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English version 0.95

Dear reader,

the following papers represent my present knowledge in handling the world concepts of Burkhard Heim. I provided it so carefully, as it was possible for me. Nevertheless still errors may be contained. Suggestions for improvement or correction are at any time gladly welcome!

I wish you will enjoy studying the work of Burkhard Heim.

Olaf Posdzech
in summer 2000

1. Maps to chapters I-1 to II-1 of „Elementary structures of matter", volume 1 (21 pages)

These maps show the central train of thought of each chapter on a separate sheet.

When reading a chapter the very first time one should not try to go too much into the details.
Better you would try to follow the rough train of thought with the help of these maps.
After this it is reasonable turning to the details.

Three of the chapters are very extensive in their logical and mathematical derivatives.
For this a complete representation of those chapters needed multiple pages.

The German versions of these maps have been proofread by Burkhard Heim.
Many thanks to all the people who helped in translating, especially to Javier, John, Jim and Hugh.

Chapter	Topic	Overview	In detail
I-1	First goal mapping	1 page	
I-2	Mathematical description of gravitation dynamics Overview to the masses and densities defined in I-2 Illustration of field and field masses	1 page + 1 + 1	5 pages
I-3	Derivation of the not-hermitian structure of a R_4 which is uniform for all fields	1 page	2 pages
I-4	Introduction of the quantum principle for space (ultimate geometrical quanta of matter)	1 page	
II-1	Derivation of the six-dimensional space R_6 on the uniform field description and the quantum principle	2 pages	6 pages

2. General illustrations to the work of Burkhard Heim (9 pages, 16 illustrations)

Download: 03 posdzech - graphics berlin 1994 en.pdf

These illustrations have been developed 1994 during a seminar with Burkhard Heim in Berlin, on which he gave an overview of his complete work on four weekends. Therefore they illustrate completely different questions from the quantum theory to Heim´s thoughts over the background of the material world.
Naturally these illustrations alone cannot explain anything. For a real understanding one must deal with the original works of Burkhard Heim.
Together with the basic books you will get an informative overview with help of these illustrations .

Content

Bases („Elementary structures of matter“, volume 1)

- Derivation of the six-dimensional quantized space of the material world (“The double way”)
  This should be actually the first of all maps, as it is the ordnance map, because the double way - thus the geometrizing of entire physics by final geometrical units in six-dimensional space – is basis for all further Heim concepts. Since I could not reconstruct this way completely, this map has unofficial character for the time being.
- 4 forms of physically interaction in R_6
- Application of the corrected gravitation law
- Classification into the system of well-known physical theories

Cosmology

- Conclusions about cosmological genesis of the world
- Age of the world and generation of matter
- Passing of another universe through our visibility range

Particles („Elementary structures“, volume 2)

- Particles as cyclic periodic processes of interchanges in R_6 (Condensor fluxes)
- Generation of quantum numbers from a dynamical geometric description of elementary particles
- Inner density of protosimplexes in elementary particles
- Geometrical quantum numbers and their empirical correspondences
- Input and results of the Heim mass formula

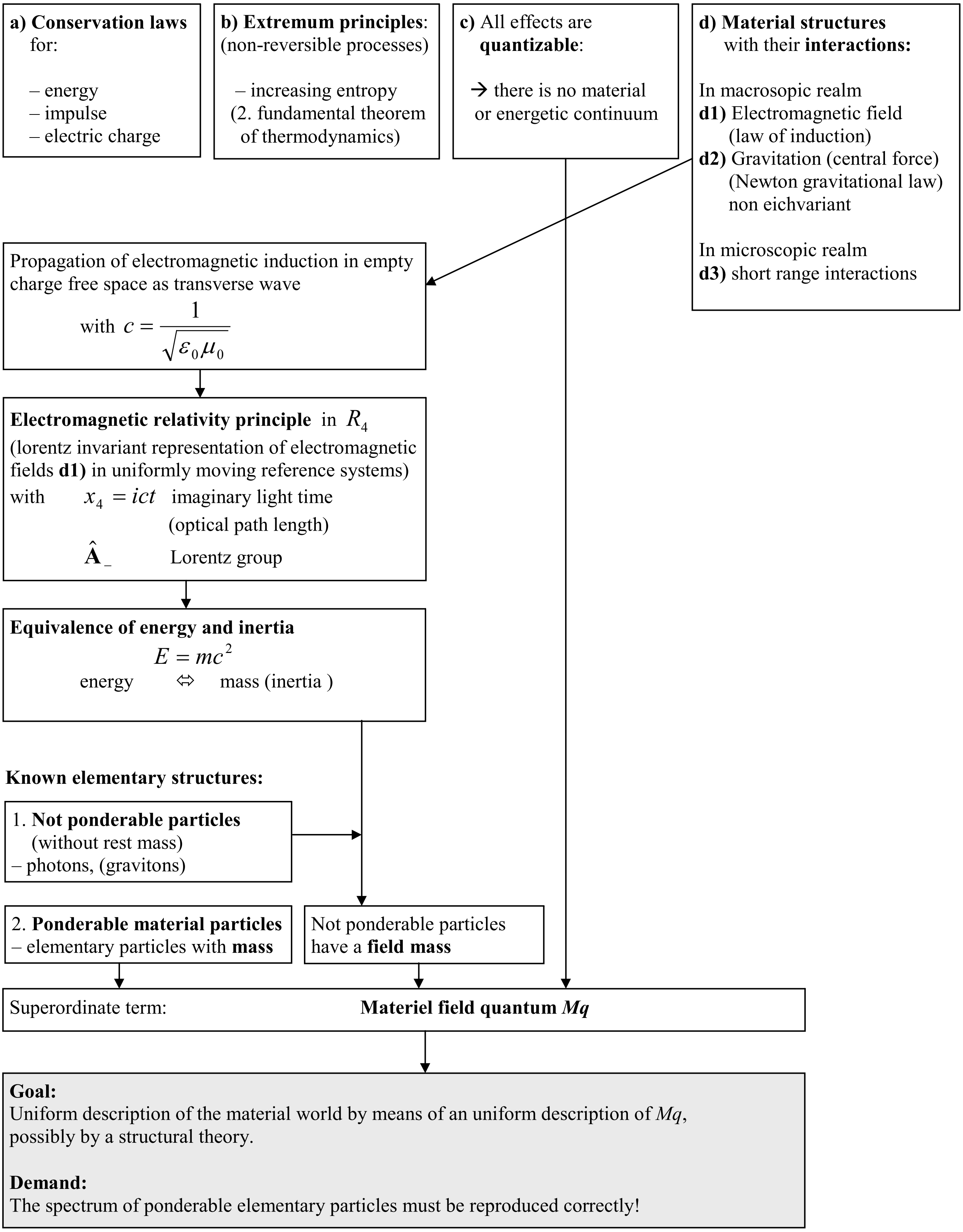
The non-material background of the material world („Elementary structures“, volume 3)

- The twelve dimensions: material and non-material background of the world
- Controlling of space-time from G_4
- Development of life on earth (phylogenesis of species)
- Chain of effects from G_4 into the range of human experience (space-time)

Chapter I-1 (overview): Goal mapping

Point of departure:
(quantitative formulated empirically well justified physical statements of greatest possible universality)

Surely exist …



a) Conservation laws for:
- energy
- impulse
- electric charge

b) Extremum principles: (non-reversible processes)
- increasing entropy (2. fundamental theorem of thermodynamics)

c) All effects are **quantizable**:
→ there is no material or energetic continuum

d) Material structures with their **interactions:**

In macrosopic realm
d1) Electromagnetic field (law of induction)
d2) Gravitation (central force) (Newton gravitational law) non eichvariant

In microscopic realm
d3) short range interactions

Propagation of electromagnetic induction in empty charge free space as transverse wave with $c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}$

Electromagnetic relativity principle in R_4
(lorentz invariant representation of electromagnetic fields **d1)** in uniformly moving reference systems)
with $x_4 = ict$ imaginary light time (optical path length)
$\hat{\mathbf{A}}_-$ Lorentz group

Equivalence of energy and inertia
$$E = mc^2$$
energy ⇔ mass (inertia)

Known elementary structures:

1. **Not ponderable particles** (without rest mass)
– photons, (gravitons)

2. **Ponderable material particles**
– elementary particles with **mass**

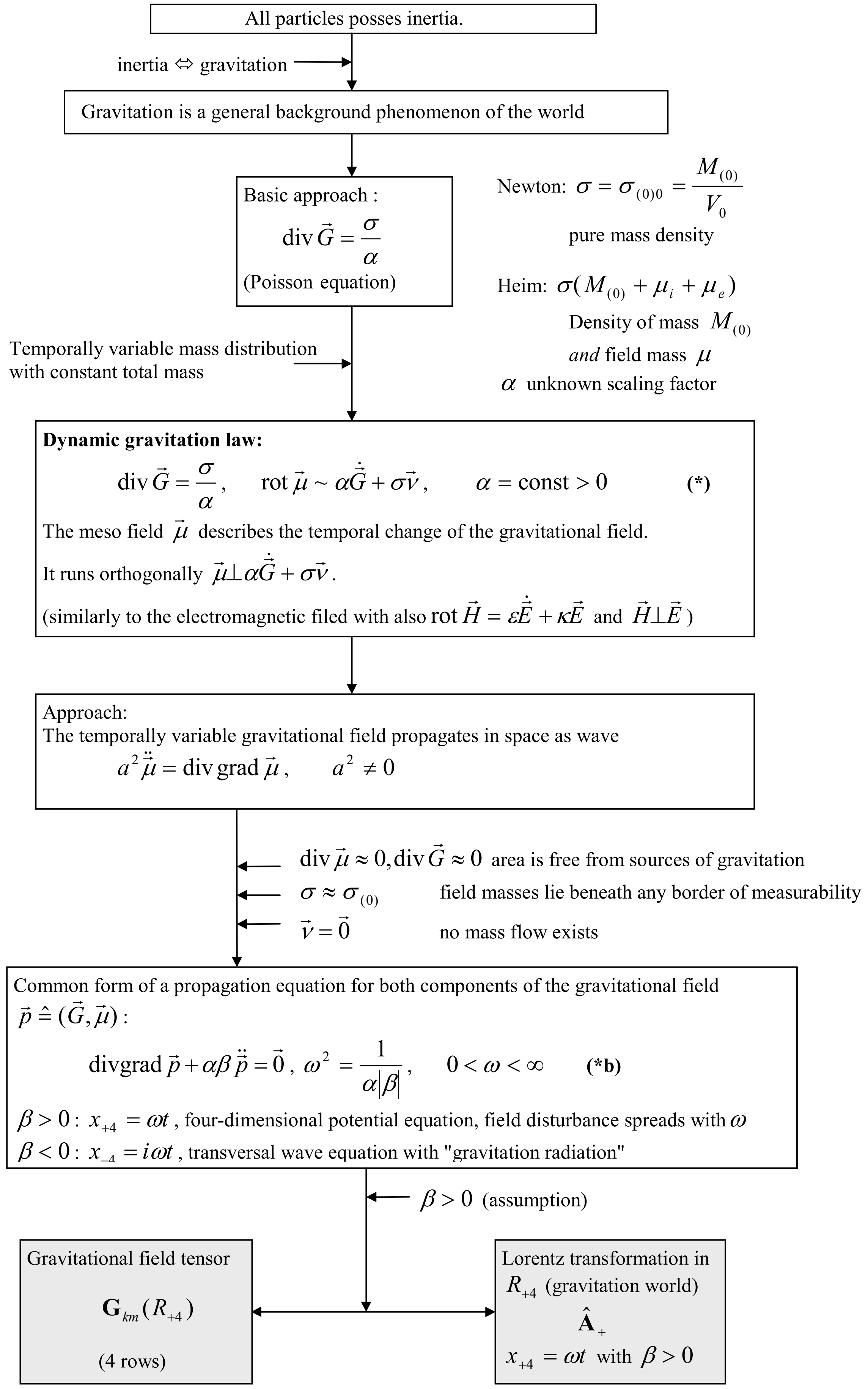
Not ponderable particles have a **field mass**

Superordinate term: **Materiel field quantum *Mq***

Goal:
Uniform description of the material world by means of an uniform description of *Mq*, possibly by a structural theory.

Demand:
The spectrum of ponderable elementary particles must be reproduced correctly!

Chapter I-2 (overview): Mathematical description of gravitation dynamics



All particles posses inertia.

inertia ⇔ gravitation

Gravitation is a general background phenomenon of the world

Basic approach :

$$\operatorname{div}\vec{G} = \frac{\sigma}{\alpha}$$

(Poisson equation)

Newton: $\sigma = \sigma_{(0)0} = \frac{M_{(0)}}{V_0}$

pure mass density

Heim: $\sigma(M_{(0)} + \mu_i + \mu_e)$

Density of mass $M_{(0)}$

and field mass μ

α unknown scaling factor

Temporally variable mass distribution
with constant total mass

Dynamic gravitation law:

$$\operatorname{div}\vec{G} = \frac{\sigma}{\alpha}, \qquad \operatorname{rot}\vec{\mu} \sim \alpha\dot{\vec{G}} + \sigma\vec{v}, \qquad \alpha = \text{const} > 0 \qquad \textbf{(*)}$$

The meso field $\vec{\mu}$ describes the temporal change of the gravitational field.

It runs orthogonally $\vec{\mu} \perp \alpha\dot{\vec{G}} + \sigma\vec{v}$.

(similarly to the electromagnetic filed with also $\operatorname{rot}\vec{H} = \varepsilon\dot{\vec{E}} + \kappa\vec{E}$ and $\vec{H} \perp \vec{E}$)

Approach:
The temporally variable gravitational field propagates in space as wave

$$a^2\ddot{\vec{\mu}} = \operatorname{div}\operatorname{grad}\vec{\mu}, \qquad a^2 \neq 0$$

$\operatorname{div}\vec{\mu} \approx 0, \operatorname{div}\vec{G} \approx 0$ area is free from sources of gravitation

$\sigma \approx \sigma_{(0)}$ field masses lie beneath any border of measurability

$\vec{v} = \vec{0}$ no mass flow exists

Common form of a propagation equation for both components of the gravitational field
$\vec{p} \mathrel{\hat{=}} (\vec{G}, \vec{\mu})$:

$$\operatorname{divgrad}\vec{p} + \alpha\beta\ddot{\vec{p}} = \vec{0}, \ \omega^2 = \frac{1}{\alpha|\beta|}, \qquad 0 < \omega < \infty \qquad \textbf{(*b)}$$

$\beta > 0$: $x_{+4} = \omega t$, four-dimensional potential equation, field disturbance spreads with ω

$\beta < 0$: $x_{-4} = i\omega t$, transversal wave equation with "gravitation radiation"

$\beta > 0$ (assumption)

Gravitational field tensor

$\mathbf{G}_{km}(R_{+4})$

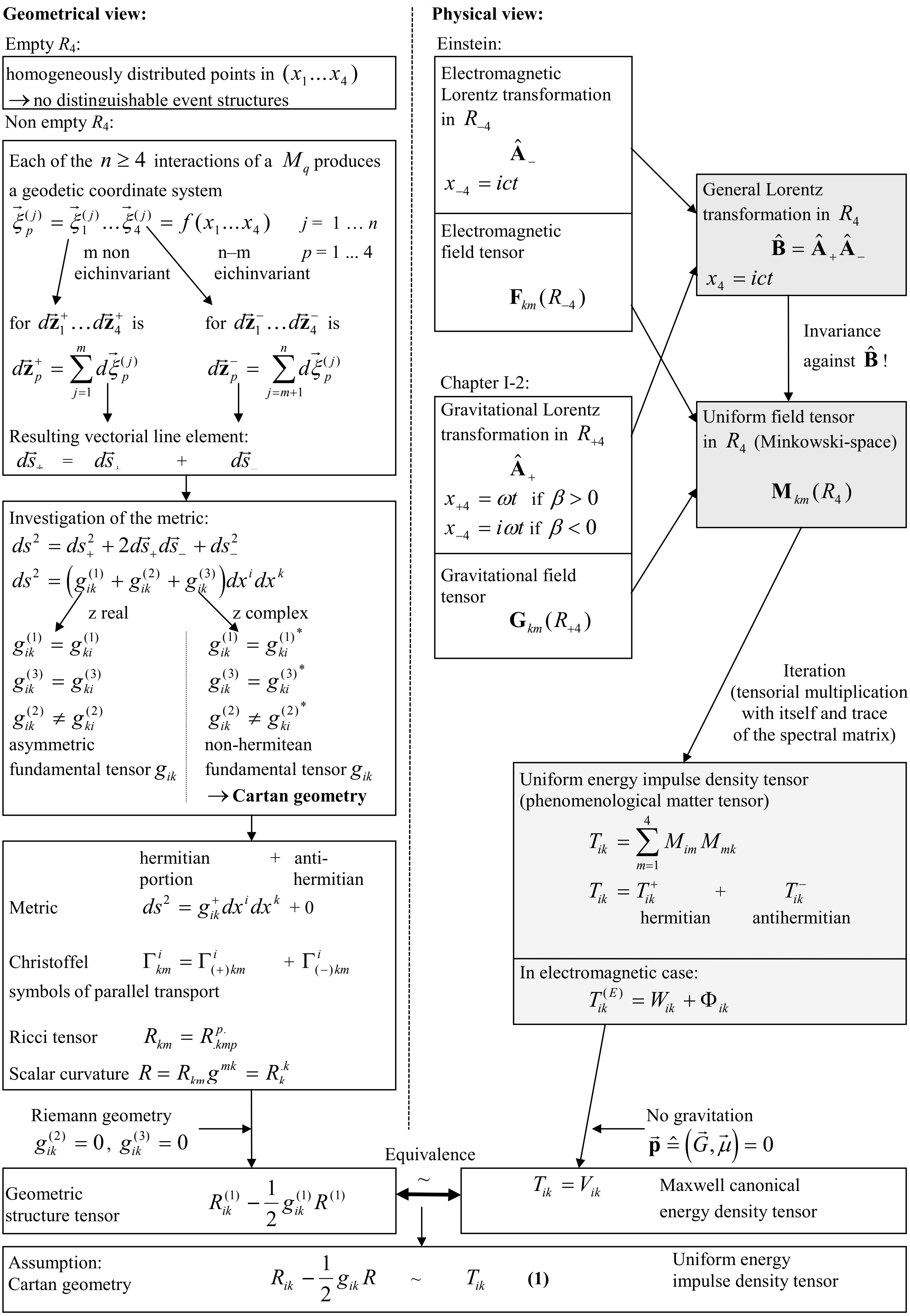
(4 rows)

Lorentz transformation in
R_{+4} (gravitation world)

$\hat{\mathbf{A}}_{+}$

$x_{+4} = \omega t$ with $\beta > 0$

Chapter I-3 (overview): Derivation of the non-hermitian structure of R_4



Geometrical view:

Empty R_4:

homogeneously distributed points in $(x_1 \ldots x_4)$
→ no distinguishable event structures

Non empty R_4:

Each of the $n \geq 4$ interactions of a M_q produces a geodetic coordinate system

$\vec{\xi}_p^{(j)} = \vec{\xi}_1^{(j)} \ldots \vec{\xi}_4^{(j)} = f(x_1 \ldots x_4)$ $\quad j = 1 \ldots n$

m non eichinvariant $\qquad$ n–m eichinvariant $\qquad p = 1 \ldots 4$

for $d\vec{\mathbf{z}}_1^+ \ldots d\vec{\mathbf{z}}_4^+$ is $\qquad$ for $d\vec{\mathbf{z}}_1^- \ldots d\vec{\mathbf{z}}_4^-$ is

$d\vec{\mathbf{z}}_p^+ = \sum_{j=1}^{m} d\vec{\xi}_p^{(j)}$ $\qquad$ $d\vec{\mathbf{z}}_p^- = \sum_{j=m+1}^{n} d\vec{\xi}_p^{(j)}$

Resulting vectorial line element:

$d\vec{s}_{\pm} = d\vec{s}_+ + d\vec{s}_-$

Investigation of the metric:

$ds^2 = ds_+^2 + 2d\vec{s}_+ d\vec{s}_- + ds_-^2$

$ds^2 = \left(g_{ik}^{(1)} + g_{ik}^{(2)} + g_{ik}^{(3)}\right) dx^i dx^k$

z real	z complex
$g_{ik}^{(1)} = g_{ki}^{(1)}$	$g_{ik}^{(1)} = g_{ki}^{(1)*}$
$g_{ik}^{(3)} = g_{ki}^{(3)}$	$g_{ik}^{(3)} = g_{ki}^{(3)*}$
$g_{ik}^{(2)} \neq g_{ki}^{(2)}$	$g_{ik}^{(2)} \neq g_{ki}^{(2)*}$
asymmetric fundamental tensor g_{ik}	non-hermitean fundamental tensor g_{ik} → **Cartan geometry**

	hermitian portion	+ anti-hermitian
Metric	$ds^2 = g_{ik}^{+} dx^i dx^k$	$+0$
Christoffel symbols of parallel transport	$\Gamma_{km}^{i} = \Gamma_{(+)km}^{i}$	$+ \Gamma_{(-)km}^{i}$

Ricci tensor $\quad R_{km} = R_{.kmp}^{p.}$

Scalar curvature $\quad R = R_{km} g^{mk} = R_k^{.k}$

Riemann geometry

$g_{ik}^{(2)} = 0,\ g_{ik}^{(3)} = 0$

Physical view:

Einstein:

Electromagnetic Lorentz transformation in R_{-4}

$\hat{\mathbf{A}}_-$

$x_{-4} = ict$

Electromagnetic field tensor

$\mathbf{F}_{km}(R_{-4})$

Chapter I-2:

Gravitational Lorentz transformation in R_{+4}

$\hat{\mathbf{A}}_+$

$x_{+4} = \omega t$ if $\beta > 0$

$x_{-4} = i\omega t$ if $\beta < 0$

Gravitational field tensor

$\mathbf{G}_{km}(R_{+4})$

General Lorentz transformation in R_4

$\hat{\mathbf{B}} = \hat{\mathbf{A}}_+ \hat{\mathbf{A}}_-$

$x_4 = ict$

Invariance against $\hat{\mathbf{B}}$!

Uniform field tensor in R_4 (Minkowski-space)

$\mathbf{M}_{km}(R_4)$

Iteration
(tensorial multiplication with itself and trace of the spectral matrix)

Uniform energy impulse density tensor
(phenomenological matter tensor)

$$T_{ik} = \sum_{m=1}^{4} M_{im} M_{mk}$$

$T_{ik} = T_{ik}^{+} + T_{ik}^{-}$

hermitian $\qquad$ antihermitian

In electromagnetic case:

$T_{ik}^{(E)} = W_{ik} + \Phi_{ik}$

No gravitation

$\vec{\mathbf{p}} \mathrel{\hat{=}} \left(\vec{G}, \vec{\mu}\right) = 0$

Geometric structure tensor $\quad R_{ik}^{(1)} - \frac{1}{2} g_{ik}^{(1)} R^{(1)}$

Equivalence $\quad \sim$

$T_{ik} = V_{ik}$ $\quad$ Maxwell canonical energy density tensor

Assumption:
Cartan geometry $\qquad R_{ik} - \frac{1}{2} g_{ik} R \quad \sim \quad T_{ik} \qquad$ **(1)** $\qquad$ Uniform energy impulse density tensor

Chapter I-4 (overview): Introducing the quantum principle

Geometrical view: | **Physical view:**

Approach (thesis):
Structural tensor of Cartan geometry (not source free) ~ Uniform energy impulse density tensor

$$R_{ik} - \frac{1}{2} g_{ik} R \sim T_{ik} \qquad \textbf{(1)}$$

Lack:
- Quantum principle **c)** is missing
- Conservation of energy **a)** is not compellingly ensured

Matrix trace:

$$g^{k\cdot}_{\cdot k} = 4 \qquad g^{ik} T_{ik} = T^{k\cdot}_{\cdot k} = T$$

$$R \sim -T$$

$$R_{ik} \sim T_{ik} + \frac{1}{2} g_{ik} (-T)$$

$$R_{ik} \sim T_{ik} - \frac{1}{2} g_{ik} T = W_{ik}$$

Extended energy density tensor

$$\text{Energy density} = \frac{\text{energy}}{\text{space}} \cdot \frac{time}{time} = \frac{\text{effect}(\omega)}{\text{space - time}(\Omega)}$$

Element of space-time:

$$d\Omega = \sqrt{-|g_{ik}|_4}\, dx^1 dx^2 dx^3 dx^4$$

$$dx_4 = icdt$$

$$d\Omega = icwdx^1 dx^2 dx^3 dt$$

$$W_{ik} = \frac{d\omega_{ik}}{d\Omega} icw$$

Empiricism: effect is quantized
$\omega_{ik} = hN_{ik}$, N_{ik} = complex integer

Differential $d \rightarrow$ Difference Δ

$$\Delta\omega_{ik} = h\Delta N_{ik}$$

$$W_{ik} = \frac{\Delta\omega_{ik}}{\Delta\Omega} icw = icwh \frac{\Delta N_{ik}}{\Delta\Omega}$$

$$\boxed{W_{ik} = icwh\eta_{ik}}$$

$\eta_{ik} = \frac{\Delta N_{ik}}{\Delta\Omega}$ Density of quanta of action per volume

$$R_{ik} \sim w\eta_{ik}, \qquad w = \sqrt{-|g_{ik}|_4} \qquad \textbf{(2)}$$

The structural tensor is quantized.
$(R_{ik}, \Gamma^i_{km}, g_{ik})$

Space-time $(d\Omega)$ is quantized.

Assumption:
There exists a fundamental geometrical unit!

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Chapter II-1(overview): Derivation of a R_6

Description of space-time R_4 by point spectra

Macroscopic realm:

Chapter I-3:

Continuous	
Structure tensor (Cartan geometry) ~	Uniform energy impulse density tensor

Three index symbol in macroscopic realm (deviation of the metric structure from pseudoeuclidean space) Γ^{i}_{km}

Structure tensor R_{km}

It is proportional to the extended energy impulse density tensor: $\alpha W_{km} = R_{km}$

$G_{(p)km}$

Structure of R_4: $R^{i\cdot}_{\cdot kmp}$

Microscopic realm:

Chapter I-4:

Not continuous	
Structure tensor ~	Density of quanta of action in R_4 (tensor)

φ^{i}_{km} Three index symbol in microscopic realm (quantum-like metric state of R_4, non hermitian)

$C_p \varphi^{p}_{km}$ A tensor field can be described. It corresponds to **quantum-like** energy steps.

Description by eigenvalue equations:

$$C_{(p)}\varphi^{(p)}_{km} = \lambda_{(p)}(k,m)\varphi^{(p)}_{km}$$ term by term

$$C_p \varphi^{i}_{km} = \lambda_p(k,m)\varphi^{i}_{km}$$

$\lambda_{(p)}$ are eigenvalues and they form discrete point spectra. They are quantum-like discrete structure steps of the curvature of the curved R_4.

Construction of a tensorial description with 64 elements

P. 41

Further investigation of $\lambda_{(p)}(k,m)$ supplies a symmetrical relationship (also term by term):

$$C_{(p)}\varphi^{(p)}_{km} - \lambda_{(p)}(k,m)\varphi^{(p)}_{km} = 0$$

P. 43:

$$C_{(p)}\varphi^{(p)}_{km} = \lambda_{(p)}(k,m)\varphi^{(p)}_{km} \qquad \textbf{(3)}$$

for 4 coordinates it supplies

$$\left.\begin{array}{l} k = 1\ldots4 \\ m = 1\ldots4 \\ p = 1\ldots4 \end{array}\right\}$$

64 nonlinear tensorial equations
64 eigenvalue equations of discrete curvature steps of R_4

and contains 4 × 16 point spectra $\lambda_p(k,m)$

(Goto page 2)

Finding empty spectra for reduction on 6 dimensions

Trace with $i = k$ supplies:

$R^{k\cdot}_{\cdot kmp} = A_{mp}$ whereby $A_{mp} = -A_{pm}$

$R^{i\cdot}_{\cdot kmm} = 0 \longrightarrow A_{mm} = 0$

Trace with $i = k$ supplies:

$$C_p \varphi^k_{km} = \lambda_p(k,m)\varphi^k_{km}$$

$$C_m \varphi^k_{km} = \lambda_m(k,m)\varphi^k_{km} = 0$$

16 + 16 - 4 = 28 empty spectra exist **(3a)**

P. 44:

(3) + **(3a)**
64 - 28 = 36 eigenvalue equations are not empty

Arrangement of the remaining 36 spectra in a 6×6 tensor.
Such tensor describes a space R_6 with 6 dimensions.

Finding more empty spectra in superspace *R₆*

P. 45: $R^{i\cdot}_{\cdot kmp}$

Building trace ?

16 - 4 = 12 further empty spectra exist **(3b)**

P. 47:

These 12 additional empty spectra can be arranged in the tensor $\mathbf{T}_{ik}$ of R_6 in such a way, that the empirical space-time R_4 is conserved.

$$\vec{\vec{\mathbf{T}}} = \begin{bmatrix} \bullet & \bullet & \bullet & \bullet & 0 & 0 \\ \bullet & \bullet & \bullet & \bullet & 0 & 0 \\ \bullet & \bullet & \bullet & \bullet & 0 & 0 \\ \bullet & \bullet & \bullet & \bullet & \bullet & \bullet \\ 0 & 0 & 0 & \bullet & \bullet & \bullet \\ 0 & 0 & 0 & \bullet & \bullet & \bullet \end{bmatrix}, \quad T_{ik} \equiv (ik) \qquad \textbf{(3c)}$$

Determination of the algebraic character of the dimensions *x₅*, *x₆*

P. 49:

Experience in macro realm:
Stabile orbits of planets exist.

Experience in the microscopic realm:
Stable ground states of electron orbits exist.

x_5 and x_6 have to be imaginary!

P. 50:

The dimensions of the material world are:

3 real dimensions $\left(x_1, x_2, x_3\right) = \left(x_1^*, x_2^*, x_3^*\right) \mathrel{\hat{=}} R_3$ Space

3 imaginary dimensions $x_4 = i\,\mathrm{c}\,t$

$x_5 = i\varepsilon$, $x_6 = i\eta$

R_4 Space-time $= R_3 + x_4$

Material world $R_6 = R_4 + x_5 + x_6$

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Chapter I-2: Mathematical description of gravitation dynamics

All particles posses inertia.

inertia ⇔ gravitation →

Gravitation is a general background phenomenon of the world.
→ **Does a relativity principle exist for gravitation?**

Basic Approach (Poisson Equation):

$$\operatorname{div}\vec{G} = \frac{\sigma}{\alpha}$$

α unknown scaling factor

Newton:
"The source of gravitation is the mass $M_{(0)}$."

$$\sigma = \sigma_{(0)0} = \frac{M_{(0)}}{V_0}$$

Mass density

Heim:
"The sources of gravitation are mass $M_{(0)}$ *and additionally* the field masses μ."

$$\sigma(M_{(0)} + \mu_i + \mu_e)$$

Total density

How does the description of a temporally variable mass distribution look like?

$M_{(0)}$ = constant

Conservation of energy

Superposition

$$M = M_{(0)} + \mu_i + \mu_e = const$$

$M_{(0)}$ Source masses in volume V_0

μ_i Field mass in volume V_0

μ_e Field mass outside of V_0

$$\boxed{\frac{d\sigma}{dt} = 0}$$

The total density is constant.

$$d\sigma = \sum_{k=1}^{3} \frac{\partial\sigma}{\partial x_k} dx_k + \dot{\sigma} dt$$

Derivation after x_1, x_2, x_3, t

$$\frac{d\sigma}{dt} = \dot{\sigma} + \sum_{k=1}^{3} \frac{\partial\sigma}{\partial x_k}\frac{dx_k}{dt}$$

change over

$$\boxed{\operatorname{div}\vec{v} = 0}$$

There is no source of velocity,
the kinetic energy remains constant,
mass elements do not accelerate.

$$\frac{d\sigma}{dt} = \dot{\sigma} + \vec{v}\operatorname{grad}\sigma = 0$$

extend ← $\sigma \operatorname{div}\vec{v} = 0$

$$0 = \dot{\sigma} + \operatorname{div}(\sigma\vec{v})$$

$$\dot{\sigma} = -\operatorname{div}(\sigma\vec{v})$$

$$\alpha \operatorname{div}\vec{G} = \sigma$$

$$\frac{d}{dt}$$

$$\alpha \operatorname{div}\dot{\vec{G}} = \dot{\sigma} \longrightarrow \alpha \operatorname{div}\dot{\vec{G}} = -\operatorname{div}(\sigma\vec{v})$$

change over

$$0 = \operatorname{div}(\underline{\alpha\dot{\vec{G}} + \sigma\vec{v}})$$

Impulse density $\frac{m\vec{v}}{V}$

Always valid with
$0 = \operatorname{div} b \operatorname{rot}\vec{\mu}$

The sum of the temporal gravitation field fluctuation and impulse density is source free (which is another expression of equivalence of inertia ⇔ gravitation).

Conclusion:

It exists an auxiliary vector field (mesofield) $\vec{\mu}(x,t) \perp \alpha\dot{\vec{G}} + \sigma\vec{v}$

$$\operatorname{rot}\vec{\mu} \sim \alpha\dot{\vec{G}} + \sigma\vec{v}$$

$$b \operatorname{rot}\vec{\mu} = \alpha\dot{\vec{G}} + \sigma\vec{v}$$

$b \neq 0$ unknown proportionality factor

Summary of the dynamic gravitation law:

The mesofield $\vec{\mu}$ describes temporal change of the gravitation field.

It runs orthogonally $\vec{\mu} \perp \alpha\dot{\vec{G}} + \sigma\vec{v}$.

(similarly to the electromagnetic field with $\operatorname{rot}\vec{H} = \varepsilon\dot{\vec{E}} + \kappa\vec{E}$ with $\vec{H} \perp \vec{E}$)

$$\operatorname{div}\vec{G} = \frac{\sigma}{\alpha}, \qquad \operatorname{rot}\vec{\mu} \sim \alpha\dot{\vec{G}} + \sigma\vec{v}, \qquad \alpha = \text{const} > 0 \qquad \textbf{(*)}$$

rot

$$b \operatorname{rot}\operatorname{rot}\vec{\mu} = \alpha \operatorname{rot}\dot{\vec{G}} + \operatorname{rot}(\sigma\vec{v})$$

rot rot = div grad - grad div

$$b(\operatorname{grad}\operatorname{div}\vec{\mu} - \operatorname{div}\operatorname{grad}\vec{\mu}) = \alpha \operatorname{rot}\dot{\vec{G}} + \operatorname{rot}(\sigma\vec{v})$$

|change over

$$\underline{\operatorname{graddiv}\vec{\mu} - \frac{\operatorname{rot}(\sigma\vec{v})}{b}} = \operatorname{divgrad}\vec{\mu} + \frac{\alpha \operatorname{rot}\dot{\vec{G}}}{b}$$

$$\vec{w} = \operatorname{divgrad}\vec{\mu} + \frac{\alpha}{b}\operatorname{rot}\dot{\vec{G}}$$

Assumption (approach):
The mesofield $\vec{\mu}$ spreads as wave in space with a speed 1/a :

$$a^2\ddot{\vec{\mu}} = \operatorname{div}\operatorname{grad}\vec{\mu}, \quad a^2 \neq 0$$

$$\vec{w} = a^2\ddot{\vec{\mu}} + \frac{\alpha}{b}\operatorname{rot}\dot{\vec{G}}$$

$$\boxed{a^2 = -\alpha\beta}$$

$$\vec{w} = -\alpha\beta\ddot{\vec{\mu}} + \frac{\alpha}{b}\operatorname{rot}\dot{\vec{G}} \qquad \left[\frac{kg}{m^3 s}\right]$$

Approach:
The substitution $\vec{w}$ depends from the temporal change of the differential density

$$\vec{w} = \dot{\sigma}\vec{f}(x)$$

$\vec{f}(x)$ is a undimensioned structural field, temporal constant, describes a property of space

$$\boxed{M_{(0)} = \text{const}}$$ in reference to *x* and *t*

$$M(x,t) = M_{(0)} + \mu(x,t)$$

time derivative of the densities

$$\dot{\sigma} = 0 + \dot{\sigma}_\mu(t)$$

$$\dot{\sigma} = \dot{\sigma}_\mu$$

$$\vec{w} = \dot{\sigma}_\mu\vec{f}(x)$$

$$\dot{\sigma}_\mu\vec{f}(x) = -\alpha\beta\ddot{\vec{\mu}} + \frac{\alpha}{b}\operatorname{rot}\dot{\vec{G}}$$ | change over

$$\frac{\alpha}{b}\operatorname{rot}\dot{\vec{G}} = \alpha\beta\ddot{\vec{\mu}} + \dot{\sigma}_\mu\vec{f}(x)$$

(page 3)

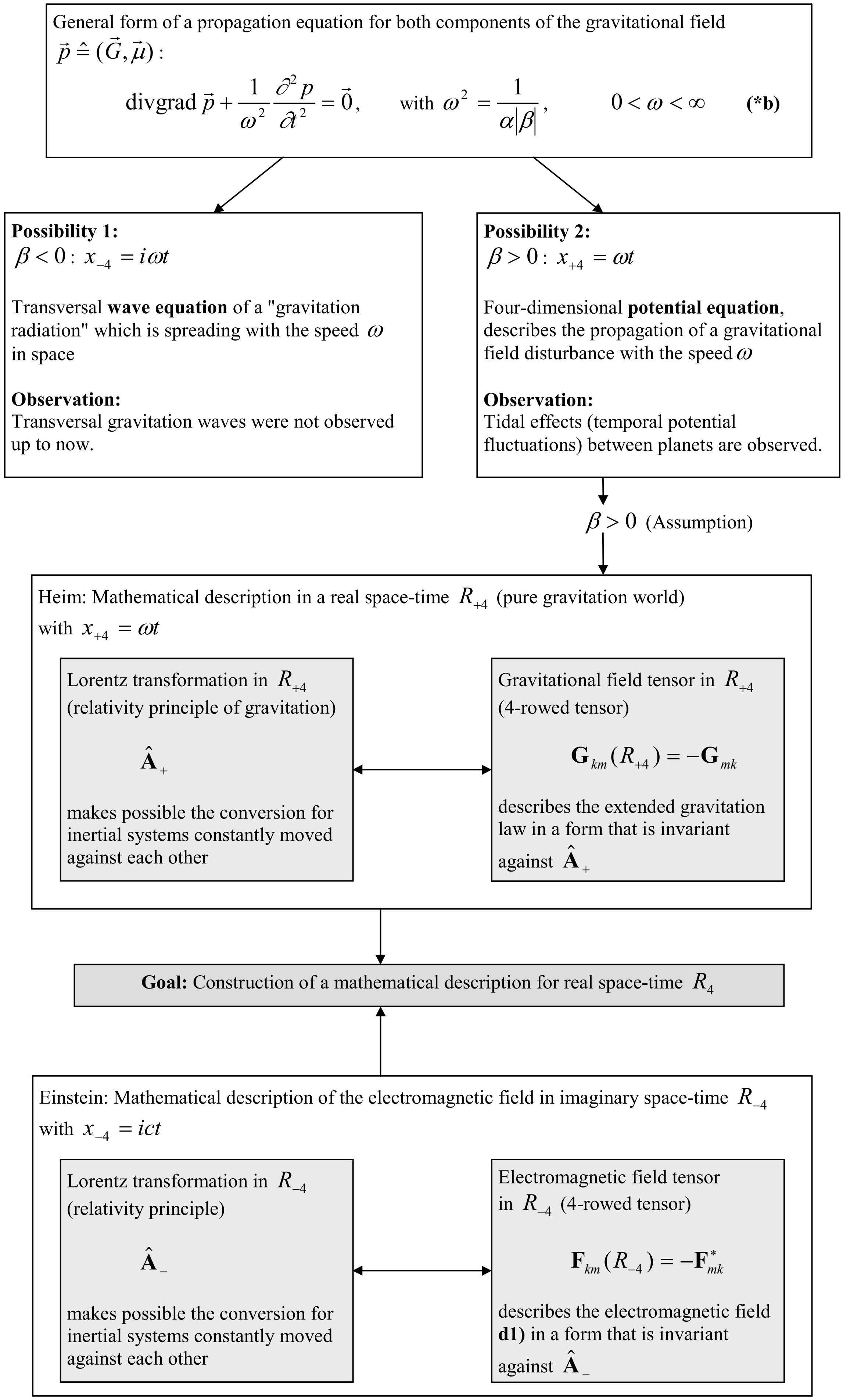
$$\begin{tikzcd}
 & \frac{\alpha}{b}\operatorname{rot}\dot{\vec{G}} = \alpha\beta\ddot{\vec{\mu}} + \dot{\sigma}_{\mu}\vec{f}(x) \arrow[d, "\text{Integral } \int dt"] & \\
 & \frac{\alpha}{b}\operatorname{rot}\vec{G} = \alpha\beta\dot{\vec{\mu}} + \sigma_{\mu}\vec{f}(x) \arrow[d] & \left|\sigma_{\mu} = \sigma - \sigma_{(0)}\right. \\
 & \frac{\alpha}{b}\operatorname{rot}\vec{G} = \alpha\beta\dot{\vec{\mu}} + (\sigma - \sigma_{(0)})\vec{f}(x) \arrow[d, "\text{div}"] & \\
\text{div rot} = 0 \arrow[r] & 0 = \alpha\operatorname{div}\beta\dot{\vec{\mu}} + \operatorname{div}\Big((\sigma - \sigma_{(0)})\vec{f}(x)\Big) \arrow[d] & \left|\text{change over}\right. \\
\boxed{\begin{array}{l}\text{Assumption:}\\ \vec{f}(x) \perp \operatorname{grad}(\sigma - \sigma_{(0)})\end{array}} \arrow[dd] & \alpha\beta\operatorname{div}\dot{\vec{\mu}} = -\operatorname{div}\Big((\sigma - \sigma_{(0)})\vec{f}(x)\Big) \arrow[d] & \\
 & \alpha\beta\operatorname{div}\dot{\vec{\mu}} = -\vec{f}\operatorname{grad}(\sigma - \sigma_{(0)}) - (\sigma - \sigma_{(0)})\operatorname{div}\vec{f} \arrow[d] & \\
\vec{f}\operatorname{grad}(\sigma - \sigma_{(0)}) = 0 \arrow[r] & \alpha\beta\operatorname{div}\dot{\vec{\mu}} = -(\sigma - \sigma_{(0)})\operatorname{div}\vec{f} &
\end{tikzcd}$$

Summary:

$$\operatorname{rot}\vec{G} \sim \beta\dot{\vec{\mu}} + \frac{\sigma - \sigma_{(0)}}{\alpha}\vec{f}(x)\,, \quad \alpha\beta\operatorname{div}\dot{\vec{\mu}} = -(\sigma - \sigma_{(0)})\operatorname{div}\vec{f}\,, \qquad \beta = \text{const} \neq 0 \qquad \textbf{(*a)}$$

Estimation of the propagation speed of gravitation

$$\begin{tikzcd}
 & \boxed{\begin{array}{l}\text{System } \textbf{(*)}\text{:}\\ b\operatorname{rot}\vec{\mu} = \alpha\dot{\vec{G}} + \sigma\vec{v}\end{array}} \arrow[dd] & & \boxed{\begin{array}{l}\text{System } \textbf{(*a)}\text{:}\\ {}^{1}\!/_{b}\operatorname{rot}\vec{G} = \beta\dot{\vec{\mu}} + \frac{\sigma - \sigma_{(0)}}{\alpha}\vec{f}(x)\end{array}} \arrow[dd] & \\
\boxed{\vec{v} = \vec{0}} \arrow[dr] & & \boxed{b = 1} \arrow[dl] \arrow[dr] & & \boxed{\sigma \approx \sigma_{(0)}} \arrow[dl] \\
\text{no mass current existing} & \operatorname{rot}\vec{\mu} = \alpha\dot{\vec{G}} \arrow[d] \arrow[ddr] & & \operatorname{rot}\vec{G} = \beta\dot{\vec{\mu}} \arrow[d] \arrow[dl] & \text{Field mass } \sigma_{\mu} \text{ is negligibly small} \\
\frac{\partial}{\partial t} \arrow[r] & \operatorname{rot}\dot{\vec{\mu}} = \alpha\ddot{\vec{G}} \arrow[dd] & \dot{\vec{\mu}} = {}^{1}\!/_{\beta}\operatorname{rot}\vec{G} \arrow[ddl] & \operatorname{rot}\dot{\vec{G}} = \beta\ddot{\vec{\mu}} \arrow[dd] & \frac{\partial}{\partial t} \arrow[l] \\
 & & \dot{\vec{G}} = {}^{1}\!/_{\alpha}\operatorname{rot}\vec{\mu} \arrow[dr] & & \\
 & {}^{1}\!/_{\beta}\operatorname{rot}\operatorname{rot}\dot{\vec{G}} = \alpha\ddot{\vec{G}} \arrow[d] & & {}^{1}\!/_{\alpha}\operatorname{rot}\operatorname{rot}\vec{\mu} = \beta\ddot{\vec{\mu}} \arrow[d] & \\
 & \operatorname{grad}\operatorname{div}\vec{G} - \operatorname{div}\operatorname{grad}\vec{G} = \alpha\beta\ddot{\vec{G}} \arrow[ddd] & & \operatorname{grad}\operatorname{div}\vec{\mu} - \operatorname{div}\operatorname{grad}\vec{\mu} = \alpha\beta\ddot{\vec{\mu}} \arrow[ddd] & \\
\boxed{\operatorname{div}\vec{G} \approx \sigma_{0}} \arrow[ur] & & \begin{array}{l}\text{The area is free from static and}\\ \text{dynamic sources of gravitation.}\end{array} & \boxed{\operatorname{div}\vec{\mu} \approx 0} \arrow[u] & \\
\boxed{\operatorname{grad}\sigma_{0} \approx 0} \arrow[uur] & & & & \\
 & \boxed{\operatorname{div}\operatorname{grad}\vec{G} = \alpha\beta\ddot{\vec{G}}} & & \boxed{\operatorname{div}\operatorname{grad}\vec{\mu} = \alpha\beta\ddot{\vec{\mu}}} &
\end{tikzcd}$$



General form of a propagation equation for both components of the gravitational field $\vec{p} \mathrel{\hat{=}} (\vec{G}, \vec{\mu})$:

$$\operatorname{divgrad} \vec{p} + \frac{1}{\omega^2}\frac{\partial^2 p}{\partial t^2} = \vec{0}, \qquad \text{with } \omega^2 = \frac{1}{\alpha|\beta|}, \qquad 0 < \omega < \infty \qquad \textbf{(*b)}$$

Possibility 1:
$\beta < 0$: $x_{-4} = i\omega t$

Transversal **wave equation** of a "gravitation radiation" which is spreading with the speed ω in space

Observation:
Transversal gravitation waves were not observed up to now.

Possibility 2:
$\beta > 0$: $x_{+4} = \omega t$

Four-dimensional **potential equation**, describes the propagation of a gravitational field disturbance with the speed ω

Observation:
Tidal effects (temporal potential fluctuations) between planets are observed.

$\beta > 0$ (Assumption)

Heim: Mathematical description in a real space-time R_{+4} (pure gravitation world) with $x_{+4} = \omega t$

Lorentz transformation in R_{+4} (relativity principle of gravitation)

$$\hat{\mathbf{A}}_+$$

makes possible the conversion for inertial systems constantly moved against each other

Gravitational field tensor in R_{+4} (4-rowed tensor)

$$\mathbf{G}_{km}(R_{+4}) = -\mathbf{G}_{mk}$$

describes the extended gravitation law in a form that is invariant against $\hat{\mathbf{A}}_+$

Goal: Construction of a mathematical description for real space-time R_4

Einstein: Mathematical description of the electromagnetic field in imaginary space-time R_{-4} with $x_{-4} = ict$

Lorentz transformation in R_{-4} (relativity principle)

$$\hat{\mathbf{A}}_-$$

makes possible the conversion for inertial systems constantly moved against each other

Electromagnetic field tensor in R_{-4} (4-rowed tensor)

$$\mathbf{F}_{km}(R_{-4}) = -\mathbf{F}^*_{mk}$$

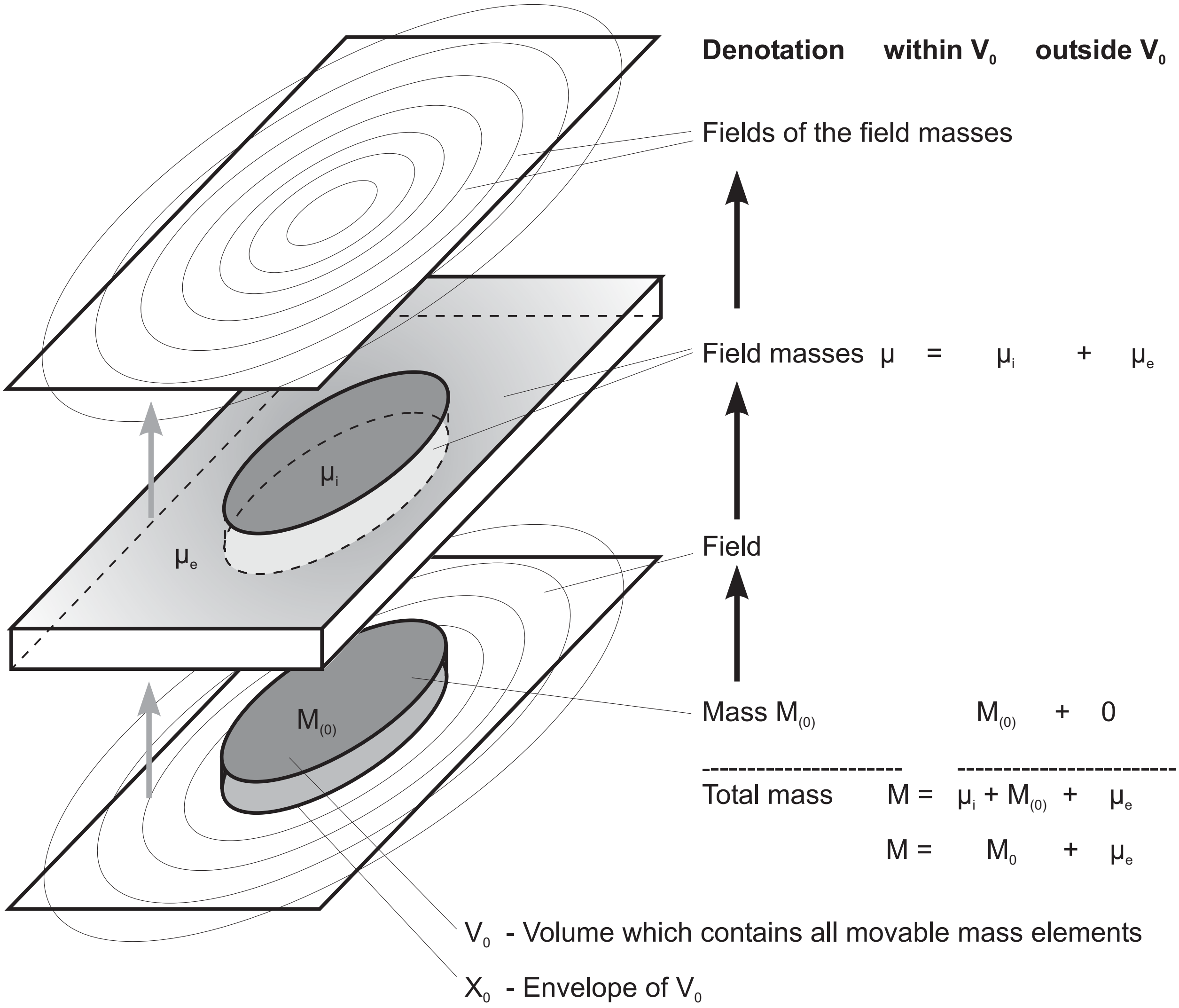
describes the electromagnetic field **d1)** in a form that is invariant against $\hat{\mathbf{A}}_-$

Comparison of the Lorentz matrixes in the special case of a constant movement along x_1

Gravitation	**Electromagnetic field**
Real gravitation world R_{+4} with $x_{+4} = \omega t$	Imaginary space-time R_{-4} with $x_{-4} = ict$
Speed: $\vec{v} = \frac{dx_1}{dt}$	Speed: $\vec{v} = \frac{dx_1}{dt}$
$\downarrow$	$\downarrow$
Direction: $v = \omega\beta_+$	Direction: $v = c\beta_-$
$\downarrow$	$\downarrow$
Real rotation: $\tan\psi_+ = \beta_+ = \frac{v}{\omega}$	Imaginary rotation: $\tan\psi_- = \beta_- = \frac{v}{c}$
Transformation $\hat{\mathbf{A}}_+ = \begin{pmatrix} \cos\psi_+ & 0 & 0 & \sin\psi_+ \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -\sin\psi_+ & 0 & 0 & \cos\psi_+ \end{pmatrix}$	Transformation $\hat{\mathbf{A}}_- = \begin{pmatrix} \cos\psi_- & 0 & 0 & i\sin\psi_- \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ -i\sin\psi_- & 0 & 0 & \cos\psi_- \end{pmatrix}$

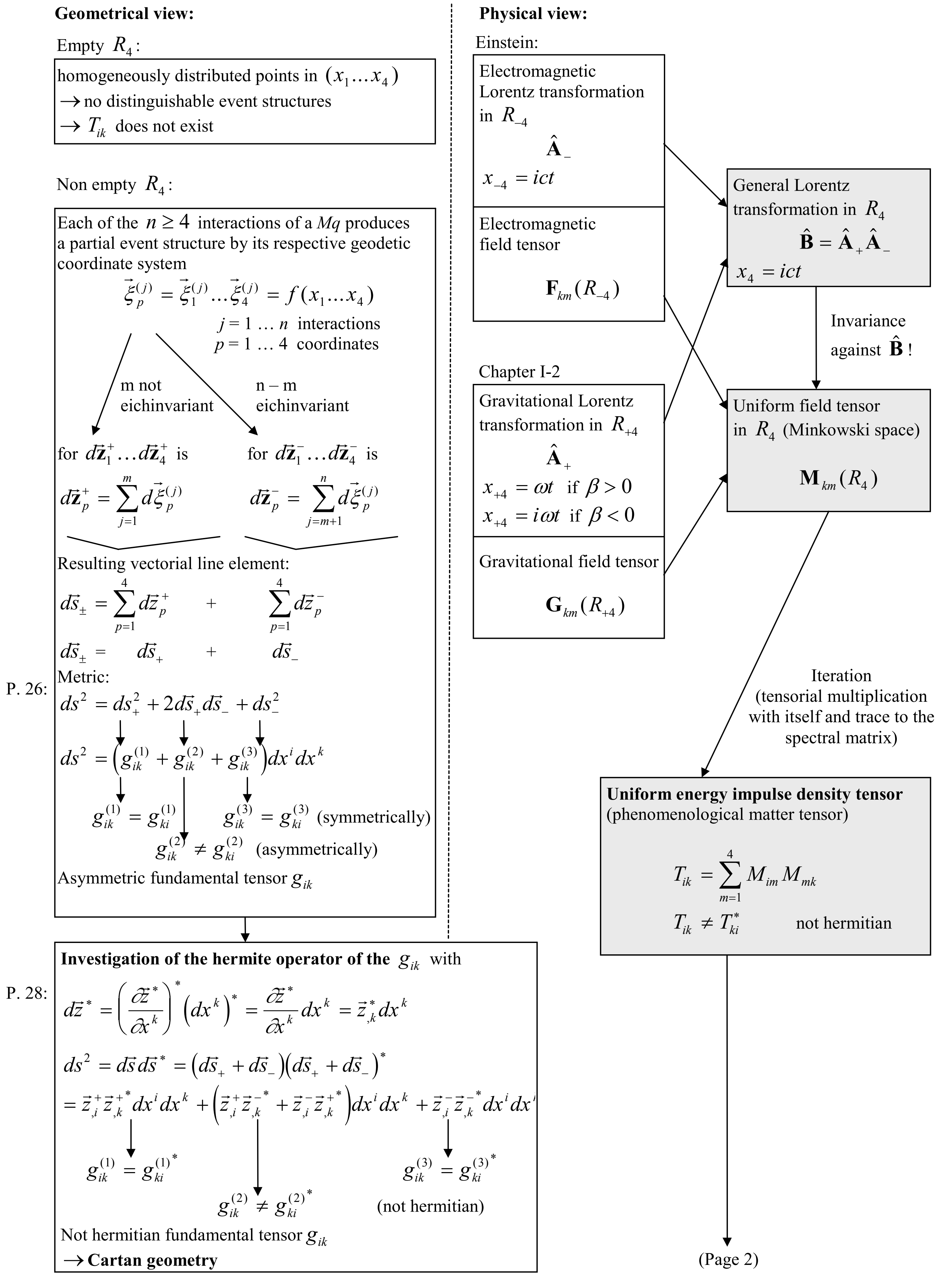
Overview to the masses and densities defined in Chapter I-2

Mass	**Meaning**	**Global density**	**Density within V_0**
$M_{(0)}$	Source masses (without field masses)	$\delta_0 = \frac{M_{(0)}}{V}$	$\delta_{0(0)} = \frac{M_{(0)}}{V_0}$
μ	$= \mu_i + \mu_e$ Total field mass	$\delta_{g\mu} = \frac{\mu}{V}$	
μ_i	Internal portion in V_0		$\sigma_i = \frac{\mu_i}{V_0}$
μ_e	External portion (only outside of V_0)	$\sigma_e = \frac{\mu_e}{V - V_0}$	
M_0	$= M_{(0)} + \mu_i$ Internal total mass	$\sigma_{g0} = \frac{M_0}{V}$	
M	$= \mu_e + M_0$ $= \mu_e + \mu_i + M_{(0)}$ $= \mu + M_{(0)}$ Total mass (masses + field masses)	$\sigma_g = \frac{M}{V}$	



Graphics regarding Burkhard Heim: "Elementarstrukturen der Materie" vol 1, chap. I-2, (c) Olaf Posdzech, 1995, 2007
Heim1-2b en.cdr

Chapter I-3: Derivation of the non-hermitian structure of R_4



Geometrical view:

Empty R_4:

homogeneously distributed points in $(x_1 \dots x_4)$
→ no distinguishable event structures
→ T_{ik} does not exist

Non empty R_4:

Each of the $n \geq 4$ interactions of a *Mq* produces a partial event structure by its respective geodetic coordinate system

$$\vec{\xi}^{(j)}_p = \vec{\xi}^{(j)}_1 \dots \vec{\xi}^{(j)}_4 = f(x_1 \dots x_4)$$

$j = 1 \dots n$ interactions
$p = 1 \dots 4$ coordinates

m not eichinvariant

for $d\vec{\mathbf{z}}^+_1 \dots d\vec{\mathbf{z}}^+_4$ is

$$d\vec{\mathbf{z}}^+_p = \sum_{j=1}^{m} d\vec{\xi}^{(j)}_p$$

n – m eichinvariant

for $d\vec{\mathbf{z}}^-_1 \dots d\vec{\mathbf{z}}^-_4$ is

$$d\vec{\mathbf{z}}^-_p = \sum_{j=m+1}^{n} d\vec{\xi}^{(j)}_p$$

Resulting vectorial line element:

$$d\vec{s}_\pm = \sum_{p=1}^{4} d\vec{z}^+_p + \sum_{p=1}^{4} d\vec{z}^-_p$$

$$d\vec{s}_\pm = d\vec{s}_+ + d\vec{s}_-$$

P. 26: Metric:

$$ds^2 = ds_+^2 + 2d\vec{s}_+ d\vec{s}_- + ds_-^2$$

$$ds^2 = \left(g^{(1)}_{ik} + g^{(2)}_{ik} + g^{(3)}_{ik}\right) dx^i dx^k$$

$g^{(1)}_{ik} = g^{(1)}_{ki}$ $g^{(3)}_{ik} = g^{(3)}_{ki}$ (symmetrically)

$g^{(2)}_{ik} \neq g^{(2)}_{ki}$ (asymmetrically)

Asymmetric fundamental tensor g_{ik}

Investigation of the hermite operator of the g_{ik} with

P. 28:

$$d\vec{z}^* = \left(\frac{\partial \vec{z}^*}{\partial x^k}\right)^* \left(dx^k\right)^* = \frac{\partial \vec{z}^*}{\partial x^k} dx^k = \vec{z}^*_{,k} dx^k$$

$$ds^2 = d\vec{s}\, d\vec{s}^* = \left(d\vec{s}_+ + d\vec{s}_-\right)\left(d\vec{s}_+ + d\vec{s}_-\right)^*$$

$$= \vec{z}^+_{,i} \vec{z}^{+*}_{,k} dx^i dx^k + \left(\vec{z}^+_{,i} \vec{z}^{-*}_{,k} + \vec{z}^-_{,i} \vec{z}^{+*}_{,k}\right) dx^i dx^k + \vec{z}^-_{,i} \vec{z}^{-*}_{,k} dx^i dx$$

$g^{(1)}_{ik} = g^{(1)*}_{ki}$ $g^{(3)}_{ik} = g^{(3)*}_{ki}$

$g^{(2)}_{ik} \neq g^{(2)*}_{ki}$ (not hermitian)

Not hermitian fundamental tensor g_{ik}
→ **Cartan geometry**

Physical view:

Einstein:

Electromagnetic Lorentz transformation in R_{-4}

$$\hat{\mathbf{A}}_-$$

$$x_{-4} = ict$$

Electromagnetic field tensor

$$\mathbf{F}_{km}(R_{-4})$$

Chapter I-2

Gravitational Lorentz transformation in R_{+4}

$$\hat{\mathbf{A}}_+$$

$x_{+4} = \omega t$ if $\beta > 0$

$x_{+4} = i\omega t$ if $\beta < 0$

Gravitational field tensor

$$\mathbf{G}_{km}(R_{+4})$$

General Lorentz transformation in R_4

$$\hat{\mathbf{B}} = \hat{\mathbf{A}}_+ \hat{\mathbf{A}}_-$$

$$x_4 = ict$$

Invariance against $\hat{\mathbf{B}}$!

Uniform field tensor in R_4 (Minkowski space)

$$\mathbf{M}_{km}(R_4)$$

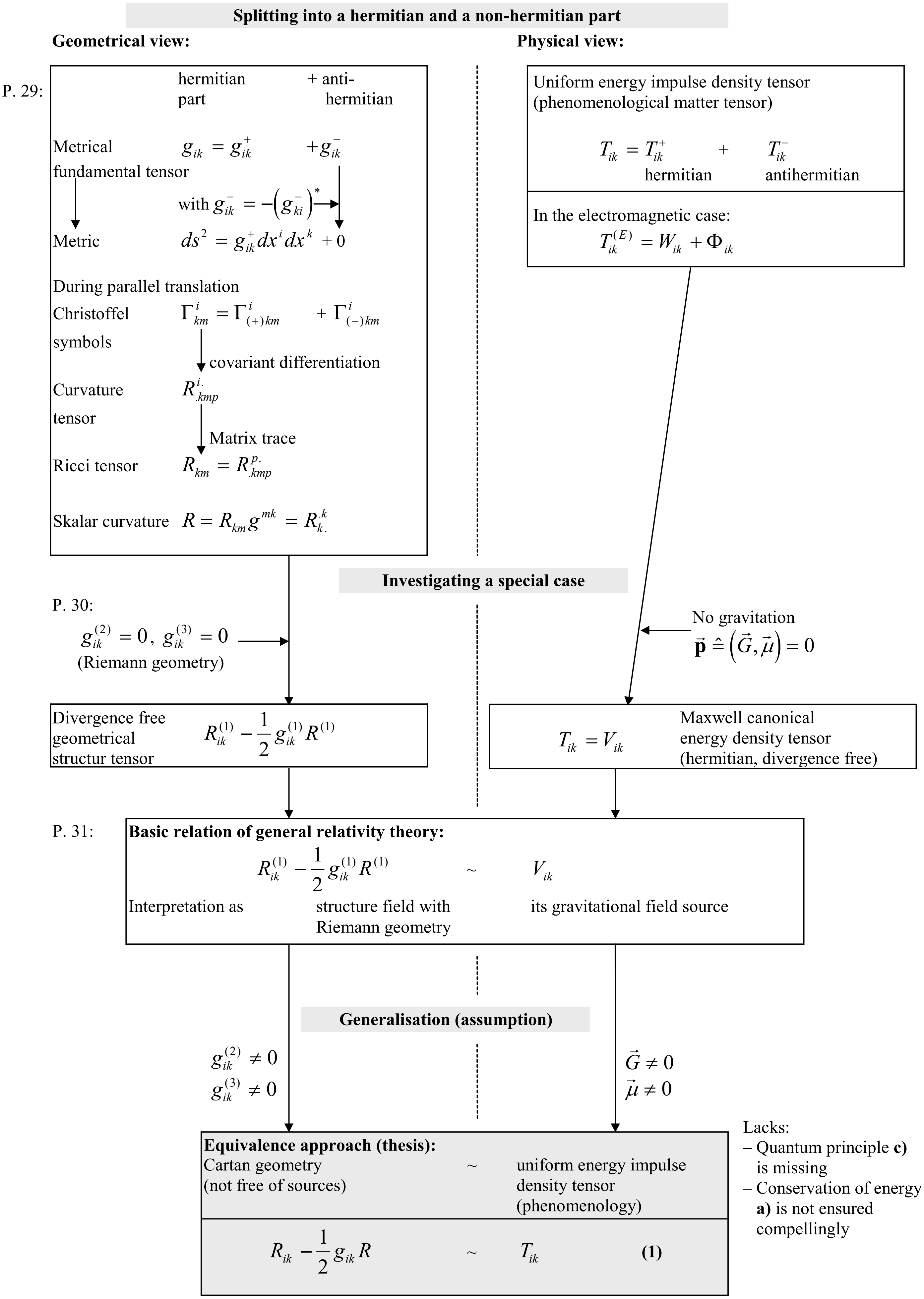
Iteration
(tensorial multiplication with itself and trace to the spectral matrix)

Uniform energy impulse density tensor
(phenomenological matter tensor)

$$T_{ik} = \sum_{m=1}^{4} M_{im} M_{mk}$$

$T_{ik} \neq T^*_{ki}$ not hermitian

(Page 2)



Splitting into a hermitian and a non-hermitian part

Geometrical view:

P. 29:

hermitian part + anti-hermitian

Metrical fundamental tensor $g_{ik} = \overset{+}{g}_{ik} + \overset{-}{g}_{ik}$

with $\overset{-}{g}_{ik} = -\left(\overset{-}{g}_{ki}\right)^*$

Metric $ds^2 = \overset{+}{g}_{ik} dx^i dx^k + 0$

During parallel translation

Christoffel symbols $\Gamma^i_{km} = \Gamma^i_{(+)km} + \Gamma^i_{(-)km}$

covariant differentiation

Curvature tensor $R^{i.}_{.kmp}$

Matrix trace

Ricci tensor $R_{km} = R^{p.}_{.kmp}$

Skalar curvature $R = R_{km} g^{mk} = R^{k}_{k.}$

Physical view:

Uniform energy impulse density tensor (phenomenological matter tensor)

$T_{ik} = \overset{+}{T}_{ik} + \overset{-}{T}_{ik}$

hermitian antihermitian

In the electromagnetic case:

$T^{(E)}_{ik} = W_{ik} + \Phi_{ik}$

Investigating a special case

P. 30:

$g^{(2)}_{ik} = 0,\ g^{(3)}_{ik} = 0$

(Riemann geometry)

No gravitation

$\vec{\mathbf{p}} \mathrel{\hat{=}} \left(\vec{G}, \vec{\mu}\right) = 0$

Divergence free geometrical structur tensor $R^{(1)}_{ik} - \frac{1}{2} g^{(1)}_{ik} R^{(1)}$

$T_{ik} = V_{ik}$ Maxwell canonical energy density tensor (hermitian, divergence free)

P. 31: **Basic relation of general relativity theory:**

$$R^{(1)}_{ik} - \frac{1}{2} g^{(1)}_{ik} R^{(1)} \sim V_{ik}$$

Interpretation as structure field with Riemann geometry its gravitational field source

Generalisation (assumption)

$g^{(2)}_{ik} \neq 0$

$g^{(3)}_{ik} \neq 0$

$\vec{G} \neq 0$

$\vec{\mu} \neq 0$

Equivalence approach (thesis):

Cartan geometry (not free of sources) ~ uniform energy impulse density tensor (phenomenology)

$$R_{ik} - \frac{1}{2} g_{ik} R \sim T_{ik} \qquad \textbf{(1)}$$

Lacks:
- Quantum principle **c)** is missing
- Conservation of energy **a)** is not ensured compellingly

Chapter II-1: Derivation of a R_6

Description of the R_4 by point spectra

In macroscopic realm:

Chapter I-3

Continous

Structure tensor (Cartan geometry) ~ uniform energy impulse density tensor

$$R_{ik} - \frac{1}{2} g_{ik} R \sim T_{ik}$$

$$R_{ik} \sim T_{ik} - \frac{1}{2} g_{ik} T = W_{ik}$$

$$R_{ik} = \alpha W_{ik}$$

W_{ik}: Extended energy impulse density tensor

g_{ik}
- Not hermitian fundamental tensor
- Describes invariant metric state of the R_4 (macroscopic field continuum)

Γ^i_{km}
- Deviation of the metric structure from pseudoeuclidic space
- Not compellingly convergently

→ $\varphi^i_{km} \neq \varphi^{i*}_{mk}$

Structure tensor R_{km} ⟷ $C_p \varphi^p_{km}$

$$\alpha W_{km} = R_{km}$$

P. 38

Approach:

$$\alpha W_{km} = \sum_{j=1}^{4} G_{(j)km}$$

Sum of 4 portions

$j = p$

$$G_{(p)km} \longleftrightarrow C_{(p)}\varphi^{(p)}_{km}$$

Statement:

R_4 is carrier of a Hilbert function space:

- Functions are linear
- a dot product is defined

In microscopic realm:

Chapter I-4

Not continuous

Structure tensor ~ Density of action quanta in R_4 (tensor)

$$R_{ik} \sim \sqrt{-\left|g_{ik}\right|_4} \cdot \frac{\Delta N_{ik}}{\Delta \Omega}$$

$$R_{ik} \sim w \cdot \eta_{ik}$$

$\varphi^i_{km} \neq \varphi^{i*}_{mk}$ Non-hermitian metric state of R_4 in microscopic realm

↓ Convergence attainable

$$J^i_{km} = \int_\Omega \varphi^i_{km} \varphi^i_{mk}{}^* d\Omega < \infty$$ convergent

↓ Standardisation possible

$$J^i_{km} = 1$$ φ^i_{km} convergent

Approach:

There exist hermitian functional operators C_p ($p = 1 \ldots 4$), then is

$$\int_\Omega ((\varphi^{(p)}_{km})^x C_{(p)} \varphi^{(p)}_{km} - \varphi^{(p)}_{km} (C_{(p)} \varphi^{(p)}_{km})^x) d\Omega = 0$$

$C_p \varphi^p_{km}$

C_p Hermitian functional operator

φ^i_{km} Convergent function of the metric state of R_4

p Dimensions 1 … 4

$C_{(p)}\varphi^{(p)}_{km}$

Assumption:

- φ^p_{km} are state functions of metric states of the R_4, which are caused by the density of quanta of action η_{ik}
- C_p are state operators

P.39

Introducing new terms:

– Hermitian linear operators $H_{km}^{(p)}$ $L_{km}^{(p)}$

with

$$H_{km}^{(p)}\Psi = h_{km}^{(p)}\Psi \qquad L_{km}^{(p)}\Psi = l_{km}^{(p)}\Psi$$

– Their eigenvalues $h_{km}^{(p)}$ $l_{km}^{(p)}$

$$h_{km}^{(p)} = h_{km}^{(p)^*} \qquad l_{km}^{(p)} = l_{km}^{(p)^*}$$

– State function Ψ with $\int \Psi\Psi^* d\Omega = 1$

In macroscopic realm:

In microscopic realm:

$$G_{(p)km} \longleftrightarrow C_{(p)}\varphi_{km}^{(p)}$$

$\cdot\Psi$

$$G_{km}^{(p)}\Psi \to H_{km}^{(p)}\Psi = h_{km}^{(p)}\Psi \qquad \varphi_{km}^{(p)}\Psi \to L_{km}^{(p)}\Psi = l_{km}^{(p)}\Psi$$

Approach:

$$H_{km}^{(p)} \sim L_{km}^{(p)}$$

$$H_{km}^{(p)} = \lambda_{(p)}(k,m)L_{km}^{(p)} \qquad |\cdot\Psi$$

$$H_{km}^{(p)}\Psi = \lambda_{(p)}(k,m)L_{km}^{(p)}\Psi$$

$$G_{(p)km} \to \lambda_{(p)}(k,m)\varphi_{km}^{(p)}$$

$$G_{(p)km} \longleftrightarrow \boxed{C_{(p)}\varphi_{km}^{(p)} = \lambda_{(p)}(k,m)\varphi_{km}^{(p)}}$$ term by term

Structure of R_4: $$R^{i\cdot}_{\cdot kmp} \longleftrightarrow C_p\varphi_{km}^{i} = \lambda_p(k,m)\varphi_{km}^{i}$$

P.39:

Investigation of $\lambda_{(p)}(k,m)$:

If $H_{km}^{(p)}$ is hermitian, then is valid

$$0 = \int (\Psi^* H_{km}^{(p)}\Psi - \Psi(H_{km}^{(p)}\Psi)^*)d\Omega$$

$$0 = (\lambda_{(p)}(k,m)l_{km}^{(p)}) - (\lambda_{(p)}(k,m)l_{km}^{(p)})^* \underbrace{\int \Psi\Psi^* d\Omega}_{=1}$$

$$l_{km}^{(p)} = l_{km}^{(p)^*}$$

$$0 = \lambda_{(p)}(k,m) - \lambda_{(p)}(k,m)^*$$

$\lambda_{(p)}$ are real and symmetrically

λ_p are discrete structure steps of R_4

$\lambda_p = 0$ provide with $R^{i\cdot}_{\cdot kmp} = 0$ an empty space-time R_4

$\lambda_p \neq 0$ provide with $R^{i\cdot}_{\cdot kmp} = 0$ a curved R_4, in which vectors and scalars change, when moved at a closed path back to their starting point

$$\lambda_{(p)}(k,m) = \lambda_{(p)}(k,m)^*$$

$\lambda_{(p)}$
- have characteristics of eigenvalues
- they form discrete point spectra

$\lambda_{(p)} \neq 0$ are quantum-like discrete structure steps of the curvature measure of R_4

P. 41

Investigation of $\lambda_{(p)}(k,m)$:

$C_p\varphi^i_{km} = \lambda_p(k,m)\varphi^i_{km}$

If those C_p are hermitian, then is valid

$$0 = \int(\varphi^i_{km}{}^{\times} C_p\varphi^i_{km} - \varphi^i_{km}(C_p\varphi^i_{km})^{\times})d\Omega$$

$$0 = (\lambda_p(k,m) - (\lambda_p(k,m))^{\times})\int\varphi^i_{km}\varphi i^i_{km}{}^{\times} d\Omega$$

$$0 = \lambda_p(k,m) - (\lambda_p(k,m))^{\times}$$

= constant (convergent)

$$\lambda_p(k,m) = (\lambda_p(k,m))^{\times} = (\lambda_p(k,m))^{*}$$

for $k = m$

$$\lambda_p = \lambda_p{}^{*}$$

$\lambda_p(k,m) = \lambda_p(m,k)$ symmetrical

P. 43:

Page 2: $C_p\varphi^p_{km} = \lambda_p(k,m)\varphi^p_{km}$ follows

$$C_p\varphi^p_{km} - \lambda_p(k,m)\varphi^p_{km} = 0$$

$C_{(p)}\varphi^{(p)}_{km} - \lambda_{(p)}(k,m)\varphi^{(p)}_{km} = 0$ also term by term

$$C_{(p)}\varphi^{(p)}_{km} = \lambda_{(p)}(k,m)\varphi^{(p)}_{km} \qquad \textbf{(3)}$$

For 4 coordinates

$k = 1 \ldots 4$ 64 nonlinear tensorial equations

$m = 1 \ldots 4$ 64 eigenvalue equations of discrete

$p = 1 \ldots 4$ curvature steps of R_4

containing 4×16 point spectra $\lambda_p(k,m)$

Finding empty spectra

Building trace $i = k$:

$$R^{k.}_{.kmp} = \Gamma^k_{kp,m} - \Gamma^k_{km,p} + \Gamma^k_{ms}\Gamma^s_{kp} - \Gamma^k_{ps}\Gamma^s_{km} = A_{mp}$$

whereby $A_{mp} = -A_{pm}$

$$R^{i.}_{.kmm} = 0 \longrightarrow A_{mm} = 0$$

Building trace $i = k$:

$$C_p\varphi^k_{km} = \lambda_p(k,m)\varphi^k_{km}$$

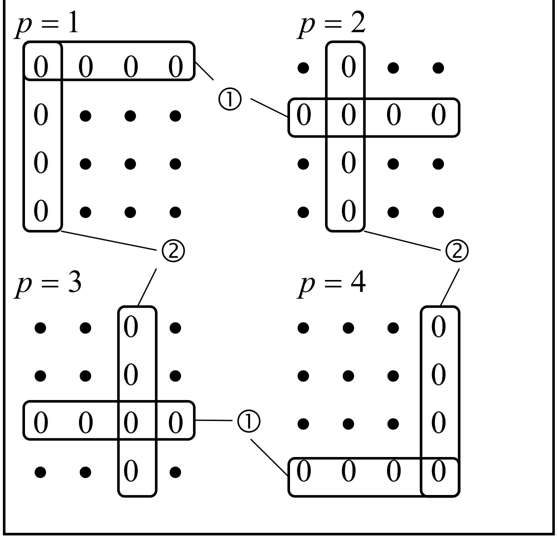
$$C_m\varphi^k_{km} = \lambda_m(k,m)\varphi^k_{km} = 0$$

$\varphi^i_{km} \neq 0$ normally (general case)

$\varphi^i_{km} = 0$ in Euclidean space or on geodetic coordinates

$\lambda_m(k,m) = 0$ 16 spectra have to be empty

Representation of the 4×16 spectra
with the empty spectra from ①, ② and ③



$\downarrow$

①: $\lambda_m(k,m) = 0$ **(3a)** 16 empty spectra

$\lambda_p(k,m) = \lambda_p^*(k,m)$ (Page 3)

②: $\lambda_m(m,k) = 0$ **(3a)** 16 empty spectra

$m = k$ are contained in both of these Spectra

③: $\lambda_m(m,m) = 0$ 4 empty spectra, which are contained in ① and ②

Relations for
16 + 16 - 4 = 28 empty spectra exist.

P. 44:

(3) + (3a)
64 - 28 = 36 Eigenvalue equations are not empty

36 point spectra $\lambda_p(k,m)$ remain. They correspond to
36 quantum-like energy densities $\varepsilon_{km}^{(p)}$

$$\lambda_{(p)}\varphi_{km}^{(p)} \sim \varepsilon_{km}^{(p)} \neq 0$$

P. 45:

36 energy densities can be arranged in a quadratic 6×6 tensor,
that must be divergence-free because of the conservation of energy **(a)**,
and which has to be invariant against coordinate transformations.
Such a tensor describes a space R_6 with 6 dimensions.

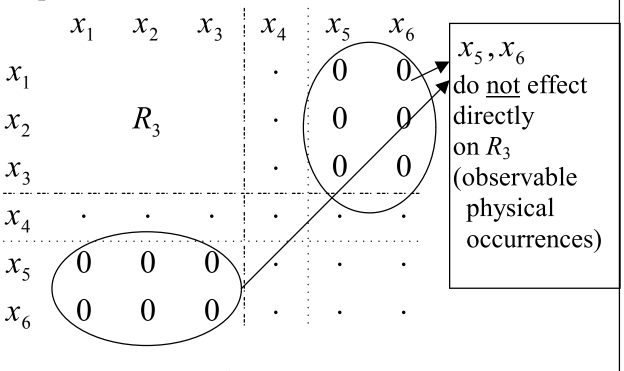
The material world must be described by a R_6 with 6 dimensions.

P. 46:

Determination of further empty spectra in superspace R_6

Assumption:
Space-time R_4 is a subspace of R_6.

Empirical demand:



x_5, x_6
do not effect
directly
on R_3
(observable
physical
occurrences)

12 spectra must remain empty!

$$R^{i\cdot}_{\cdot kmp} \longleftarrow C^{\cdot}_{p}\varphi^{i}_{km}$$

Building trace ? $\longrightarrow$ $C_p\varphi^i_{mp} = -C_m\varphi^i_{pp}$

$$\lambda_p(m,p)\varphi^i_{mp} = -\lambda_m(p,p)\varphi^i_{pp}$$

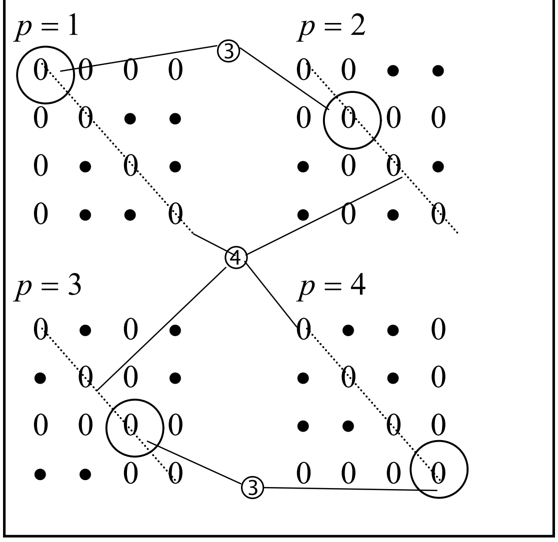
$\varphi^i_{km} \neq 0$

(3a): $\lambda_m(m,p) = 0$

$$\lambda_m(p,p) = 0$$

P. 47:

Representation of the 4×16 spectra
with removed empty spectra from ④ and ① to ③



④: $\lambda_p(m,m) = 0$ 16 empty spectra

$m = p$ spectra already contained in **(3a)**

③: $\lambda_m(m,m) = 0$ 4 empty spectra, that are not contained in **(3a)**

$\lambda_p(m,m) = 0$, $p \neq m$ **(3b)** 16 – 4 = 12 empty spectra

The tensor $\mathbf{T}_{ik}$ of the R_6 actually contains 12 empty components, which can arranged as the empirical measurements require.

$$\vec{\vec{\mathbf{T}}} = \begin{bmatrix} (11 & (12) & (13) & (14) & 0 & 0 \\ (21) & (22) & (23) & (24) & 0 & 0 \\ (31) & (32) & (33) & (34) & 0 & 0 \\ (41) & (42) & (43) & (44) & (45) & (46) \\ 0 & 0 & 0 & (54) & (55) & (56) \\ 0 & 0 & 0 & (64) & (65) & (66) \end{bmatrix}$$

$$T_{ik} \equiv (ik) \qquad \textbf{(3c)}$$

Proof of the existence of a R_6 as hyperspace of the world according to DRÖSCHER:

(3a) $\lambda_{(m)}(m,p)\varphi^i_{mp} = -\lambda_{(p)}(m,m)\varphi^i_{mm}$ Symmetry of R_4

$$\varphi^i_{mp} = -\frac{\lambda_{(p)}(m,m)}{\lambda_{(m)}(m,p)}\varphi^i_{mm}$$

(3b) $\lambda_m(m,p) = \lambda_p(m.M) = 0$ Empty spectra

$$\varphi^i_{mp} = -\frac{0}{0}\varphi^i_{mm}$$ Improper quotient

$$\lim\frac{\lambda_{(p)}(m,m)}{\lambda_{(m)}(m,p)} = a_{mp} = \text{const} \neq 0$$

Determination of the algebraic character of the dimensions x_5, x_6

P. 49:

In R_4:

$(+++-)$ with the functional determinant $w = \sqrt{-g}$

Variants in R_6: Number of real dimensions *p*

a	$(+++-++)$	$p = 5$	
b	$(+++-+-)$	$p = 4$	not allowed, because the Poincaré group must be approximately invariant
c	$(+++--+)$	$p = 4$	
d	$(+++---)$	$p = 3$	

Experience within the macro realm

Effects of a **gravitation law** for *p* different real dimensions

$p > 4$ No stable orbits, logarithmic spirals

$p = 4$ Circular path degrades to a logarithmic spiral immediately, because of the irrationality of π

$p \leq 3$ Stable orbits

$p \leq 3$

Experience in the micro realm

Quantum-theoretical investigation of **stable ground states in electron orbitals**

$p > 3$ No stability possible

$p = 3$ Stability is possible

$p = 3$

P. 50:

6-dimensional structure of the world:

$$\left.\begin{array}{l}\left.\begin{array}{l}(x_1, x_2, x_3) = (x_1^*, x_2^*, x_3^*) \mathrel{\hat{=}} R_3 \quad \text{Space} \\ x_4 = i\,c\,t\end{array}\right\} \text{Space-time } R_4 \\ x_5 = i\varepsilon \\ x_6 = i\eta\end{array}\right\} \text{World } R_6 \qquad \textbf{(4)}$$

Description by means of a standardised orthogonal system with unit vectors $\vec{e}_k$

$$1 \leq k \leq 6, \qquad \vec{x}_k = \vec{e}_k x_k, \qquad \vec{e}_i \vec{e}_k = \delta_{ik} \qquad \textbf{(4a)}$$