Torsion theory, a classically quantized physical theory

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Introduction

It is well known that every physical theory is an attempt to translate our observations into a formula which clarifies these observations, puts them in order and provides the means to explain situations which occur. There is a metaphysical desire of physici hidden in this attempt. That is, that every event should be declarable by universal laws. The success of present-day physical knowledge creates the assumption that this metaphysical desire will one day be fulfilled. However, at this moment in time, we are far from achieving that universal theory.
To acquire such a theory, it seems necessary to describe, as principally as possible, all aspects of observation. These aspects, called principles, should be dealt with as unprovable suppositions.
The set of principles must not contradict each other and must cover, as far as possible, all observations which are done and verified.

That the principles fulfil these two requirements cannot be proved satisfactorily at this moment. So the only sensible step to take is the trial and error method.

To specify this further:

a. Make a choice of principles by intuition;
b. Develop a theory out of these principles;
c. Compare this theory to the observations.

This paper reports on tasks a and b.
The comparison of theory and observations is, of course, a task for us all.

1. Principles

Principle 1

The physical theory is described in a four-dimensional differential geometry.
(Gauss, Riemann, Lorentz, Einstein, Minkovsky, H. Weyl,).

Principle 2

Physics is quantized.
(Avogadro, Lohschmidt, Boltzmann, Planck, Bohr,).

Principle 3

Measurement instruments are realizations of physics.
(Man, photon, clock, rod, ...)

Principle 4

There are distinct particles.

Principle 5

Previous observations brought together in well-verified theories must either be incorporated into the new theory, or they must be incorporated approximately. This approximation must then be within the tolerance arising from the measurement inaccuracy in verifying the theory.

2. Method

Principle 1 gives a set of four coordinates:

$$\{x,y,z,t\} = \{x^a\}, \quad a \in \{1,2,3,4\}. \tag{2.1}$$

to describe the geometry.

If equal physical laws describe two universa, and if the first universum, in a domain, differs slightly from the description of an agreeing domain in the second universum, then I call this difference in the description a forcing function.

Principle 2 states that there is a quantity, the action W, which is quantized. So, this action is insensible to forcing functions.
Thus, W is a functional over space-time, to be created by a volume integral over a Lagrange density L.

$$W = \int L \, dvol. \quad , \text{ with } \delta W = 0 \qquad (2.2)$$

In the four-dimensional geometry a volume element must be defined and a scalar density field, L.
Suppose that this physics is described over a set of fields, E, and over the partial derivatives of E (of sufficient high order), then L is a function of these fields.

Principle 2, the forcing function insensibility of W, gives that the Lagrange derivative from L to E must be zero. This is a wave equation. So, there is a wave equation over E which describes this physics.

Principle 5, the Michelsen-Morley experiment, asks for a geometry with zero directions. Thus there must be a tensor field g_{ab} so that

$$g_{ab} \; dx^a dx^b = 0 \qquad (2.3)$$

has solutions dx^a. The space of solutions has dimension three.
With this condition g_{ab} is defined in proportionality, so the geometry must be a conformal geometry.

Principle 3. Measurement instruments are solutions of the wave equation which are stationary during the time that the instrument exists.

Principle 5. Thus every physical measurement is the mutual comparison of two or more parts of the solution of the wave equation.

There are no measurements which are able to measure the length, ds, in the sense of a Riemann geometry.

$$ds^2 = g_{ab}dx^a dx^b \ .$$

For, "ds" is not expressable in the solutions of the wave equation.

Therefore the geometry which must be used in this theory cannot be a Riemann geometry, but has to be a conformal geometry.
(With regard to the Riemann geometry the gauge factor is lacking. As the tensor field g_{ab} is a solution for the wave equation, every $'g_{ab} = \tau^2 g_{ab}$ satisfies the wave equation.
Here τ is an undefined function of x, unequal to zero. τ is called the gauge function).

From here follows that there is no absolutely defined unit of length and thus the action W from principle two is a number without physical dimension. The Lagrange density has consequently the dimension $[\text{time}^{-4}]$.
L dvol must be gauge invariant.

Principle 4. Separated particles are realized by stating that there is, per particle, a world line with a short distance surrounding, where the Lagrange density differs considerably from zero.
Vacuum is then the domain in which L is approximately zero.

Principle 5. Electromagnetism is described with the skewsymmetric tensor field F_{ab}. The first set of Maxwell equations reads $\partial_{[a}F_{bc]} = 0$.
These are the integrability conditions for:

$F_{bc} = \partial_{[b}\phi_{c]}$, in which ϕ_a is the e.m. four-potential. (2.4)

If F^*_{bc} is the tensor dual to F_{bc}, then the second set of Maxwell equations for vacuum reads:

$$\partial_{[a} \overset{*}{F}_{bc]} = 0, \qquad (2.5)$$

These are the integrability conditions for

$$\overset{*}{F}_{bc} = \partial_{[b} \theta_{c]}. \qquad (2.6)$$

Thus the electromagnetic field theory for vacuum will be realized if for $L = 0$ out of the fields $\{E\}$ and their derivatives two vector fields ϕ and θ can be made which satisfy:

$$\left(\partial_{[b}\phi_{c]}\right)^{*} = \partial_{[b}\,\theta_{c]}. \tag{2.7}$$

The Einstein gravitation theory <u>for vacuum</u> is defined over a Riemann geometry by means of the Ricci tensor K_{ab} through the formulation:

$$K_{ab} = \frac{1}{4}\,\Lambda\, g_{ab} \tag{2.8}$$

in which Λ is the cosmological constant and g_{ab} is the fundamental tensor.

For incorporating this theory in a conformal geometry, it is necessary to find an appropriate gauge factor where

$$K_{ab} - \frac{1}{4}\,\Lambda\, g_{ab} = 0 \quad \text{holds for } L = 0, \text{ vacuum.} \tag{2.9}$$

Afterwards, this expression must be written in gauge invariant form. The appropriate gauge factor has to relate the Einstein clock, ds, to the solution of the wave equation which serves as a clock in this theory.

Principle 5. In quantum mechanics and quantum field theory the behaviour of particles is described by means of the wave function Ψ. Often Ψ has a dimension greater than one.

A characteristic of the particle, the mean presence, is described, in quantum physics, by the innerproduct, $\Psi\,\Psi^{*}$. Ψ is a solution of the quantum wave equation.

This wave equation is constructed by translation in a Lagrange density, the classical behaviour of the particle, the symmetries and the quantum numbers, and applying Hamiltonian calculus to this Lagrangian density.

A rôle is played by:

Energy-impulse, mass, nucleon number, lepton number, charge, spin, isospin,.....

The solutions can be very robust. Note the stationarity of electron, proton and neutron.

In this theory none of the above qualities is mentioned except for L. L is to be compared to $\Psi\Psi^*$ and also to the above-mentioned Lagrangian density.
This is why I choose for L the squared structure:

$$L = H_{bc} H^{bc} \quad , \text{ or} \tag{2.10}$$

$$L = H_{bc} H^{cb} \quad . \tag{2.11}$$

$H_{(bc)} = 0$ has to deliver the gravitation condition for vacuum (see eq. 2.9 and par. 5).
$H_{[bc]} = 0$ has to deliver the electromagnetic condition for vacuum (see eq. 2.7 and par. 5).
H_{bc} must be a function of a tensor which lodges enough symmetries to conserve all above mentioned quantum numbers.
H_{bc} must be, for some solutions (electron, proton, neutron), robust against rather large forcing functions.
H_{bc} must be gauge invariant (see par. 4).

In the Einstein gravitation theory the mass energy density is given by the Gaussian curvature K diminished by the cosmological constant Λ.
This theory must also yield, in the appropriate gauge:

$$L \neq 0 \Rightarrow K - \Lambda \neq 0$$

and $L = 0 \Rightarrow \Lambda$ is approximately constant.
(The constantness of the cosmological constant has not yet been verified).

3. Macrophysics, microphysics

Microphysics is the physics which is described by quantum mechanics and quantum fields.

Historically speaking, microphysics starts with Planck.

Macrophysics describes the great phenomena. Historically speaking, the development of macrophysics stops with the gravitation theory of Einstein, though refinements and small corrections still come to light. In this paper microphysics and macrophysics act together in one formulation.

The microphysical parts provide constantness of the moments, in which, under the name "moments" such quantities as:

charge, mass, energy, impulse, spin, ...

are included.

The macrophysical part has to describe the behaviour of the moments. To split these two aspects from an unknown wave equation succeeds only in the vacuum situation, and then only under the condition that gravitation field and electromagnetic field are mutually independent.

Vacuum: $$0 = L = H_{bc}\ H^{bc} \text{ or } H_{bc}\ H^{cb} = \qquad (3.1)$$

$$= H_{(bc)}\ H^{(bc)} \pm H_{[bc]}\ H^{[bc]}$$

The skewsymmetric tensor $H_{[bc]}$ must describe the equation (2.7) under vacuum conditions.

Therefore all six components of this tensor must be made zero in vacuum by an internal condition which is fulfilled for vacuum.

For the symmetric part of H_{bc} yields:

$$H_{(bc)}\ H^{(bc)} \geqslant 0. \qquad (3.2)$$

So for only gravitation field in vacuum holds:

$$L = 0 \Rightarrow H_{(bc)} = 0.$$

The gravitation equation for vacuum has only nine degrees of freedom, because

$$K_{ab} - \frac{1}{4} \Lambda g_{ab} = 0$$

implies the identity:

$$g^{ab}(K_{ab} - \frac{1}{4} g_{ab} \Lambda) = K - \Lambda = 0.$$

4. Geometry

The metrical-symmetrical differential geometry of Riemann is supposed to be well-known.

For study, the literature has to be consulted, e.g. Schouten or Bishop-Goldberg.

Only a summary is given some additions to deal with the aspects of conformal geometry which are necessary to understand this paper.

The space-time M is assumed to be a paracompact, Hausdorff, connected C^∞ four-dimensional manifold with a locally Lorentzian metric g.

Let U be a local coordinate neighbourhood of $p \in M$ with local coordinates $x = \{x^a\}$, then the coordinate basis is introduced:

$$\underline{B} = \{\underline{B}_a\} = \left\{ \left(\frac{\partial}{\partial x^a}\right)_p \right\}$$

with a = 1,2,3,4, and the dual basis is also introduced.

$$\underline{B}^* = \{\underline{B}^a\} = \{(\underline{dx}^a)_p\}$$

Every vector $\underline{V}$ at p can be written as $\underline{V} = V^a \underline{B}_a$.

The metric tensor $\underline{g}$ is written as

$$\underline{g} = g_{ab} \, \underline{B}^a \otimes \underline{B}^b , \qquad (4.1)$$

where the metric components are the inner products of the coordinate basis vectors,

$$g_{ab} = g(\underline{B}_a, \underline{B}_b) = g(\underline{B}_b, \underline{B}_a) . \qquad (4.2)$$

A system of four orthonormal vector fields $\underline{E}(p) = \{\underline{E}_A(p)\}$ is introduced such that

$$g(\underline{E}_A, \underline{E}_B) = g(\underline{E}_B, \underline{E}_A) = \eta_{AB} , \tag{4.3}$$

where

$$\eta = \{\eta_{AB}\} = \text{diag } (1,1,1,-1) \text{ and } A,B = (I,II,III,IV).$$

The vector fields, $\underline{E}(p) = \{\underline{E}_A(p)\}$, are expressed in the coordinate basis by

$$\underline{E}_A = E^b_A \underline{B}_b . \tag{4.4}$$

The dual vector fields $\underline{E}^*(p) = \{\underline{E}^A(p)\}$ are expressed in the dual coordinate basis by

$$\underline{E}^A = E^A_b \underline{B}^b. \tag{4.5}$$

Conversely, it follows that

$$\underline{B}^b = E^b_A \underline{E}^A \text{ and } \underline{B}_b = E^A_b \underline{E}_A . \tag{4.6}$$

The components $\{E^a_A\}$ and $\{E^B_b\}$ are 32 functions of x which satisfy:

$$E^a_A E^A_b = \delta^a_b , \quad E^b_A E^B_b = \delta^B_A \tag{4.7}$$

$$E^A_a \eta_{AB} E^B_b = g_{ab} , \quad E^a_A g_{ab} E^b_B = \eta_{AB} . \tag{4.8}$$

From (4.5) it follows that for any vector

$$\underline{V} = V^b \underline{B}_b = V^A \underline{E}_A. \tag{4.9}$$

The components satisfy

$$V^A = E^A_b V^b \text{ and } V^b = E^b_A V^A . \tag{4.10}$$

This rule of converting upper case indices to lower case indices and vice versa is applied to any tensor of higher rank.

The linear affine connection $\underline{\Gamma}$ is metrical and symmetrical and satisfies

$$\nabla_a g_{bc} = \partial_a g_{bc} - \Gamma_{ab}{}^{e} g_{ec} - \Gamma_{ac}{}^{e} g_{be} = 0. \tag{4.11}$$

Therefore

$$\Gamma_{ab}{}^{c} = \Gamma_{ba}{}^{c} = \Gamma_{(ab)}{}^{c} = \left\{{c \atop ab}\right\} = \frac{1}{2} g^{cd} \left\{\partial_a g_{db} + \partial_b g_{ad} - \partial_d g_{ab}\right\}. \tag{4.12}$$

$\Omega_{(abc..)}$ is the sum of components of Ω with indices being permutations of (abc..), divided by the number of permutations.

$\Omega_{[abc..]}$ is the sum of components of Ω with indices being even permutations of (abc..), diminished with the sum of components of Ω with indices being odd permutations of (abc..), and this difference divided by the sum of permutations.

$$\varepsilon_{\mathrm{I\ II\ III\ IV}} \stackrel{\underline{\underline{\mathrm{def}}}}{} 1 \ , \qquad \varepsilon_{ABCD} \stackrel{\underline{\underline{\mathrm{def}}}}{} \varepsilon_{[ABCD]} \ , \tag{4.13}$$

$$\varepsilon_{abcd} = \varepsilon_{ABCD} E^A_a E^B_b E^C_c E^D_d \ , \qquad \frac{\varepsilon}{2}{}_{ab..}{}^{pq} \frac{\varepsilon}{2}{}_{pq..}{}^{cd} = -\delta^{cd}_{[ab]}, \tag{4.14}$$

$$\mathrm{dvol} \stackrel{\underline{\underline{\mathrm{def}}}}{} \varepsilon_{abcd}\ \underline{dx}^a \otimes \underline{dx}^b \otimes \underline{dx}^c \otimes \underline{dx}^d \ . \tag{4.15}$$

$$T_{ab}{}^{B} \stackrel{\underline{\underline{\mathrm{def}}}}{} \nabla_a E^B_b \ , \quad T_{abc} = T_{ab}{}^{B} E^d_B g_{dc} = T_{ab}{}^{B} E_{Bc} \ , \ T_{a(bc)} = 0, \tag{4.16}$$

$$S_{ab}{}^{B} \stackrel{\underline{\underline{\mathrm{def}}}}{} \nabla_{[a} E^B_{b]} = \partial_{[a} E^B_{b]} = T_{[ab]}{}^{B} \ , \quad S_{abc} = S_{ab}{}^{B} E_{Bc} \ . \tag{4.17}$$

The following identity between T and S holds:

$$T_{abc} = S_{abc} - S_{bca} + S_{cab} \ . \tag{4.18}$$

$$S_a \stackrel{\underline{\underline{\mathrm{def}}}}{} \frac{2}{3} S_{ab}{}^{b} \ , \quad P_q \stackrel{\underline{\underline{\mathrm{def}}}}{} \frac{1}{3} \varepsilon_q{}^{ab}{}_c S_{ab}{}^{c} \ . \tag{4.19}$$

$$X_{ab}{}^{c} \stackrel{\underline{\underline{\mathrm{def}}}}{} S_{ab}{}^{c} - S_{[a} \delta^{c}_{b]} + P_q \frac{\varepsilon^q}{2}{}_{.ab}{}^{c} \ . \tag{4.20}$$

with: $$X_{[abc]} = 0\ ,\ X_{(ab)c} = 0 \text{ en } X_{ab}{}^{b} = 0. \tag{4.21}$$

It now follows that $X_{ab}{}^{c}$ has 16 degrees of free-dom.

$$P_{ab}{}^{c} \stackrel{\text{def}}{\equiv} S_{pq}{}^{c}\ \frac{\varepsilon}{2}\ ab\ \overset{pq}{\cdot\cdot} = P_{[a}\delta^{c}{}_{b]} + S_{q}\frac{\varepsilon}{2}{}^{q}\ {}_{ab}{}^{c} + Y_{ab}{}^{c} \tag{4.22}$$

with: $$Y_{ab}{}^{c} \stackrel{\text{def}}{\equiv} \frac{\varepsilon}{2}\ ab^{pq}\ X_{pq}{}^{c}\ . \tag{4.23}$$

And so: $$Y_{[abc]} = 0,\ Y_{(ab)c} = 0 \text{ en } Y_{ab}{}^{b} = 0. \tag{4.24}$$

Where: $$S_{ab}{}^{c} = \nabla_{[a}E^{C}{}_{b]} = \partial_{[a}E^{C}{}_{b]}\ , \tag{4.25}$$

follows the identity:

$$\nabla_{[a}S_{bc]}{}^{D} = \partial_{[a}S_{bc]}{}^{D} = \partial_{[a}\partial_{b}E^{D}{}_{c]} = 0 \rightarrow \nabla_{a}P^{abD} = 0. \tag{4.26}$$

After some reduction this gives:

$$(2S_{(b}+\nabla_{(b})P_{c)} + \frac{1}{2}(-4S_{a} + \nabla_{a})P^{a}\ g_{bc} = \tag{4.27}$$

$$= 2(-S_{a}+\nabla_{a})\ Y^{a}(bc) + P_{a}X^{a}{}_{(bc)} + 2X^{ae}{}_{b}\ Y_{aec}$$

and

$$\nabla_{[b}P_{c]} + \varepsilon^{qa}{}_{bc}\ \nabla_{a}S_{q} = (-3S_{a}+\nabla_{a})Y_{bc}{}^{a} + \frac{3}{2}\ P_{a}\ X_{bc}{}^{a} \tag{4.28}$$

Notice that in (4.28) the Maxwell equations for vacuum (see 2.7) remain under the condition that $X_{ab}{}^{c} = 0$.

The Riemann curvature tensor is defined by:

$$K_{abc}{}^{d} = 2\ \partial_{[a}\left\{{}_{b]c}^{\ d}\right\} + 2\ \left\{{}_{e[a}^{\ d}\right\}\left\{{}_{b]c}^{\ e}\right\}. \tag{4.29}$$

$$K_{bc} \stackrel{\text{def}}{\equiv} K_{abc}{}^{a}\ ,\ K \stackrel{\text{def}}{\equiv} K_{b}{}^{b}\ ,\ G_{bc} \stackrel{\text{def}}{\equiv} K_{bc} - \frac{1}{2}\ Kg_{bc}, \tag{4.30}$$

with: $\nabla_b G^b_c = 0.$ (4.31)

$$\left(K_{bc}+2\nabla_{(b}S_{c)}+2S_bS_c+g_{bc}\nabla_aS^a-2g_{bc}S_aS^a\right)+\tfrac{1}{2}\left(g_{bc}P_aP^a\right)-\left(\tfrac{1}{2}P_bP_c\right)=$$

$$=-2(-S_a+\nabla_a)X^a{}_{(bc)}+\left(P_aY^a{}_{(bc)}\right)-2\left(X^{ae}{}_b\,X_{aec}\right) \qquad (4.32)$$

If the orthonormal vector fields $\underline{E}(p)$ are transformed in

$$'\underline{E}(p)=\left\{'\underline{E}_A(p)\right\}=\left\{'E_A{}^b\,\underline{B}_b(p)\right\},\ \text{with}\ \ 'E^b_A=\frac{1}{\tau}E^b_A\,,$$

(τ is a scalar function of x, unequal to zero), then the geometry is transformed into another Riemann geometry. This transformation is called conform.

The components of the fundamental tensor are transformed in:

$$'g_{ab}=\tau^2g_{ab},\ 'g^{ab}=\frac{1}{\tau^2}\,g^{ab}. \qquad (4.33)$$

The Christoffel symbols transform as:

$$'\left\{{e \atop ab}\right\}=\frac{1}{2}\,'g^{cd}\left(\partial_a\,'g_{bd}+\partial_b\,'g_{ad}-\partial_d\,'g_{ab}\right)=$$

$$=\left\{{c \atop ab}\right\}+2\delta^c_{(a}\partial_{b)}\ln\tau-g^{cd}g_{ab}\partial_d\ln\tau. \qquad (4.34)$$

$$'S_a=\frac{2}{3}\,'E^b_B\,\partial_{[a}\,'E^B_{b]}=\frac{2}{3}\left(E^b_B\partial_{[a}E^B_{b]}+\frac{1}{\tau}\,\delta^b_{[b}\partial_{a]}\tau\right)=S_a+\partial_a\ln\tau. \qquad (4.35)$$

$$'g^{bp}\,'g^{cq}\,'dvol='g^{bp}\,'g^{cq}\,\varepsilon_{ABCD}\,'E^A_a\,'E^B_b\,'E^C_c\,'E^D_d\,\underline{dx}^a\otimes\underline{dx}^b\otimes\underline{dx}^c\otimes\underline{dx}^d=$$

$$=\frac{g^{bp}}{\tau^2}\frac{g^{cq}}{\tau^2}\,\varepsilon_{ABCD}\,\tau E^A_a\,\tau E^B_b\,\tau E^C_c\,\tau E^D_d\,\underline{dx}^a\otimes\underline{dx}^b\otimes\underline{dx}^c\otimes\underline{dx}^d=$$

$$=g^{bp}g^{cq}dvol. \qquad (4.36)$$

Thus this last form is invariant under conformal transformation. Other tensor components, which are invariant under conformal transformation, as is apparent from similar calculations, are:

$$P_a,\ X_{ab}{}^c,\ Y_{ab}{}^c,\ \nabla_{[b}S_{c]},\ \nabla_{[b}P_{c]},\ \delta_a^b,\ \varepsilon_{ab}{}^{cd},\ g_{ab}g^{cd},$$

$$(3S_a-\nabla_a)X_{bc}{}^a,\ (3S_a-\nabla_a)Y_{bc}{}^a,\ (S_a-\nabla_a)Y^a{}_{(bc)},\ (S_a-\nabla_a)X^a{}_{(bc)},$$

$$(2S_{(b}+\nabla_{(b})P_{c)} - g_{bc}P_aS^a\ ,$$

$$K_{bc} + 2\nabla_{(b}S_{c)} + 2S_bS_c + \nabla_aS^ag_{bc} - 2S_aS^ag_{bc}\ .$$

Where the action, $W = \int L\ dvol = \int H_{bc}H_{pq}g^{bp}g^{cq}\ dvol$, has to be invariant under conformal transformation, consequently H_{bc} is invariant under conformal transformation (see 4.36).

H_{bc} has the physical dimension $[\text{time}^{-2}]$.

5. The Lagrange density

All the quantities given in par. 4 are derived from the components of the orthonormal vector fields E and the partial derivatives of these components.

There are only 15 degrees of freedom in E with regard to the variational calculus.

The 16th degree of freedom is the gauge factor τ. This freedom must be used to fit the Einstein theory optimal within this theory.

I call the most suitable Riemann geometry the Einstein gauge.

The wave equation which follows from variational calculus on the Lagrange density describes therefore only 15 degrees of freedom.

In general there can be 16 degrees of freedom in H_{bc} but the wave equation is capable, via microphysical aspects, of controlling only 15 degrees.

The vacuum condition

$$H_{bc} = 0 \qquad (5.1)$$

is thus allowed to describe only 15 degrees of freedom.

This is realized if H_{bc} satisfies:

$$g^{bc} H_{bc} = 0 \qquad (5.2)$$

and this agrees with the number of degrees of freedom which are necessary to describe the Einstein and Maxwell vacuum fields.

From

$$\partial_{[a} S_{bc]}{}^{D} = 0, \ (4.26), \ \text{follows:}$$

$$\nabla_{[b} P_{c]} + \varepsilon^{qa}_{\ \cdot\cdot\ bc} \nabla_a S_q = \left(-3S_a + \nabla_a\right) Y_{bc}{}^{a} + \frac{3}{2} P_a X_{bc}{}^{a} . \qquad (4.28)$$

If the right member of this equation is zero, then the left member equated to zero shows the Maxwell conditions for vacuum (2.7).

Certainly the right member is zero if $X_{bc}{}^{a}$ is zero, but then 16 degrees of freedom are claimed to fulfil the Maxwell conditions for vacuum.

It is sufficient to choose for $H_{[bc]}$:

$$H_{[bc]} = (-3S_a + \nabla_a) Y_{bc}{}^{a} + \frac{3}{2} P_a X_{bc}{}^{a}, \qquad (5.3)$$

and it is supposed that $X_{ab}{}^{c}$ are very small for vacuum without neutrinos.

This expresses that $X_{ab}{}^{c}$ for the Lagrange density L fulfils the same rôle as Ψ fulfils in quantum field theory.

Indeed the physical dimension of this $H_{[bc]}$ is $[\text{time}^{-2}]$, and this $H_{[bc]}$ is invariant under conformal transformation.

For the introduction of the gravitation conditions in this theory it seems necessary to dispose of the correct gauge. But this cannot be found because the wave equation, which generates the physical time, is not yet available.

Throughout, it is only possible to choose for $H_{(bc)}$ a conformally invariant form with physical dimension $[\text{time}^{-2}]$, having $X_{ab}{}^{c}$ as internally defining components, which fulfils the Einstein conditions in vacuum for some Einstein gauge.

Here identity (4.32) must be used.

$$\left(K_{bc}+2\nabla_{(b}S_{c)}\right) + 2S_bS_c + g_{ab}\nabla_aS^a - 2g_{bc}\nabla_aS^a\big) - \left(\tfrac{1}{2}P_bP_c\right) + \left(\tfrac{1}{2}g_{bc}P_aP^a\right) =$$

$$= -\left(2(-S_a+\nabla_a)X^a{}_{(bc)}\right) + \left(P_aY^a{}_{(bc)}\right) - \left(2X^{ae}{}_bX_{aec}\right) . \qquad (4.32)$$

All terms between ( ) are invariant under conformal transformation.

In the absence of the electromagnetic field holds: $\nabla_{[b}S_{c]} = 0$ then S_c is a gradient field and can be made by re-gauging zero.

In that gauge holds:

$$K_{bc} - \frac{1}{2}P_bP_c + \frac{1}{2}g_{bc}P_aP^a \overset{*}{=} -2\nabla_aX^a{}_{(bc)} + P_aY^a{}_{(bc)} - 2X^{ae}{}_bX_{aec} , \quad \text{(special gauge)} \qquad (5.4)$$

and $$K + \frac{3}{2}P_aP^a \overset{*}{=} -X^{acb}X_{acb} . \quad \text{(special gauge)} \qquad (5.5)$$

It turns out to be impossible to combine

$$K_{bc} - \frac{1}{4}g_{bc}K = 0 , \qquad (2.9)$$

with the requirement that $H_{(bc)}$ is an operation on $X_{ab}{}^c$.
The invariant form could be chosen:

$$H_{(bc)} = \frac{1}{2}P_bP_c - \frac{1}{8}g_{bc}P_aP^a - 2(-S_a+\nabla_a)X^a{}_{(bc)} + P_aY^a{}_{(bc)} -$$

$$- 2X^{ae}{}_bX_{aec} + \frac{1}{2}g_{bc}X^{aed}X_{aed} =$$

$$= K_{bc} + 2\nabla_{(b}S_{c)} + 2S_bS_c - \frac{1}{4}g_{bc}(K+2\nabla_aS^a+2S_aS^a). \qquad (5.6)$$

In the above mentioned gauge this should be:

$$H_{(bc)} \overset{*}{=} K_{bc} - \frac{1}{4}Kg_{bc} \quad \text{(special gauge)} \qquad (5.7)$$

That choice, which agrees as far as possible with the Einstein concept of gravitation, suffers from the following disadvantages:

a. The wave equation which is derived from this Lagrange density has, as an only solution for the Maxwell-free universum, L constant.Vacuum. (see appendix A).

b. $H_{(bc)}$ is not only an operation on $X_{ab}{}^{c}$ but also on P_a.

c. In an universum with electromagnetic fields still holds for the vacuum part:

$$K_{bc} - \frac{1}{4} g_{bc} K \overset{*}{=} 0_{\text{(vacuum, special gauge)}}$$

while the Bianchi identity gives:

$$\nabla^b\left(K_{bc} - \frac{1}{2} g_{bc}K\right) = 0, \qquad (4.31)$$

together leading to the conclusion that K is constant in this special gauge, for the vacuum part.

Consideration c, the stationarity of the vacuum domain of the universum, as far as this domain is connected, has some unacceptable consequences:

There is no "big bang"
An explanation for Hubbles constant is absent.
Currently accepted theories concerning the creation of galaxies do not fit in a stationary universum.
There is no place for the evolution of the gravity "constant".

Brans-Dicke describe the evolution of the gravitational constant in such a way that the Einstein theory is a special case of their theory.
It is important to know that within this theory it cannot be decided by observation if the Einstein theory is correct.
At present, observational tests are not capable of clarifying this matter.
For this reason I too suggest a small correction on the Einstein theory. This correction will be small, under the condition that $P_b P_c$ are small in relation to K_{bc} here and now. Nevertheless, this correction must be sufficient to introduce the above mentioned aspects into this theory.

For this reason I <u>choose</u>:

$$H_{(bc)} \stackrel{*}{=} (K_{bc} - \frac{1}{2} P_b P_c) - \frac{1}{4} g_{bc} \; (K - \frac{1}{2} P_a P^a)_{\text{(special gauge)}} \quad (5.8)$$

which can be written in invariant form as:

$$A\,H_{(bc)} = -2(-S_a + \nabla_a)X^a{}_{(bc)} + P_a Y^a{}_{(bc)} - 2X^{ae}{}_b X_{aec} + \frac{1}{2} g_{bc} X^{aed} X_{aed}. \quad (5.9)$$

(A is a proportionality constant with regard to $H_{[bc]}$).

This gives:

1st $H_{(bc)}$ is conform invariant.

2nd $H_{bc} g^{bc} = 0$

3rd $H_{(bc)}$ is an operation on $X_{ab}{}^c$

4th The gravitation-constant is not constant.

5th The universum is not stationary and therefore has an evolution.

6th $H_{(bc)}$ has dimension $[\text{time}^{-2}]$.

With A = 1 this gives:

$$H_{bc} = H_{(bc)} + H_{[bc]} = (2S_a X_{bc}{}^a + P_a Y_{bc}{}^a + 2(-S_a + \nabla_a) \quad X^a{}_{bc} -$$

$$- P_a Y^a{}_{bc} + 2X^{ae}{}_b X_{aec} - \frac{1}{2} g_{bc} \quad X^{aed} X_{aed}) \quad (5.10)$$

Both $L = H_{bc} H^{bc}$ and $L = H_{bc} H^{cb}$ will create a wave equation by equating the Lagrange derivative of L to E to zero.

It is likely that these two wave equations describe two different physics.

Which of the two is most suitable to our observations has not yet been analysed.

6. An approximation of the Einstein gauge

The above created theory interprets the presence of $(\text{matter})^2$ density within a conformal geometry within the quantity $(X_{abc}X^{abc})^2$, (with physical dimension $[\text{time}^{-4}]$).

Within the Einstein gravitation theory mass energy density is described by K.

With the aim of making the two theories mutually comparable, it is possible to introduce an extra gauge condition.

This will fix the 16th degree of freedom in E by means of a voluntary choice, no physical necessity exists for this.

Where

$$-K = 2X^{acd}X_{acd} + 6\nabla_a S^a - 6S_a S^a + \frac{3}{2} P_a P^a , \qquad (6.1)$$

the following

$$\nabla_a S^a - S_a S^a + \frac{1}{4} P_a P^a = 0 \qquad (6.2)$$

seems a good choice for local problems.

On cosmoligical scale, an Einstein gauge is certainly impossible, while the Einstein conditions, slightly modified, are introduced in $H_{(bc)}$.

A better name for the above proposed gauge would be: Brans-Dicke gauge.

7. Interactions

Quantum mechanics and quantum fields use a well-known formalism to introduce the external electromagnetic force, namely: $\underline{\partial}_a$, the partial derivative operator, becomes:

$$j\phi_a + \partial_a , \qquad (7.1)$$

in which ϕ_a is the external electromagnetic four-potential.

In this paper it is not yet clear whether S_a or P_a, or perhaps a linear combination of these two vectors will act as the electromagnetic four-potential. But in the proposed Lagrange density both S_a and $P.\frac{\varepsilon}{4}$ (indices suppressed) act together with ∇_a on $X_{ab}{}^c$, and so the electromagnetic interaction is found in this theory as a consequence of the five principles.

But $X_{ab}{}^c$ has a comparable function.

This appears by reducing the function $L = H_{bc}H^{bc}$ to

$$L = \left(2S_a X_{bc}{}^a + P_a Y_{bc}{}^a + 2\left(S_{[a}{}^g{}_{e]b} - \frac{1}{4} P_q \varepsilon^q{}_{aeb} + X_{aeb} + \nabla_{[a}{}^g{}_{e]b}\right)X^{ae}{}_c\right).$$

$$\cdot \left(2S^d X^{bc}{}_d + P^d Y^{bc}{}_d + 2\left(-S^{[d}{}_g{}^{t]b} - \frac{1}{4} P^r \varepsilon_r{}^{dtb} + X^{dtb} + \nabla^{[d}{}_g{}^{t]b}\right)X_{dt}{}^c\right) -$$

$$- (X_{aeb}X^{aeb})^2. \qquad (7.2)$$

The operator $\nabla_{[a}{}^g{}_{e]b}$ on $X^{ae}{}_c$ operates in combination with X_{aeb}. So X_{aeb} acts here as a rather intricate tensor potential on itself.

Here is a force which sees itself.

X_{aeb} are components which can have very large values within the particles, but outside the particles the values diminish to the very small values which are necessary for realizing the vacuum curvature, neutrinos being absent.

Therefore it is a force which sees itself and acts on a short distance. Is this only the strong interaction or is the weak interaction concealed in this form?

In any case, vacuum transport for neutrinos is possible because

$$H_{[bc]}H^{[bc]} = 0$$

is also possible for $X_{ab}{}^c$ being large, then the two eigenvalues of $H_{[bc]}$ have to be absolutely equal.

8. Conclusions

Two universal field theories are constructed out of 5 principles. In the construction only vacuum fields are used as cement.

The result is a geometry which conceals gravity in the curvature and introduces, as a necessary consequence, the electromagnetic interaction and introduces as another necessary consequence, a tensor potential seeing itself at short distance, but also being able to work on a long distance under restricted conditions.

Noether's theorem permits the construction of an energy-momentum-stress tensor with the conserved energy-momentum fourvector. Therefore, the equivalence principle is satisfied. Conservation of angular momentum is demonstrated in the same way.

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