Fundamental Principles in Physics

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Abstract

The currently accepted Standard Model of Particle Physics and the Theory of General Relativity for Gravitation (GR) are still theoretical, and are not consequences of valid fundamental physical postulates. The accepted standard theories are based on the quantization procedure of energy and fields (QT) and on two relativity theories, the theories of Special Relativity (SR) and GR which are, to this day, only scientific conventions. All in all, these theories all use the concept of energy conservation: they are energetic theories. A number of undeniable and irreconcilable discrepancies observed in nature are herein taken as an opportunity to elaborate new fundamental principles in physics. First, the basics postulates of the currently accepted theories are assembled. These basic postulates are reviewed in terms of their consistency and of their dependability for physical theories. The results of this review process lead to new basic postulates in physics. These are consistent due to correct mathematical formulations. A separate physical innovation brings the new basic postulates in-line with the key experimental observations. The first key observation is that the Universality of Free Fall has been observed to be inconsistent, and the second is that all microscopic objects are essential smaller than the the wave lengths of their emitted electromagnetic radiations. Further, planetary motion offers conditions for UFF violations, which induced the establishment of a new appropriate basis of gravitation on new appropriate basics. The second key observation leads to the conclusion that the emission of electromagnetic radiation is purely a wave phenomenon and not corpuscular. The additional physical assumption is that both electromagnetism and gravitation are caused by conserved elementary charges. The number, the sizes and the signs of the newly introduced elementary gravitational charges are adjusted on the basics of experimental observations, with the consequence that both kinds of elementary charges can be assigned to the physical properties of four stable elementary particles. Otherwise put, the new basic principles of theories lead to a concept of an atomistic physics instead of the energetic physics. The theory is also a type of quantum physics, however only the sources of the interacting field are quantized; not the fields and not the energy.

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1 Review of the Basic Postulates in Physics

At first, we declare that all physical processes have to be described in a space-time continuum with the properties that time and space are homogeneous and that space is isotropic. Generally, the scientific term "homogeneous" means the same event can occur at each point, whereas "isotropic" means the same action can occur in every direction from a particular point. Infinity is not included in physical descriptions.

The postulates of the Special Relativity (SR) are:

1. First postulate (principle of relativity)

The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of coordinates in uniform translatory motion. Or: The laws of physics are the same in all inertial frames of reference.

2. Second postulate (invariance of c)

As measured in any inertial frame of reference, light is always propagated in empty space with a definite velocity c that is independent of the state of motion of the emitting body. Or: The speed of light in free space has the same value c in all inertial frames of reference.

The first criticism is that both postulates make use of the concept "inertial frame of reference". However, such a frame of reference is not defined within the basic postulates. Anyhow, it is often argued that everybody knows what inertial frame of reference is: inertial frames refer to observers which have uniform translatory motions to each other. This concept is based on classical physics. Namely, that at an exact point of time an observer can mark exact equidistant positions in order to fix his frame of reference and that the observer can register, within this frame, uniform translatory motions. This classical concept is generalized to other inertial frames of reference, to other observers, which move with uniform translatory motions. This idea of classical physics could, perhaps, be physically constructed with microscopic point-like particles placed at equidistant positions and with exactly known velocities and at the required exact time points. One can immediately see that such a physical construct would be impossible to realize. Nobody can register the exact positions and velocities of microscopical particles. The concept of an inertial frame of reference is scientifically injudiciously and cannot be physically constructed. Therefore, the principle of relativity based on "inertial frames of of references", is scientifically very questionable. Since its formulation by Einstein in 1905 special relativity has met with massive criticism and its many paradoxes are discussed today. It is scientifically appropriate to completely leave out "the principle of relativity" from all physical discussions of laws of physics. Therefore, one can also question whether the speed of light "in all inertial frame of reference" has the same value c. Also the "invariance of c" must be re-postulated, without the principle of relativity. The new postulation of the invariance of the propagation of light is that:

Light is always propagated in empty space with a definite velocity, c, and it is independent of the state of motion of the emitting body.

Or: The speed of light in free space has the same value, c, and it is independent of the motion of the source.

It obviously differs to the previous definition of the invariance of c. The invariance of the propagation of light is independent of each frame of reference, and it is also valid if an observer accelerates. The distinction between SR and GR, which is defined in an uniformly accelerated frame of reference, is lapsed. The invariance of light propagation at c defines the Minkowski space with Riemann metric in which an invariant distance is also defined as connecting space and time.

With the formulation of GR, Einstein took over the statement, that all bodies have exactly the same acceleration in an external gravitational field. Here, we are again faced with a situation that is mainly based on the classical physics: that that the acceleration of bodies can be "exactly observed". One of Einstein's thought experiments said that in an elevator one cannot decide whether the elevator moves with an acceleration motion, or because of the influence of the gravitation. He concluded that gravitation is physically not a physical force, but it is caused by the deformation of space-time around masses. Einstein's field equation relates the presence of matter and energy to the curvature of space-time. On the left side of his equation we see a tensor that represents the time-space curvature. This is not a whole Riemann tensor; it only describes the Ricci curvature. Einstein did not perform control measurements for the UFF hypothesis, with fall experiments and with different composed bodies, Rather, he stated the weak equivalence principle: the equivalence of the inertial mass, m^i ,and the gravitational mass, m^g, of each bodies. Already planetary motion has provided conditions for a UFF violation. With the best known data about planets, taken from *Allen's Astrophysical Quantities, 2000*, the calculation of R^3/T^2 gives a difference of 0.15% between Uranus and Mars because the compositions of the planets are quite different. Therefore, it is scientifically justified to connect the gravitational mass, m^g, anyhow with the generation of gravity and the inertial mass, m^i, only in connection to the motions influenced by any forces. This motivated a completely new design of the gravitation. The new design of gravitational model requires a new physical assumption: the introduction of conserved elementary gravitational charges, g_i. This physical assumption is one of the new postulates and it can be experimentally confirmed. The elementary gravitational charges, g_i, generate a continuous, time dependent field for gravitational interaction. The gravitational field also propagates with c which was experimentally confirmed with a measurement by *Sergei Kopeikin, 2002* and by *the LIGO detection of gravitational waves, 2015*. The numbers and values for g_i are derived from experimental observations and a connection is made between g_i and the elementary masses m_e and m_P in order to determine the gravitational masses of each body and the strength of gravitation (measured with the universal gravitational constant G).

Quantum theories (QT) are based on the fundamental assumption that light is quantized. For quantization the Einstein postulate $E = h\nu$ is used. This connects the energy of photons with the Planck constant, h, and the frequency of the light ν. Consequently, the emission of light by atoms is interpreted as a corpuscular phenomenon. However, from the observed sizes of microscopic objects and from the wavelengths of their radiation we can conclude that all microscopic objects are smaller than the wavelengths of their electromagnetic radiation *(Szász, 2005)*. Therefore, light emissions are always wave phenomena, not corpuscular. Light is nothing other than electromagnetic waves; a time dependent continuous electromagnetic field generated by elementary electric charges, q_i, and propagating with c. The electromagnetic field is not quantized and, consequently, the energies of the emitting bodies are also not quantized.

Supposing that conserved elementary charges, q_i and g_i, are the only physical properties of particles, we can define stable elementary particles with q_i and g_i. We are now able to introduce the fundamental interaction between the elementary particles in a generalized form as the sum of electromagnetic and gravitational interactions. We state that the interaction between the particles propagate with c. This generalized interaction allows the general use of Minkowski space with an Riemann metric. We must not use different metrics for electromagnetic interactions or for gravitation.

The new basic postulates in physics are

1. The continuous interaction field is always propagating in empty space with a definite velocity, c, and it is independent of the state of motion of the interacting body. Or: The speed of interaction in free space has a constant value, c, and it is independent of the motion of the sources, (invariance of interaction).

2. The sources of the interaction field are quantized with conserved elementary charges. The sources of the interacting field are the stable elementary particles, (principle of quantization).

3. All physical systems are to be described in finite range of space-time and neither the positions, nor the velocities of particles can be ever observed exactly, (principle of uncertainty).

With these postulates we shall construct a general physical theory which is independent of any frames of reference and which is valid at each possible particle velocities, v, where it doesn't matter how large they are in accordance with $v < c$. The physical realization according to the basic postulates follows now.

2 Equation of Motion for the Fields

The space-time continuum is described within finite ranges of Minkowski space $\{x = (\mathbf{r}, t)\}\varepsilon\Omega$. Minkowski space is a combination of Euclidean space, $\mathbf{r}$, and time, t, in a four-dimensional manifold where the space space-time interval between any two points is independent of any coordinate system in Ω. This space has a Minkowski metric which is a metric tensor η of the Minkowski space. The Minkowski metric is a pseudo-Riemannian metric. The mathematician Hermann Minkowski first developed it for Maxwell's equations of electromagnetism. The Lorentz transformations Λ^{μ}_{v} are coordinate transformations with $\Lambda^{-1}\Lambda = \eta$ which allow the distance between two points in Minkowski space

$$(s)^2 = x_\alpha x^\alpha = c^2 \cdot (t_1 - t_2)^2 - (x_1 - x_2)^2 - (y_1 - y_2)^2 - (z_1 - z_2)^2. \quad (1)$$

invariant and let be the Maxwell equation form invariant. The tiny invariant distance ds is defined by

$$(ds)^2 = dx_\alpha dx^\alpha = (c \cdot dt)^2 - (dx)^2 - (dy)^2 - (dz)^2. \quad (2)$$

A standard basis for Minkowski space is a set of four mutually orthogonal vectors, e_0, e_1, e_2, e_3, written as

$$\eta(e_0 e_0) = -\eta(e_1 e_1) = -\eta(e_2 e_2) = -\eta(e_3 e_3) = 1, \quad (3)$$

or written compactly

$$\eta(e_\mu e_\nu) = \eta_{\mu\nu}. \quad (4)$$

The metric tensor η can be used to lowering or to heightening an index. The four-vector described with $b = b^\nu e_\nu$ transform under Lorentz transformation

$$b'_\mu = \Lambda^v_\mu b_\nu, \quad (5)$$

and leaves a Lorentz scalar

$$b'_\mu b'^\mu = \Lambda^v_\mu b_\nu \Lambda^\mu_v b^\nu = b_\mu b^\mu, \quad (6)$$

invariant. The Einstein notation $b = b^\nu e_\nu$ is used, which means double occurring indices are the sum of all four components $v = (0, 1, 2, 3)$. In Minkowski space the Lorentz scalars, four-vectors, four-tensors and four-spinors, can be defined; each have definite transformation behaviors. With two four-vectors, analogously to Eq. (6), a Lorentz scalar

$$a'_\mu b'^\mu = \Lambda^v_\mu a_\nu \Lambda^\mu_v b^\nu = a_\mu b^\mu, \quad (7)$$

is invariant under Lorentz transformation. Examples of Lorentz scalars are for instant $x_\alpha x^\alpha$ and $dx_\alpha dx^\alpha$. Analogously, a four-tensors $F_{\alpha\beta}$ (x) can also be used to define an invariant (a Lorentz scalar)

$$F'_{\alpha\beta}(x) F'^{\alpha\beta}(x) = F_{\alpha\beta}(x) F^{\alpha\beta}(x). \quad (8)$$

Please note: the Lorentz transformation could be parametrized in a way that would be interpreted as rotation-free coordinate transformation with a real parameter v/c, but v is not the observed constant velocity of the embedded bodies.

One can construct a Lorentz invariant Lagrange density, L, for a Lorentz scalar action integral from the four-vector potentials $A^{(em)\nu}(x)$, $A^{(g)\nu}(x)$, with the four-current charge densities $j^{(em)\nu}(x)$, $j^{(g)\nu}(x)$, and from the Faraday four-tensors

$$F^{(em)}_{\alpha\beta}(x) = \partial_\alpha A^{(em)}_\beta(x) - \partial_\beta A^{(em)}_\alpha(x), \quad (9)$$

$$F^{(g)}_{\alpha\beta}(x) = \partial_\alpha A^{(g)}_\beta(x) - \partial_\beta A^{(g)}_\alpha(x). \tag{10}$$

In each case denotes (em) the electromagnetism and (g) the gravitation. The Lagrange density is defined on $\{x = (\mathbf{r}, t)\}\varepsilon\Omega$

$$L(x) = L^{(p)}(x) + L^{(em)0}(x) + L^{(em)Int}(x) + L^{(g)0}(x) + L^{(g)Int}(x), \tag{11}$$

with a uniform definition of terms for the electromagnetism and the gravitation

$$L^{(em)0}(x) + L^{(em)Int}(x) = -\frac{F^{(em)}_{\lambda\varrho}(x)F^{(em)\lambda\varrho}(x)}{4} - j^{(em)}_\alpha(x)A^{(em)\alpha}(x), \tag{12}$$

$$L^{(g)0}(x) + L^{(g)Int}(x) = -\frac{F^{(g)}_{\lambda\varrho}(x)F^{(g)\lambda\varrho}(x)}{4} + j^{(g)}_\alpha(x)A^{(g)\alpha}(x). \tag{13}$$

The $L^{(p)}(x)$ denotes the interaction free particles; $L^{(em)0}(x)$, $L^{(g)0}(x)$ denote the free fields and $L^{(em)Int}(x)$, $L^{(g)Int}(x)$ denote the interactions between the charges and the fields. Please note: $L(x)$ is not an expression for the energy density. The Lorentz scalar action integral is then

$$I = \int_\Omega L(x)(dx)^4. \tag{14}$$

The Hamilton principle, within the variation calculus for Lagrangian, deliver the equations of motions of the fields

$$\partial_\alpha\partial^\alpha A^{(em)\beta}(x) = +j^{(em)\beta}(x), \tag{15}$$

$$\partial_\alpha\partial^\alpha A^{(g)\beta}(x) = -j^{(g)\beta}(x). \tag{16}$$

However, the four-vector potentials must full fill the subsidiary conditions

$$\partial_\alpha A^{(em)\alpha}(x) = 0, \tag{17}$$

$$\partial_\alpha A^{(g)\alpha}(x) = 0. \tag{18}$$

Eq. (17) is the Lorenz gauge for the electromagnetic field. Because the integration for I is performed in finite ranges of Minkowski space, Ω, we need boundary and subsidiary conditions for all quantities are needed which build the Lagrange density, *(see, M. Giaquinta & S. Hildebrandt; Calculus of Variation I: The Lagrangian Formalism)*. Eq. (15) is the Maxwell equation for the electromagnetic field and the difference to the gravitation field equation, Eq. (16), is only a change of the sign at the four-current charge densities.

3 Elementary Gravitational Charges and Consequences

The four stable elementary particles are the electron (e), the positron (p), the proton (P) and the elton (E). Their elementary electric charges, q_i, are well-known

$$q_i \quad = \quad \{-e, +e, +e, -e\}, i = e, p, P, E. \tag{19}$$

Coulomb law states that static force $\mathbf{F}_{ij}^{(Coulomb)}(\mathbf{r}_{ij})$ exists between two electric charges, q_i and q_j, with a relative distance, $\mathbf{r}_{ij}$. We will now ascertain the elementary gravitational charges, g_i. We use this for the Newtonian equation for the static gravitational force between g_i and g_j

$$\mathbf{F}_{ij}^{(Newton)}(\mathbf{r}_{ij}) = -\frac{g_i \cdot g_j \cdot \mathbf{r}_{ij}}{4\pi \cdot r_{ij}^3} = \mp G \cdot \frac{m_i \cdot m_j \cdot \mathbf{r}_{ij}}{r_{ij}^3}. \tag{20}$$

The conserved gravitational charges of the stable elementary particles are set up as

$$g_i \quad = \quad \{-g \cdot m_e, +g \cdot m_e, +g \cdot m_P, -g \cdot m_P\}, i = e, p, P, E. \tag{21}$$

The g_i values are expressed with the elementary masses of the electron m_e, and the proton m_P, and with $g = +\sqrt{G \cdot 4 \cdot \pi}$. The specific gravitational charges, $g > 0$, are the same for all four elementary particles. Equations. (20) and (21) also show the signs of g_i. The Newtonian force $\mathbf{F}_{ij}^{(Newton)}(\mathbf{r})$ with two charges, g_i and g_i, corresponds to an attractive force between gravitational charges of the same sign (the original Newtonian equation featured the universal gravitation constant G) and a repulsive force for charges with different signs. This is contrary to the behavior of electric charges. Therefore, a sign change appears in Eqs. (15) and (16). The elton is a negatively charged proton, normally known in the particle physics as "antiproton". Euler and Lagrange used point-like masses with the same sign of g_i. The result was a purely attractive gravitational force.

With Eq. (20) and with conserved gravitational charges, g_i, the gravitational mass of an electrically-neutral isotope with the mass number A can be derived. Note: the isotope contains A protons and A electrons, can be derived as

$$m^g(A) \quad = A \cdot (m_P - m_e). \tag{22}$$

The gravitational mass is independent of the number of positrons N_p contained in an electrically-neutral isotope. Also the inertial mass of an isotope with N_p electron-positron pairs and with the bound energy, $E_{bound}(A)$, can be derived:

$$m^i(A) \quad = A \cdot (m_P + m_e) + 2 \cdot N_p \cdot m_e - E_{bound}(A)/c^2. \tag{23}$$

In Equations (22) and (23) it is assumed that there are no eltons present. From these equations it follows that the inertial mass and the gravitational mass are different. Acceleration in the Newtonian equation of motion in the gravitational field depends on A through the mass defect $Delta(A)$

$m^g(A)/m^i(A) = 1 + Delta(A)$.

The mass defect can be calculated with the known inertial masses of isotopes to $-0.109\% < Delta(A) < +0.784\%$. The value -0.109% belongs to the hydrogen atom and the greatest value $+0.784\%$ to the isotope ^{56}Fe.

4 Equation of Motion for the Particles

With the conserved elementary charges, q_i and g_i, we can express the four-current charge densities, $j^{(em)\nu}(x)$, $j^{(g)\nu}(x)$, as

$$j^{(em)\nu}(x) = \sum_{i=e,p,P,E} q_i \cdot j_i^{(n)\nu}(x), \tag{24}$$

$$j^{(g)\nu}(x) = \sum_{i=e,p,P,E} g_i \cdot j_i^{(n)\nu}(x), \tag{25}$$

written with the four-current particle number densities

$$j_i^{(n)\nu}(x) = (c \cdot \varrho_i(\mathbf{r},t), \mathbf{j}_i(\mathbf{r},t)), i = e,p,P,E. \tag{26}$$

Whereby the $\varrho_i(\mathbf{r},t)$ is the density of particles i and $\mathbf{j}_i(\mathbf{r},t)$ the appropriate current density. It should be noted that there is a difference between the meaning of $\varrho_i(\mathbf{r},t)$ and $\mathbf{j}_i(\mathbf{r},t)$, when looking at classical physics and quantum physics with discrete charges q_i and g_i. For classical physics $j_i^{(em)0}(x) = c \cdot q_i \cdot \varrho_i(\mathbf{r},t)$ in the expression

$$q_i = \varrho_i^{(em)0}(\mathbf{r},t)dV = c \cdot q_i \cdot \varrho_i(\mathbf{r},t)dV, \tag{27}$$

if the volume dV is sufficiently small and contains the charge q_i, the charge density is considered as a continuous function for the electric charge of the particle kind, i. In quantum physics $\varrho_i(\mathbf{r},t)$, $\mathbf{j}_i(\mathbf{r},t)$ and $j_i^{(em)\nu}(x)$, $i = e,p,P,E$ are exclusively the probability densities for charges and currents. The change in the meaning of $j_i^{(em)\nu}(x)$, respectively for $j_i^{(g)\nu}(x)$, is often forgotten when using Maxwell equation, Eq. (15). Setting equations (24) and (25) into Eqs.(15) and (16), we gain an expression of the equation of field motion with the elementary charges q_i and g_i and with the four-current probability densities for the particles $j_i^{(n)\nu}(x)$ of the kinds $i = e,p,P,E$.

To obtain the equations of particle motions, we first set the Lorentz scalar expression

$$L^{(p)}(x) = \sum_{i=e,p,P,E} m_i \cdot c \cdot \partial_\nu j_i^{(n)\nu}(x), \tag{28}$$

in the Lagrange density. The constants $m_i \cdot c$ are appropriately chosen to set in $L^{(p)}(x)$ together with the other terms. Furthermore, we have to express $j_i^{(n)\nu}(x)$ with something like a quadratic form in order to perform the variation of the action integral I to obtain the equations of particle motion. A form of $\psi_i * (x) \cdot \psi_i(x)$ with a complex valued scalar functions $\psi_i(x)$ in not suitable, because it would not correspond to the statements that NEITHER the positions, NOR the velocities of the particle are ever exactly known. For this reason we could chose the Dirac spinors $\Psi_i(x)$ and the adjoint spinors $\overline{\Psi_i(x)} = \Psi_i^*(x)\gamma^0$ for a suitable construction. Since we know the relation $j_i^{(n)\nu}(x) = (c\rho_i^{(n)}(x), \mathbf{j_i^{(n)}}(x))$, we can express $j_i^{(n)\nu}(x)$ as

$$j_i^{(n)\nu}(x) = c \cdot \overline{\Psi}_i(x)\gamma^\nu \Psi_i(x). \tag{29}$$

with the well known four-matrices γ^ν lending the correct transformation behaviors for the four-vectors $j_i^{(n)\nu}(x)$. The spinors can be normalized at each time $t = t_0$

$$\begin{aligned} \int_V j_i^{(n)0}(\mathbf{r})/c \cdot d^3r &= \int_V \Psi_i * (\mathbf{r})\gamma^0 \Psi_i(\mathbf{r}) d^3r \\ &= \int_V \sum_{k=0,3} \Psi_{i,k}^\star(\mathbf{r}) \cdot \Psi_{i,k}(\mathbf{r}) d^3r = N_i. \end{aligned} \tag{30}$$

The continuity equations $\partial_\nu \overline{\Psi}_i(x)\gamma^\nu \Psi_i(x) = 0$ take care to the time development of the spinors. Simultaneously, the continuity equations with Eq. (29)

$$\int_\Omega \partial_\nu j_i^{(n)\nu}(x)(dx)^4 = G_i = 0, \quad i = e, p, P, E \tag{31}$$

are the subsidiary conditions for the particles of the variation

$$\delta I + \sum_{i=e,p,P,E} \lambda \delta G_i = 0. \tag{32}$$

which produce a real valued Lagrange multiplier $\lambda > 0$ in finite space-time regions Ω. Indeed, we are expect more Lagrange multipliers, λ_i, with different values. For simplicity Eq. (32) is written with only one λ. The mathematical procedure considering boundary and subsidiary conditions for "continuous systems" is seldom used for basic statements in physics. It isn't used for the quantization of the probabilistic wave function, or for the spinors, or for the particle fields. Nevertheless, applying the Hamilton principle with the subsidiary conditions that $G_i = 0$ at the variation of the Lagrangian, we get the equation of motion for particle, i, and Lagrange multiplier, λ,

$$\begin{aligned} &(m_i \cdot c^2 + \lambda \cdot c) \cdot (\gamma^\alpha \partial_\alpha \Psi_i(x)) \\ &+ q_i \cdot c \cdot A_\alpha^{(e)}(x)\gamma^\alpha \Psi_i(x) = 0. \end{aligned} \tag{33}$$

Here, for simplicity, we have neglected the gravitation, but not the elementary masses, m_i. This differential equation is linear in all derivations and Eq. (33) expresses the movement of particle i within the framework of the new basic principle. This is a completely new definition of particle motions compared to classical physics and non-relativistic quantum mechanics (as described by the Schrödinger equation).

5 Relativity for the Motion of Particles

This framework automatically leads to relativity if we want to consider bound states of two (or more) particles in their mutual interaction which is temporally stationary. In classical physics it is easy to separate the motion of center of mass COM (with mass $m_{ij}^{COM} = m_i + m_j$), and the relative motion with the reduced mass, $m'_{ij} = \frac{m_i \cdot m_j}{m_i + m_j}$. But this relativity has nothing to do with the SR or GR theories. Within this framework one can address two different motions with m_{ij}^{COM} and m'_{ij}. But the treatment of temporally stationary motion of two particles in the mutual interaction corresponds to the treatment of conditional probability: if particle j is at the position x_j what would be the probability of finding the particle i in a distance of $x_{ij} = x_i - x_j$. Concerning the relative motion of particle i we disregard the frame independent condition and the Lorentz invariance of the relative motion and a new condition appears: we are looking for timely stationary relative motions. As a condition, we can assume the condition that both particles are simultaneously within a space-time region Ω'. That is, particle numbers conservation in Ω' is also valid and so Lagrange multipliers appear. However, the Lagrange density of the relative motions concerns conditional probabilities. We should always bear this circumstance in mind if we consider the Dirac Lagrange density of the conventional quantum theory:

$$L^{QT} = -i\hbar c \overline{\Psi} \gamma_\alpha (\partial^\alpha - ieA^{(em)\alpha})\Psi - m'c^2 \overline{\Psi}\Psi - 1/4 \cdot F_{\mu\nu}^{(em)} F^{(em)\mu\nu}, \qquad (34)$$

which gives the movement of a particle with the mass, m', and with the electric charge, e. At the position of the Lagrange multiplier, λ, the Planck constant $\hbar = h/2\pi$ appears. Anyhow $\hbar$ incorporates λ and the condition that the motion is timely stationary. The Dirac Lagrange density in Eq. (34) is also distinguished from our Lagrange density. The calculation of the Planck constant, h, derived by Sommerfeld, $h = e^2/2c \cdot \sqrt{m' \cdot c^2/2 \cdot E_{bound}} = e^2/2c \cdot 1/\alpha$ is really not understood within the conventional quantum mechanics, i.e. it is not known why is $\alpha = 1/137.01$. The expression $\sqrt{2 \cdot E_{bound}/m' \cdot c^2}$ was interpreted as relative velocity v/c in the mutual interaction. This relative velocity could be near c, even if the COM motion is far away to be relativistic. The E_{bound} is the radiated energy of the many-particle motion in the mutual interaction and this term appears also in the expression of inertial mass, Eq. (23). As the inertial mass, m^i, cannot be less then zero, the radiated energy E_{bound}/c^2 can be maximal equal to the sum of particle masses composing a may-body system. However, the stable elementary particles can never be annihilated or created.

Summary

New basic postulates in physics were set up and compared with the known postulates of QT, SR and GR. Within the new basic postulates, the equations of motions for the electromagnetic and gravitational fields are derived in a unified level. The introduction of conserved elementary gravitational charges, g_i, and the determination of their physical properties allowed the construction of a gravitation model also for particle physics. The action integral, I, is not an expression for energy; it deals with non-conservative interactions in finite space-time regions, Ω. The equations of motions for the fields and particles were derived from a Lorentz scalar action integral within a Lorentz-invariant theory (LIT). The interactions between stable particles are caused by two continuous fields, electromagnetism and gravitation. The fields are generated by two kinds of conserved discrete/quantized charges. Completely new differential equations were presented for the motions of particles, as usually used in classical physics, or non-relativistic quantum mechanics. The classical Newtonian equation of motion in a gravitational field was also enhanced, because there is a difference between the inertial mass, m^i, and the gravitational mass, m^g. The new basic postulates have led to an atomistic physics, based on four kinds of stable elementary particles. None of the conventional energetic physics, $m^i = m^g$, $E = mc^2$ and $E = h\nu$ have been retained. Furthermore, the concept of wave-particle dualism can now be disregarded. Since neither the positions, nor the velocities of particles can be exactly observed, the identical acceleration of each body (the UFF) within a gravitational field can also not be assumed. The validity and the distinction of SR and GT are scientifically questionable. This paper has shown that the laws of physics are non-deterministic, however causal. Quod erat demonstrandum

References:

The literature for this paper is taken from the (self-) published works of the author. Previously, reviewers of physical journals have declined all publications on this development. The Atomistic Theory is defined in the book: *Physics of Elementary Processes; Basic Approach in Physics and Astronomy, Cerberus, Budapest (2005) ISBN: 963 219 791 7.* Almost all sections of the book are also available on the website *www.*atomsz.com.

Several accompanying articles are also published there. The most important articles are

The Atomistic Theory of Matter: Stable particles and a Unified Field,

Physikalische Evidenz; Experimentelle Bestätigung gegen empirische Behauptung,

Paradigmenwechsel in der Physik,

Variationsprinzipien: klassische Massenpunkte und stabile Teilchen mit Feldern.

A new work with the title *Lorentz-Invariant Theory; Unified Theory of Electromagnetism and Gravitation* is ready and appears soon.