [4, 5], and also the third law of Kepler, showing that the relation between the 2D-state and the 1D-state is given inevitably in squared form. This observation demonstrates the generally validity of the difference between the essence of frequency and time in the real state, which in the last consequence approves the correctness of (4) and (11).

All these discussed observations are important also for the confirmation of the general validity of (12), which can be obtained by comparison of this equation with the third law of Kepler. Due to the third law of Kepler, the orbital time of earth $t_{G,E}$ is given by [4]

$$t_{G,E} = (a_{G,E})^{3/2} t_E , \qquad (14)$$

where the specific time of earth t_E with respect to (1) is defined by

$$t_E = \lambda_{G,E}/c = 1.4797 \times 10^{-11}\,\text{s} . \qquad (15)$$

Starting from (12), the application of it to the particular conditions of the earth yields the equation

$$M_{G,E} = t_E M_{U,E}^* . \qquad (16)$$

Eqs. (12) and (16) demonstrate that the category time represents a connection of the real values of the masses $M_{U,E}$ and $M_{G,E}$ with the unreal value $M_{U,E}^*$. Therefore, finally, we can draw the striking and for our investigation of the essence of time important conclusion that according to the effect of KE [1] and the DSS-model [4, 5], the category time suggests to be a magnitude to connect the 2D-state with the 1D-state, thus to be a factor of realization between reality and unreality.

As has been shown, this description of the essence of time is based on the proposed identity of the limit of mass with the limit of frequency, formulated by (4) and experimentally confirmed by many, quite different observations:

1. By the mysterious Klitzing-Effect (KE), which discloses the existence of an unresistance $R_{xx} = 0$ ohm at the Quantum-Hall-Effect (QHE),

2. by the physical description of the process of seeing and hearing [4, 5], resulting in the discovery of the DSS structure of space,

3. by the value of the gravitational number of the surface of the earth $a_{G,E}$, determined from the mass and the radius of the earth, which modifies the limits of mass and frequency in (4),

4. by the results of the limiting current of the QHE [8, 9],

5. by the found approximate identity of the value of the Hubble time $T_{U,E}$, experimentally determined by telescopes [4, 11], with the theoretically deduced limit time given by (8), which certifies the validity of the statements of (4) and (11),

6. by the coherence of the summarized result of the here listed experimental observations with the third law of Kepler [4], demonstrating that indeed the finding of the DSS-state and the possibility of unification of the basic units are in a perfect agreement with the assumed general validity of the third law of Kepler.

Considering all these experimental findings, the presented model of the essence of time should be viewed as physically confirmed.

6 Summarized conclusions

The physical description of vision and sound in form of the DSS-model [4,5], reflecting the experimental data of the Klitzing-Effect (KE) [1], reveals that the phenomenon time is given as a consequence of the interaction of the wave-related 2D-state with the 1D-state, i.e. the particular state, which shows exclusively real circumstances. This finding is the physical reasoning for the fact that the phenomenon time as well as the frequency in real form are always observable solely in connection with the category length [6] [9, pp. 9–10].

The analysis of the experimental data of basic units shows that surprisingly a generally valid identity of mass and frequency can be supposed, theoretically described by (4) and confirmed by different experimental data. These findings result in the possibility to formulate an equation, given by (11), in which, astonishingly, the transformed categories mass, length and time are given only by the same, single number, referring in the last consequence to the existence of an unreality in being. This observation has to be considered to be the physical description of the mysterious experimental effect of the $R_{xx} = 0$ ohm related Klitzing-Effect (KE), discovered in the Quantum-Hall-Effect (QHE) [1].

The third law of Kepler proves that the phenomenon time is observable only in the given state of the spatial three-dimensionality. This circumstance points out that – with respect to the DSS-model – the category time must be effective as a mediator for the coupling of the 2D-state with the 1D-state, thus being an important background of the realization of the category mass.

Summarizing all the presented experimental findings, it is allowed to conclude that the "unification" of the basic units length, mass, time and electric current appears to be a physical fact. Based on this important discovery, we can state that the phenomenon time is a dualistic factor, which is related on the one side to the localized, i.e. real 1D-state, noticeable as time, on the other side in the wavy, i.e. unreal 2D-state, in realistic form known as frequency. Evidently, this finding shows the existence of a substantial difference between time and frequency, and that to be a physical legitimate circumstance.

Acknowledgements

References

1. von Klitzing K., Dorda G. and Pepper M. New method for high-accuracy determination of fine-structure constant based on quantized Hall resistance. *Phys. Rev. Lett.*, 1980, v. 45, 494–497.

2. Hehl F. W. and Lämmerzahl C. Physical Dimensions/Units and Universal Constants: Their Invariance in Special and General Relativity. *Ann. Phys. (Berlin)*, 2019, 1800407.

3. Kose V. and Wöger W. Neuere empfohlene Werte von Fundamentalkonstanten. *Phys. Bl.*, 1987, v. 43, 397–399.

4. Dorda G, The Interpretation of the Hubble-Effect and of Human Vision Based on the Differentiated Structure of Space. *Prog. Phys.*, 2020, v. 16 (1), 3–9.

5. Dorda G. The Interpretation of Sound on the Basis of the Differentiated Structure of Three-Dimensional Space. *Prog. Phys.*, 2020, v. 16 (1), 15–19.

6. Smolin L. The Trouble with Physics. Houghton Mifflin Company, New York, 2006. In German: Die Zukunft der Physik. Deutsche Verlags-Anstalt, Muenchen, 2009, pp. 344–346.

7. Mende D. and Simon G. Physik. Gleichungen und Tabellen. Carl Hanser Verlag, Fachbuchverlag Leipzig, Muenchen, 2013.

8. Wittmann F. Magnetotransport am zweidimensionalen Elektronensystem von Silizium-MOS-Inversionsschichten. Dissertation, University of Armed Forces, Muenchen, Institute of Physics, Abb. 4–5.3, S. 143, 1992.

9. Dorda G. Quantisierte Zeit und die Vereinheitlichung von Gravitation und Elektromagnetismus. Cuvillier Verlag, Goettingen, ISBN 978-3-86955-240-8, 2010. In particular: pp 34–42, Fig. 2.1 and 2.2, and (2.14).

10. Dorda G. Die Struktur von Raum und Zeit und die Interpretation der Wärme. Cuvillier Verlag, Goettingen, ISBN 978-3-7369-9388-4, eISBN 978-3-7369-8388-5, 2016.

11. Bernhard H., Lindner K. and Schukowski M. Wissensspeicher Astronomie. Volk und Wissen Verlag, Berlin, ISBN 3-06-081705-7, 1995.