The Physics of Burkhard Heim and its Applications to Space Propulsion

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Abstract

If one is searching for field propulsion systems for a real interstellar spaceflight, one has to look for a theory which offers the possibilities for

- generating gravitational fields,
- producing gravitational waves
- lowering inertia
- superluminal velocity.

All of these four requirements seem to be fulfilled by the 6-dimensional unified fully geometrised quantum field theory of Burkhard Heim, which has been proven to be correct, because it supplies a suitable formula for all known particle masses (ground and excited states), as well as the correct values of coupling constants.

The knowledge of the internal structure of elementary particles makes it possible, in principle, to alter their properties, such as inertia.

The physicist Burkhard Heim, who deceased on January 14th , 2001, in Northeim, near Goettingen, was the German equivalent to Stephen Hawking and one of the greatest German physicists. Since he left the *Max-Planck-Institute* in Goettingen in 1954 because of his bodily handicap (he lost his eyes, his hearing and his hands by an accident) he worked privately. When he published his theory in two voluminous books (written in German, about 600 pages) in 1979 and 1984, nobody could believe that Heim discovered the unified mass formula. And nobody remembered that he had become famous in 1959, when he proposed a new propulsion system for spaceflight.

In this paper the author will give a short overview of Heim's theory and then will deduce some experiments to manipulate gravity. Heim started with Einstein's General Relativity Theory, but modified it for application in the microscopic range. Here, the field equations become eigenvalue equations. For invariance reasons Heim had to introduce a 6-dimensional manifold. The existence of a smallest area required the computation with differences rather than with differentials, and with selectors instead of tensors. According to Heim, Einstein's assumption of one single metric was too simple. He introduced three partial structures, which constitute four possible metrical tensors by correlations. This complicated geometry leads to 1956 eigenvalue equations from which it is possible to deduce the mass spectrum of elementary particles and to describe their internal structure fluxes. Matter consists of an exchange of maxima and minima of condensations of the smallest areas in subspaces of an R_6. Contrary to vacuum fluctuations, matter exists when the geometrical exchange processes always return to their starting point. These geometrical fluxes produce a spin. Since this spin tends to stay orthogonal to the vector of world velocity, each acceleration leads to a resistance force or inertia.

There are several possible ways to generate gravitational fields and gravitational waves in Heim's theory. A theoretical possibility consists in the generation of gravitons from neutrons. The generation of acceleration fields has been investigated by the spaceflight company DASA. Heim himself proposed to test the contrabaric effect predicted by his theory. For financial reasons these experiments could not be finished.

1. General Relativity Theory

In the middle of the 1950s the blind and handless physicist Burkhard Heim started to investigate the unified field theory by Albert Einstein and discovered how one has to modify Einstein's ansatz in order to get sufficient physical solutions.
In the macroscopic world general relativity has incorporated a new concept into physics. It assumes that the properties of space itself are modified in the presence of masses. However, the equations of relativity are restricted in the sense that they only govern gravitation. In addition, they are too symmetric and cannot be extended into the microscopic world of quantum theory. For this reason Heim regards relativity as an incomplete description of nature. He does, however, accept its basic philosophy of space being capable of deformation.

Let us recapitulate:
Einstein field equations of gravitation contain on the left side a geometrical part, the Einstein curvature tensor G_{ik} , and on the right side a phenomenological or physical part, the energy-momentum density T_{ik}

$$G_{ik} = R_{ik} - \tfrac{1}{2}R\, g_{ik} = - \kappa\, T_{ik} \qquad (1)$$

(with $R_{ik} = R^{l}_{ilk} \equiv$ Ricci or contracted curvature tensor of Riemann geometry, R = scalar of curvature, $g_{ik} = g_{ki}$ = metric tensor, T_{ik} = energy-momentum-density tensor, (k,i = 1,...,4), $\kappa = 8\pi\gamma/c^2$).
These are 4² coupled equations, which number is reduced due to the symmetry of all involved tensors to 10. In the absence of masses, $g_{11}=g_{22}=g_{33}=1$, $g_{44}=-1$, and all other g_{ik}'s are zero. This set of metric tensor components signifies so-called „flat", or empty, space, in which unperturbed objects propagate along straight lines.. In the presence of a single spherical mass space becomes curved, and the trajectories of unperturbed objects are curved orbits in a plane.

One gets the metric tensor from the behaviour of coordinate differentials by transformation.
If ξ^1 are euclidic coordinates of a local inertial system and x^m non-euclidic coordinates, then the two coordinate systems are joined together by the following connection:

$$g_{ik} = \eta_{lm} \frac{\partial \xi^l}{\partial x^i} \frac{\partial \xi^m}{\partial x^k} \qquad (2)$$

where ξ^i is a locally inertial coordinate system and η_{ik} is the metric tensor of the flat Minkowski space-time. The contracted Riemann curvature tensor

$$R_{ik} = g^{lm} R_{limk} , \qquad (3)$$

is the divergenceless Ricci tensor.

In case of small gravitational fields and small velocities equation (1) reduces to the Poisson equation of Newton theory of gravitation

$$\Delta\varphi = 4\pi\gamma\rho, \qquad (4)$$

(φ = gravitation potential, γ = constant of gravitation, ρ = density of matter, Δ = three-dimensional Laplace operator: div grad).

In the Ricci tensor

$$R_{ik} = \frac{\partial \Gamma^{l}_{il}}{\partial x^{k}} - \frac{\partial \Gamma^{l}_{ik}}{\partial x^{l}} + \Gamma^{m}_{il}\Gamma^{l}_{km} - \Gamma^{m}_{ik}\Gamma^{l}_{lm} \qquad (5)$$

the Christoffel symbols or the affine connection Γ^{l}_{ik} designate the affine displacement in a curved space :

$$\Gamma^{l}_{ik} = \frac{\partial x^{l}}{\partial \xi^{m}} \frac{\partial^{2} \xi^{m}}{\partial x^{i} \partial x^{k}} \qquad (6)$$

were $\xi^{m}(x)$ are local inertial coordinates.

A special property of these symbols is their behaviour under transformations:

$$\Gamma^{l}_{ik} \longrightarrow \Gamma'^{l}_{ik} \equiv \frac{\partial x'^{l}}{\partial x^{p}} \frac{\partial x^{n}}{\partial x'^{i}} \frac{\partial x^{m}}{\partial x'^{k}} \Gamma^{p}_{nm} + \frac{\partial x'^{l}}{\partial x^{p}} \frac{\partial^{2} x^{p}}{\partial x'^{i} \partial x'^{k}} \qquad (7)$$

i.e. they do not transform like tensors, for which the second term in (7) would vanish.
The affine symbols are connected with the metric tensors g_{ik} as follows:

$$\Gamma^{l}_{ik} = 1/2\, g^{lm} \left(\frac{\partial g_{mi}}{\partial x^{k}} + \frac{\partial g_{mk}}{\partial x^{i}} - \frac{\partial g_{ik}}{\partial x^{m}} \right) \qquad (8)$$

The equations of motion for a mass point m under the influence of a non-gravitational force K^{l} are:

$$m \frac{d^{2} x^{l}}{ds^{2}} + \Gamma^{l}_{ik} \frac{dx^{i}}{ds} \frac{dx^{k}}{ds} = K^{l} \qquad (9)$$

with the quadratic line element of Riemann geometry: $ds^2 = g_{ik} dx^i dx^k$
(in the case of a flat pseudo-Euclidian Minkowski-space-time: $g_{ik} \equiv \eta_{ik}$)
In the Newtonian approximation for a time-like component g^{0}_{0} one gets:

$$g^{0}_{0} = -1 - 2\varphi/c^{2}, \qquad \text{with } \varphi = \gamma m/r \qquad (10)$$

The only central symmetrical solution (Birkhoff theorem) for (1) is that with the metric introduced by Carl Schwarzschild :

$$ds^{2} = g_{rr} dr^{2} + g_{\varphi\varphi} d\varphi^{2} + g_{\theta\theta} d\theta^{2} - g_{00} c^{2} dt^{2} \qquad (11)$$

$$ds^{2} = -\frac{dr^{2}}{1 - \frac{2\gamma M}{c^{2} r}} - r^{2} d\varphi^{2} - r^{2} \sin^{2}\varphi\, d\Theta^{2} + \left(1 - \frac{2\gamma M}{c^{2} r}\right) c^{2} dt^{2} \qquad (12)$$

Since Einstein's gravitation theory with Schwarzschild's solution has been proven to be correct by many experiments, any gravitational theory must have the field equations of general relativity (1) as an approximation.

2. Extension of Field Equations to Microscopic Domains by Burkhard Heim

2.1 Eigenvalue Equations of Metrical Structures

Burkhard Heim extends the geometrical description of gravitation to the microscopic domain. In this range one has to account for the of quantum nature of matter. Heim asks: Which is the geometry that describes the gravitational field of an elementary particle?
Since in (1) on the right side one has a quantized expression one has to introduce on its left side a quantized function which has to describe quantum states of the metric structure. Therefore, the field equations become eigenvalue equations, which describe discrete states of different possible values of deformations of the space-time geometry.

The affine tensor Γ^i_{kl} of Riemannian geometry is replaced by a state function ψ^l_{ik} of the metric but non-hermitic R_4-condition in the micro domain, on which a non-linear operator C_p acts such that by transition to the macro domain the Ricci tensor R_{ik} appears:

$$C_p\psi^p_{ik} \rightarrow R_{ik} \qquad (13)$$

In conformity with the requirements of a unified field theory, Heim's microscopic equations must be written,

$$C_{(p)}\,\psi^{(p)}_{ik} = \lambda_{(p)}(ik)\,\psi^{(p)}_{ik} = T_{ik}{}^p \qquad (14)$$

(where the parantheses around p signify suspension of the summation convention).
$\lambda_p(i,k)$ are real eigenvalues of a discrete point spectrum. $T_{ik}{}^p$ denotes an energy density. Now, i, k, and p independently run from 1 to 4, and hence equation (14) represents a set of $4^3 = 64$ eigenvalue equations.

Einstein (macroscopic)		Heim (microscopic)
Γ^i_{kl}	$\rightarrow$	ψ^i_{kl}
R_{kl}	$\rightarrow$	$C_p\psi^i_{kl}$
$G_{ik} = T_{ik}$	$\rightarrow$	$C_p\psi^p_{ik} = \lambda_{(p)}(ik)\,\psi^p_{ik}$

2.2 The 6-Dimensional World-Continuum

The corresponding space for the 64 equations, in conformity with the requirements of Lorentz-invariance, is 8-dimensional, since all of the energy density components can be written invariantly by an 8-dimensional tensor.

As long as the operator C_p in (14) is non-linear many of the eigenvalues are zero.
Because of
$\lambda_m(k,m) = 0$, $\lambda_m(m,k) = 0$, $\lambda_p(m,m) = 0$, $\lambda_m(m,m) = 0$
there are 16+(16 - 4) +(16 - 4) = 40 empty spectra.

The appropriate energy density tensor T_{st} , can be constructed if i and k are allowed to vary from 1 to 8. The tensor turns out to be

$$T_{ik} = \begin{pmatrix} T_{11} & T_{12} & T_{13} & T_{14} & 0 & 0 & 0 & 0 \\ T_{21} & T_{22} & T_{23} & T_{24} & 0 & 0 & 0 & 0 \\ T_{31} & T_{32} & T_{33} & T_{34} & 0 & 0 & 0 & 0 \\ T_{41} & T_{42} & T_{43} & T_{44} & T_{45} & T_{46} & 0 & 0 \\ 0.. & 0.. & 0... & T_{54} & T_{55} & T_{56} & 0 & 0 \\ 0.. & 0.. & 0... & T_{64} & T_{65} & T_{66} & 0 & 0 \\ 0.. & 0.. & 0... & 0 & 0 & 0 & 0 & 0 \\ 0.. & 0.. & 0... & 0 & 0 & 0 & 0 & 0 \end{pmatrix} \qquad (15)$$

This specifies a set of subspaces whose elements are different numbers of coordinates x_i that have equal properties

$R_8 \equiv \{x_1; x_2, x_3\}, \{x_4\}, \{x_5, x_6\}, \{x_7, x_8\}$

$R_8 = R_3 \cup T_1 \cup S_2 \cup I_2$

$R_3 \equiv (x_1, x_2, x_3) =$ space,

$T_1 \equiv x_4 = ict =$ time coordinate,

$S_2 \equiv (x_5, x_6)$, with $x_5 = i\varepsilon$ = entelechial coordinate and $x_6 = i\eta$ = aeonic coordinate

$I_2 \equiv (x_7, x_8)$ = coordinates changing probability states

The physically relevant continuum, however, is the 6-dimensional space, because of the remaining 36 equations in (14) which imply that the important space is the R_6 :

$R_6 = R_6\,(x_1, x_2, x_3, x_4, x_5, x_6)$ with the signature (+++---).

The 5th and 6th dimension, although imaginary like the time-dimension, have to be something different, because more than one single time dimension leads to unphysical results (Cole 1980). According to Heim, the two higher dimensions are associated with organizational properties. They will be called "trans-coordinates", to distinguish them from the four dimensions with which we are all familiar. They are denoted by x_5 and x_6 . x_5 is a coordinate designating the degree of organization of a system. The dependence on x_5 of the mathematical expressions describing configurations of evolving systems is a measure of the degree of organizational order prevailing in a system during the various phases of its evolution in time until it reaches the final state of stability. Organizational states evolving in time towards a final goal were defined already in antiquity as "entelechial" systems. Accordingly, Heim calls x_5 the *entelechial* coordinate. The x_6 coordinate guides states of high order towards those of low organizational order via x_5 actions in time , and it is called the *aeonic* coordinate. Both trans-coordinates always appear in combination. Every event must involve both dimensions. All structures existing in the 3-dimensional world of our experience extend into the two trans-dimensions. All physical invariants which are written as tensors have to be extended into 6 dimensions.

6-dimensional theories were also developed by Ahner & Anderson (1971) and Penrose (1975).

2.3 A Polymetric 8-Dimensional Modified Riemann Geometry

The fundamental tensor of Riemannian geometry can deduced from a coordinate transformation due to (2) for $\xi_m = \xi_m\,(x_i)$, were ξ_m are coordinates of an euclidian and x_i the coordinates of a non-euclidian system (with i, k = 1,...,4).

In R_8 one can assume that there are two 8-dimensional non-euclidean coordinate systems x_i and y_k ,which depend on each other: $y_k = y_k\,(x_i)$
These coordinates again can be functions of euclidian coordinates $\xi_m = \xi_m\,(y_k(x_i))$.
(were i, k = 1,...,8)

The equivalent to the fundamental tensor is deduced according to Eq.(2) . Forming the total differentials and summing up over indices appearing twice:

$$d\xi^m = \frac{\partial \xi^m}{\partial y^k}\frac{\partial y^k}{\partial x^i}dx^i \equiv \sum_{k=1}^{8} \kappa_{ki}^{(k)} dx^i , \tag{16}$$

The quadratic line element is

$$ds^2 = d\xi^m d\xi^m = \left(\frac{\partial \xi^m}{\partial y^l}\frac{\partial y^l}{\partial x^i} \right)\left(\frac{\partial \xi^m}{\partial y^n}\frac{\partial y^n}{\partial x^k} \right) dx^i dx^k \equiv \sum_{l,n=1}^{8} \kappa_{mi}^{(l)} \kappa_{mk}^{(n)} dx^i dx^k = \sum_{l,n=1}^{8} g_{ik}^{(ln)} dx^i dx^k , \tag{17}$$

Splitting up into subspaces structures with (15)

$$\frac{\partial \xi_m}{\partial x_i} = \sum_{\omega=1}^{3} \kappa_{mi}^{(\omega)} + \kappa_{mi}^{(4)} + \sum_{\omega=5}^{6} \kappa_{mi}^{(\omega)} + \sum_{\omega=7}^{8} \kappa_{mi}^{(\omega)} = \kappa_{mi}^{(3)} + \kappa_{mi}^{(2)} + \kappa_{mi}^{(1)} + \kappa_{mi}^{(0)} \quad . \tag{18}$$

In Heim's theory there exist principally three different interacting metrics. The $\kappa^{(\mu)}{}_{mi}$ = "**lattice-cores**" (with polymetric index μ = 0,1,2,3) are functions of the following coordinates: For μ = 3 the lattice core only depends on the three real space coordinates x_1,x_2,x_3 . The remaining ones are imaginary. μ = 3 determines a time depending lattice-core with x_4. μ = 1 signifies a lattice-core which depends on the two imaginary coordinates x_5 and x_6 .
(If the two non-energetical structures are involved, than the lattice-core will be defined by the coordinates x_7,x_8)

$\kappa^{(3)}{}_{ik} = \kappa^{(3)}{}_{ik}\,(x^1,x^2,x^3)$
$\kappa^{(2)}{}_{ik} = \kappa^{(2)}{}_{ik}\,(x^4)$
$\kappa^{(1)}{}_{ik} = \kappa^{(1)}{}_{ik}\,(x^5,x^6)$
$\kappa^{(0)}{}_{ik} = \kappa^{(0)}{}_{ik}(x^7,x^8)$

The lattice cores with different indices ν (= 0,1,2,3) according to (16) build up "**partial structures**" $g^{ik}{}_{(\mu\nu)}$:

$$g^{ik}{}_{(\mu\nu)} = \mathrm{sp}\,\Sigma(\,\kappa^{im}{}_{(\mu)} \times \kappa^{kl}{}_{(\nu)}) = \kappa^{im}{}_{(\mu)}\,\kappa^{km}{}_{(\nu)} \tag{19}$$

With the polymetric indices one can form 4 different composition tensors or "**correlators**" $\hat{g}^{ik} = \hat{g}^{ik}\left(g^{ik}_{(\mu\nu)}, \kappa^{ik}_{(\mu)}\right)^3_{\mu,\nu} = \hat{g}_x$ with x = a,b,c,d (Droescher and Heim 1996):

$$\hat{g} = \begin{pmatrix} g_{(00)} & g_{(01)} & g_{(02)} & g_{(03)} \\ g_{(10)} & g_{(11)} & g_{(12)} & g_{(13)} \\ g_{(20)} & g_{(21)} & g_{(22)} & g_{(23)} \\ g_{(30)} & g_{(31)} & g_{(32)} & g_{(33)} \end{pmatrix} = \hat{g}_d \tag{20}$$

For instance: $g_{(21)} \equiv g^{ik}{}_{(21)} = \kappa^{mi}{}_{(2)}\, \kappa^{mk}{}_{(1)}$. (i) describes the coordinates of the different subspaces to which the metrical partial structures are referred:

$$\begin{aligned} &(0) \equiv (x_7, x_8) \\ &(1) \equiv (x_5, x_6) \\ &(2) \equiv (x_4) = t \\ &(3) \equiv (x_1, x_2, x_3) = R_3 \end{aligned} \tag{21}$$

In R_8 "sieve operators" can act on $\hat{g}$, which let the structures (2),(3), or (2,3) vanish Therefore there exist in addition to $\hat{g}_d$ three further correlators:

$$\hat{g}_c = \begin{pmatrix} g_{(00)} & g_{(01)} & \boldsymbol{k}_{(0)} & g_{(03)} \\ g_{(10)} & g_{(11)} & \boldsymbol{k}_{(1)} & g_{(13)} \\ \boldsymbol{k}_{(0)} & \boldsymbol{k}_{(1)} & E & \boldsymbol{k}_{(3)} \\ g_{(30)} & g_{(31)} & \boldsymbol{k}_{(3)} & g_{(33)} \end{pmatrix} \tag{22}$$

$$\hat{g}_b = \begin{pmatrix} g_{(00)} & g_{(01)} & g_{(02)} & \boldsymbol{k}_{(0)} \\ g_{(10)} & g_{(11)} & g_{(12)} & \boldsymbol{k}_{(1)} \\ g_{(20)} & g_{(21)} & g_{(22)} & \boldsymbol{k}_{(2)} \\ \boldsymbol{k}_{(0)} & \boldsymbol{k}_{(1)} & \boldsymbol{k}_{(2)} & E \end{pmatrix} \tag{23}$$

$$\hat{g}_a = \begin{pmatrix} g_{(00)} & g_{(01)} & \boldsymbol{k}_{(0)} & \boldsymbol{k}_{(0)} \\ g_{(10)} & g_{(11)} & \boldsymbol{k}_{(1)} & \boldsymbol{k}_{(1)} \\ \boldsymbol{k}_{(0)} & \boldsymbol{k}_{(1)} & E & E \\ \boldsymbol{k}_{(0)} & \boldsymbol{k}_{(1)} & E & E \end{pmatrix} \tag{24}$$

In the correlators (22), (23), and (24) partial structures of the coordinate groups (2), (3), or (0) do not appear. Structures in these coordinates remain pseudo-euclidian. The other remaining partial structures act deforming. They are called „**hermetic**" in these coordinates (deduced from <u>herme</u>neutic of geome<u>try</u>). In all investigations about energetic processes the g_{0i} and g_{i0} do not take part. They are antihermetric and will not be regarded in further analyses. But they may be required when quantum mechanical probability fields will be regarded, in which case all of the 64 components in (15) are different from zero. The composition tensors $\hat{g}_x$ in the following investigations only contain the three lattice cores $\boldsymbol{k}_{ik}^{m}$ (with μ = 1,2,3). The "**hermetry-forms**" than designate the lattice cores $\kappa_{(\mu)}$ were the index signifies the contributing coordinates. Coordinates which are not involved in partial structures are "**antihermetric**" , i.e. pseudo-euclidian).

$$
\begin{aligned}
\hat{g}_a &= f(\bar{\boldsymbol{k}}_{(1)}) \\
\hat{g}_b &= f(\boldsymbol{k}_{(1)}, \boldsymbol{k}_{(2)}) \\
\hat{g}_c &= f(\boldsymbol{k}_{(1)}, \boldsymbol{k}_{(3)}) \\
\hat{g}_d &= f(\boldsymbol{k}_{(1)}, \boldsymbol{k}_{(2)}, \boldsymbol{k}_{(3)})
\end{aligned} \qquad (25)
$$

2.4 Metronic Mathematics

In the microscopic domain the differential calculus seems to be unsuitable, since quantum physics limits its use to a smallest range where all measurements in principle will be useless. That boundary has been found by simple considerations of specific lengths defined by an elementary particle (Treder 1974).
The characteristic length for a particle with a mass m is characterised by its Compton-wave length: $\boldsymbol{l}_c = \dfrac{h}{mc}$, and by its Schwarzschild radius: $a = \dfrac{2gm}{c^3}$
The product $a\lambda_c$ yields the product of the Planck length. Heim calculated a similar value and called it

“**Metron**“ $\tau = \dfrac{8}{3}\dfrac{gh}{c^3} = 6.15 \times 10^{-70}\ \text{m}^2$

Since the metron is a constant of nature, mathematics used to describe the geometry in micro domain must be based on metron calculus if it shall have a physical meaning.
While the mathematics of finite lengths has been developed in literature (Noerlund 1924; Gelfond 1958), the novel feature of Heim’s metronic theory is that it is a mathematics of finite *areas*. This area is exceedingly small. (Consider a sphere whose surface area is just equal to one metron, making its radius equal to 7×10^{-36} m. Just for comparison, if the radius of a proton were enlarged to moon diameter, then the metron would be as large as a proton). For most applications it may be regarded as infinitesimal in the mathematical sense. But there are instances, however, when it becomes obligatory to use metronic differentiation and integration.
Ashtekar also found the same smallest area (1994), whereas Meessen (1978, 1999) uses smallest distances only.
To give some impression of the metronic calculus, some counterparts of mathematical objects, as opposed to differential calculus, are shown:

Each metronic function $\varphi(n_1,...n_L)$ is a numerical order with L = 6 the dimension of space and n the number of areas τ. A metronic differential, for instance, is defined by the difference of numerical orders,

$$\partial_i\varphi(n_1,...,n_L) = \varphi(n_1,...n_L) - \varphi(n_1,...,n_i\text{-}1,...,n_L). \qquad (26)$$

Coordinate variables x^λ are replaced by “**lattice-selectors**“, acting on n

$$x^\lambda = C^\lambda;n = \alpha_k\ (\ )_k\ ; n \qquad (27)$$

„( )“ means “place holder“ (in this case for n).
A metronic derivation is:

$$d/dx^k \rightarrow \quad \delta_k = \delta/\alpha_k \text{ (with } \alpha_k = \boldsymbol{k}_k \sqrt[p]{\boldsymbol{t}}\text{)}\ , \qquad (28)$$

and a metronic integral: $\underset{n_1}{\overset{n_1}{S}} \varphi\, dn = \Phi(n_1) - \Phi(n_1-1) = (\delta\Phi)_{n1} = \varphi(n_1)$ (29)

Lattice selectors in the case of a curved space so-called "**hyperselectors**" ψ_λ:

$$\xi_\lambda = \psi_\lambda \,;\, n\,, \qquad (30)$$

Due to metronisation of infinitesimal translations (corresponding to the equations (6) and (8) in Riemannian geometry) the metronic change of a vector field in the projection to the cartesian space appears as a density change of the metron numbers which determine the field.

The counterparts to the Christoffel symbols of Riemannian geometry Γ^i_{kl} are $\Gamma^i_{kl}(\tau)$, which describe the changes of the metronic condensation degree of a vector field by changing a location in curved space of a fundamental type. They are named, therefore, "**fundamental condensors**"

$$\Gamma^i_{kl}(\tau) = \begin{bmatrix} i \\ kl \end{bmatrix}_{(a,b,c,d)} \qquad (31)$$

They are formed by the non-hermitic **fundamental selectors,** respectively the **composition field**: $g^{ik}_{(ab)}$

$$g^{ik}_{(ab)} = g^{ik}_{(ab)}\,; n \qquad \text{and} \qquad \hat{g}_{(x)} = \hat{g}_{(x)} : n \qquad (32)$$

with the **correlator** $\hat{g}_{(x)}$

with

$$g^{ik}_{(ab)} = sp({}^2\overline{a} \times {}^2\overline{b}) \neq g^{ik}_{(ab)}{}^* \qquad (33)$$

$${}^2\overline{a} = \kappa_a^{ik} \text{ and } {}^2\overline{b} = \kappa_b^{ik}\,, \quad \text{and } x = (a,b,c,d)$$

The covariant form of fundamental condensors in analogy to (8) is

$$\Gamma_{ikl}^{(ab)}\,(\tau>0) \equiv [_{ikl}]_{(ab)}\,;\, n \qquad (34)$$

and its mixed-variant form:

$$\gamma^{ip}{}_{(cd)}\,[_{ikl}]_{(ab)} = \sum_{n=1}^{N} c^i_n\, d^p_n\, [_{ikl}]_{(ab)} \equiv [_k{}^i{}_l]^{(cd)}_{\substack{-+\\(ab)}} \equiv \begin{bmatrix} \overset{\frown}{\underset{-}{c} \quad \underset{+}{d}} \\ a \quad b \end{bmatrix} \qquad (35)$$

The contravariant index i is applied by the lattice core ${}^2\overline{c}_{(-)}$, and the index p from ${}^2\overline{d}_{(+)}$ makes the summation possible. (ab) is designed as "**basic-signature**" and (cd) as "**contra-signature"**. (- +) and (+ -) are the "**acting-signatures**" which mark the contra (+) and co (-) acting. These fundamental condensors can be separated in a hermitic and an antihermitic part. There are 81 condensors (34) in R_6, which are, other than in general relativity, real forces.

When the steps of variance in Riemann geometry are changed, this can be described by the Kronecker symbol $g_{ik}g^{jk} = \delta^j_i$. In metron mathematics these products are interactions or „correlations" which form a "**correlations-selector**" Q^i_k :

$$Q^i_k\binom{a\ b}{c\ d} = g^{is}_{(cd)} g_{(ab)sk} = \left(g^{is}_{(cd)};(\ )g_{(ab)sk}\right);n = F^i_k\begin{pmatrix} c & d \\ a & b \end{pmatrix};n \neq d^i_k \qquad (36)$$

$$Q^i_m\binom{c\ d}{a\ b} = F^i_m\binom{c\ d}{a\ b} - \delta^i_m E, \qquad E = [\,1\,] \qquad (37)$$

There are two kinds of interactions:

correlations are internal interactions between the fundamental selectors $g^{ik}_{(ab)}$, i.e. between the elements within the composition field $\hat{g}$, and

correspondences, which are external interactions between the $\overline{l} \neq 0$, following from the fundamental condensors $\overset{\cap}{[\,]} = \overset{\cap}{\begin{bmatrix} mn \\ {}^{-+} \\ pq \end{bmatrix}}$.

Parallel translations are possible with $[{}_k{}^i{}_l]^{(cd)}_{\overset{-+}{(ab)}}$ and with $Q^i_m\binom{c\ d}{a\ b}\ [{}_k{}^m{}_l]^{(cd)}_{\overset{-+}{(ab)}}$. Therefore, the basic law of structure condensations can be written:

$$\overset{\cap}{[\,]} = \begin{bmatrix} i \\ kl \end{bmatrix} = \sum_{a,b,c,d=1}^{w^4}\left(\begin{bmatrix} c & d \\ \overset{-}{a} & \overset{+}{b} \end{bmatrix} + sp^2\overline{Q}\begin{pmatrix} c & d \\ a & b \end{pmatrix};(\ )\times\begin{bmatrix} c & d \\ \overset{-}{a} & \overset{+}{b} \end{bmatrix}\right) \qquad (38)$$

(with ω = 3).

A condensor describes a metrical state of condensations of metrons, related to the empty R_6 . These structure changes cause a compression state which can be denoted by a „**structure-compressor**" ${}^4\overline{r}^i_{klmp}$: (corresponding to the curvature tensor in the Riemann geometry R^i_{kmp}):
(Fig. 1)

$$R^i_{kmp} \rightarrow {}^4\overline{r}^i_{kmp};n = \left(d_m\begin{bmatrix} i \\ kp \end{bmatrix} - d_p\begin{bmatrix} i \\ km \end{bmatrix} + \begin{bmatrix} i \\ ms \end{bmatrix};(\ )\begin{bmatrix} s \\ kp \end{bmatrix} - \begin{bmatrix} i \\ ps \end{bmatrix};(\ )\begin{bmatrix} s \\ km \end{bmatrix}\right);n = K^{(m)}_p;\begin{bmatrix} i \\ km \end{bmatrix};n \qquad (39)$$

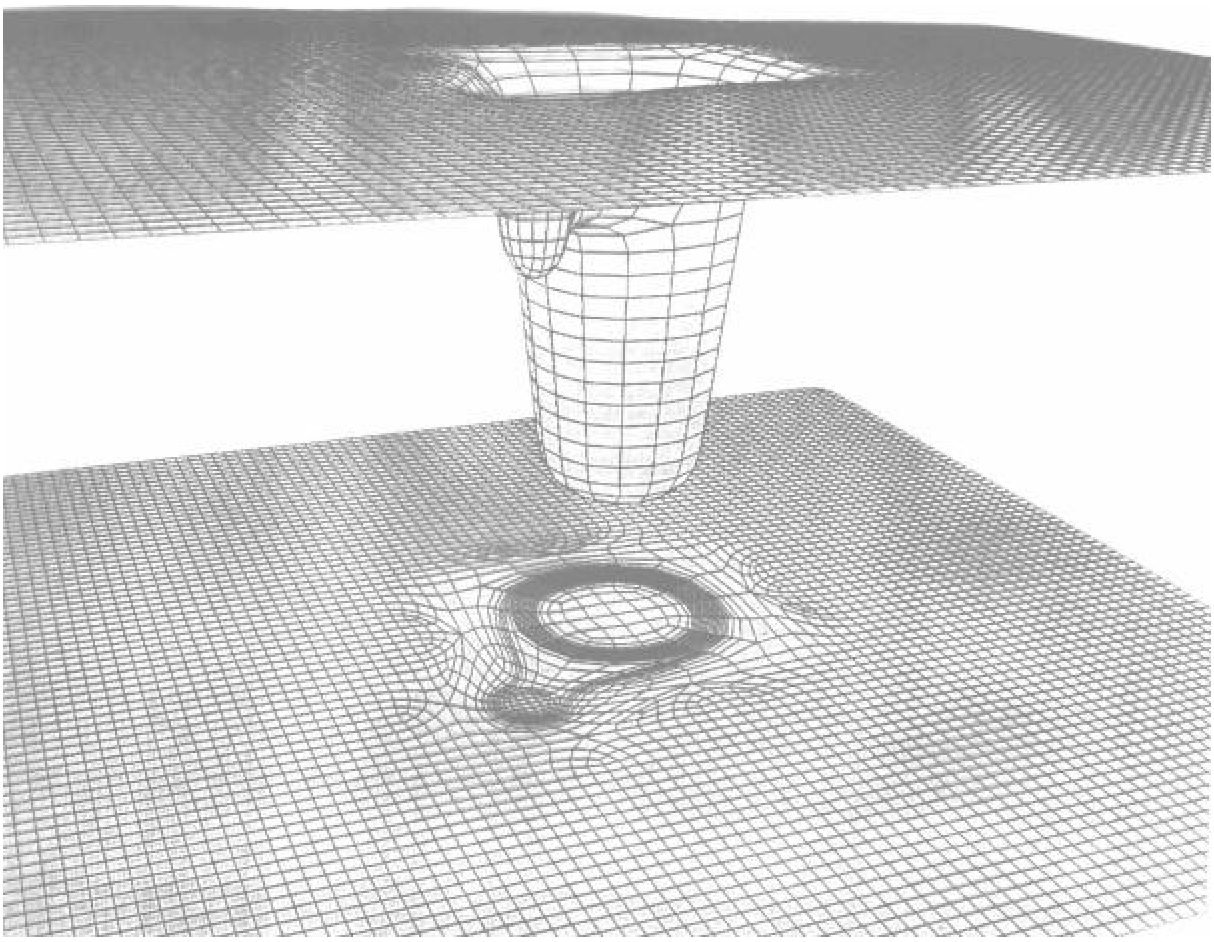

Fig. 1: 3-dimensional space curvature by the earth-moon-system and its 2-dimensional projection (approximate representation)

3. Cosmology

In Heim's theory, both the cosmic diameter D and the metronic size τ depend on the age of the universe, T. The dependence is such that D is presently expanding and τ was larger. There are good reasons that at one time in the past the area πD^2 of a sphere of diameter D in our 3-dimensional world was equal to the metronic area τ. This instant marks the origin of the universe and the beginning of time.

If the surface of diameter D is much grater than τ, the relation is given approximately by

$$D = \frac{\pi}{e}\left(\frac{3}{32}\sqrt{\frac{3}{2}}\frac{\pi}{e}\right)^{\frac{4}{3}} \frac{E^{\frac{7}{3}}}{\tau^{\frac{11}{6}}}, \qquad e = 2.71828... \tag{40}$$

In this equation E = 1 m² for dimensional reasons. (In numerical calculations, E may simply be set to unity).

When πD^2 is equal to τ, the relation between D and τ is much more complicated and involves the solution of a seventh order algebraic equation. Three different values of D are found to satisfy this equation at the beginning of time. It follows that the universe started out as a trinity of spheres, whose diameters turn out to be

$$D_1 = 0.90992 \text{ m}, \qquad D_2 = 1.06426 \text{ m}, \qquad D_3 = 3.70121 \text{ m}. \qquad (41)$$

(It is a strange coincidence that the size of the universe at the start, according to theory, has had dimensions easily visualised by us.)

The magnitude of τ at the beginning of time, T = 0, $D = D_3$, was 43.04 m². Since then it has shrunk to 6.15×10^{-70} m², and, since all constants of nature are functions of the metronic size, they too have changed in accordance with their dependence on τ.

The development of the universe may be followed from the original trinity of spheres to its greatest diameter and back to origin. In Heim's theory time is quantized, i.e. time proceeds in finite steps. Each step corresponds to a smallest time interval, called a „chronon", δ, given by the relation,

$$\boldsymbol{d} = \frac{3}{4}\frac{e\boldsymbol{t}^{\frac{5}{6}}}{2^{\frac{1}{3}}\boldsymbol{p}^{\frac{1}{4}}E^{\frac{1}{3}}c} \quad . \qquad (42)$$

After the first time step δ the outermost sphere expands and enters time, the middle sphere expands to diameter D_3, and the inner sphere expands to diameter D_2. The surface of the outer sphere, which originally had an area equal to τ, now is subdivided into a number of metrons. After a further chronon is elapsed, the inner sphere expands to diameter D_3 and the two outer ones expand further and are covered with an increasing number of metrons. Finally, another chronon later, the inner sphere expands one more step and it, too, enters time and so on. (Fig. 2)

From this moment on, the spherical shells expand together, the inner one always a chronon behind the middle sphere and the outer one always a chronon ahead. At the same time the number of metrons on each spherical shell multiplies and each metron becomes smaller as time goes on. The situation after a long period of time is such that the surface curvatures of the originally spheres are now no more measurable, i.e. flat sheets.

As soon as time enters the picture the 3-dimensional spheres become 4-dimensional, time being the 4th dimension. In reality, the visible universe is confined to the surfaces of three 4-dimensional spheres. The 3-dimensional volume, and the corresponding projections of the square metrons become 3-dimensional cubes. Each sphere is truly 3-dimensional only during the short time its diameter is equal to D_3 and its surface area is equal to a single τ.

Heim's theory results in a present age of the universe approximately equal to 5×10^{107} years, and a diameter D of about 6×10^{109} light years.

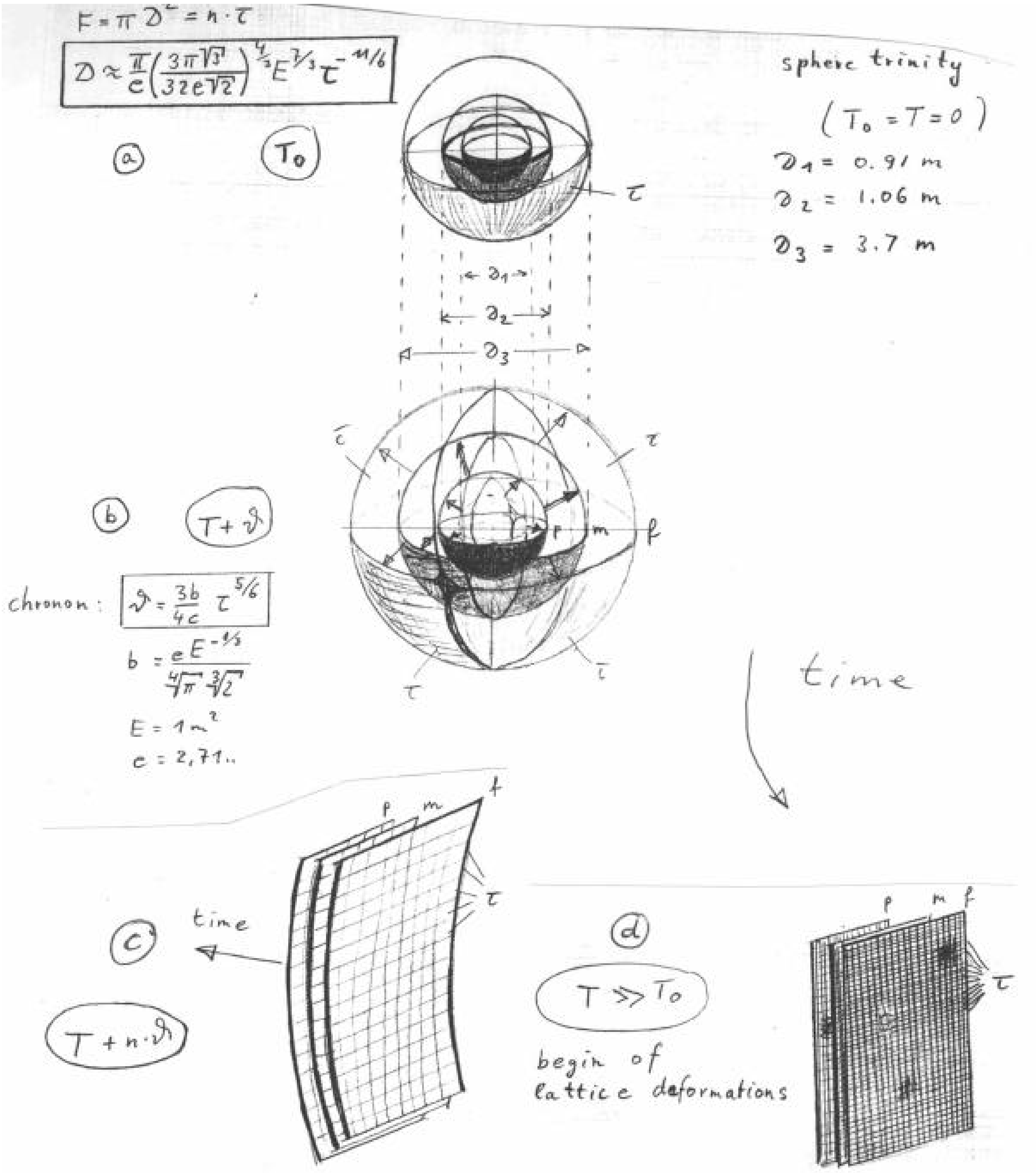

Fig. 2: Development of the primordial trinity of spheres in time:

a) The initial configuration at time T = 0 with $pD_3^2 = t$
b) One chronon later. The spheres have expanded and the outer one is subdivided into metrons, symbolised by quadrants.
c) A portion of the expanding metron-covered spheres at a much later time. The metrons have become smaller.
d) A part of three expanding spheres at a time when metrons are small enough to form condensations and matter

In Heim's theory there was no big bang, since, contrary to Einstein's equations (1), Heim has only geometrical sizes in his equations. During most of its existence the universe consisted of an empty metronic lattice, whose metrons kept getting smaller as the universe grew larger. Eventually, metrons became small enough for matter to come into existence, as a consequence of the fluctuations of metrons after a long time of expansion. Suddenly they could form cyclic exchanges of maxima and minima of metronic compression. They also were large enough that the corresponding energy to form such cyclic fluxes was high. These processes may have occurred some 15-20 billion (10^9) years ago, at which time matter was created throughout the cosmic volume. Hence, according to Heim, matter did not originate very soon after a big bang explosion but more uniformly in scattered “fire-cracker“ like bursts of galactic proportions. It could be possible that the observed gamma-bursts which happened in very early times of the cosmos may be these creation processes.

4. Heim’s Worldselector Equations and its Solutions

Equation (39) can written as eigenvalue equation according to (14)

$$K_p^{(m)};\begin{bmatrix} i \\ km \end{bmatrix};n = \lambda_p(k,m)\times\begin{bmatrix} i \\ km \end{bmatrix};n \tag{43}$$

with the „**structure selector**“ $K^{(m)}{}_p$. For (43) there exists a metronic function space in general Hilbert space, and the λ-values describe metrical steps of structure which must be interpreted as structural condensations. The energy in the condensation steps λ are summed up by the energetic states of the partial structures, expressed by the condensor signatures in the $\lambda^{(kl)}_{(mn)}$.

Equation (43) expressed by the selector $L^{(m)}{}_p$.
$L;[\ ] = {}^4\bar{0}$ means that the **worldselector** L selects from possible fundamental selectors those selectors which can exist as world structures in such a way, that the influence from L leads to a null selector of degree 4: the “**<u>worldselector equation</u>**“.

$$L_p^{(m)} \equiv K_p^{(m)} - \lambda_p(k,m)\times(\ ) = {}^4\bar{0} \tag{44}$$

Forming the trace of equation (44) yields for $\tau \to 0$, reducing the polymetry to $g_{ik} = \kappa_{\lambda\mu}\,\kappa_{\nu\mu}$, and $R_6 \to R_4$, the field equations (1). The number of equations is $6^4 = 1296$ (according to i,k,m,p and 6 dimensions).

The worldselector-equation

$$K_m;\begin{bmatrix} i \\ kl \end{bmatrix} = \lambda_m(k,l)\times\begin{bmatrix} i \\ kl \end{bmatrix} \tag{45}$$

i.e.

$$\left(\delta_l\begin{bmatrix} i \\ km \end{bmatrix} - \delta_m\begin{bmatrix} i \\ kl \end{bmatrix} + \begin{bmatrix} i \\ ls \end{bmatrix};(\ )\begin{bmatrix} s \\ km \end{bmatrix} - \begin{bmatrix} i \\ ms \end{bmatrix};(\ )\begin{bmatrix} s \\ kl \end{bmatrix}\right) = \lambda_m(k,l)\begin{bmatrix} i \\ kl \end{bmatrix} \tag{46}$$

was solved by Heim (1983) for the eigenvalues λ_m (k,l) . To become a little bit familiar with calculations of that kind, some hints on the steps will be given.

Setting k = m in (46) yields:

$$\left(\boldsymbol{d}_l\begin{bmatrix} i\\ mm\end{bmatrix} - \boldsymbol{d}_m\begin{bmatrix} i\\ ml\end{bmatrix} + \begin{bmatrix} i\\ ls\end{bmatrix};(\ )\begin{bmatrix} s\\ mm\end{bmatrix} - \begin{bmatrix} i\\ ms\end{bmatrix};(\ )\begin{bmatrix} s\\ ml\end{bmatrix}\right) = \boldsymbol{l}_m(m,l)\begin{bmatrix} i\\ ml\end{bmatrix} \qquad (47)$$

Forming the corresponding expression for $\boldsymbol{l}_l(m,m)\begin{bmatrix} i\\ mm\end{bmatrix}$ and adding up (46) yields

$$\boldsymbol{l}_m(m,l)\begin{bmatrix} i\\ ml\end{bmatrix} + \boldsymbol{l}_l(m,m)\begin{bmatrix} i\\ mm\end{bmatrix} = 0 \qquad (48)$$

Substituting the eigenvalue ratio

$$a_{ml} = -\frac{\boldsymbol{l}_l(m,m)}{\boldsymbol{l}_m(m,l)} \qquad (49)$$

in (46)

$$\left(\frac{a_{km}}{a_{kl}}\boldsymbol{d}_l - \boldsymbol{d}_m\right);\begin{bmatrix} i\\ kl\end{bmatrix} + \left(\frac{a_{ls}a_{lm}}{a_{lk}a_{kl}} - \frac{a_{ms}a_{km}}{a_{mk}a_{kl}}\right)\begin{bmatrix} i\\ kl\end{bmatrix};(\ )\begin{bmatrix} s\\ kl\end{bmatrix} = \boldsymbol{l}_m(k,l)\begin{bmatrix} i\\ kl\end{bmatrix} \qquad (50)$$

or with the abbreviations

$$a_m^{(kl)} = \frac{a_{km}}{a_{kl}}, \qquad b_{ms}^{(kl)} = \left(\frac{a_{ls}a_{lm}}{a_{lk}a_{kl}} - \frac{a_{ms}a_{km}}{a_{mk}a_{kl}}\right), \qquad (51)$$

$$a(k,l) = \sum_{m=1}^{q} a_m^{(kl)}, \qquad b_s^{(kl)} = \sum_{m=1}^{q} b_{ms}^{(kl)}, \qquad \boldsymbol{l}(k,l) = \sum_{m=1}^{q}\boldsymbol{l}_m(k,l) \qquad (52)$$

$$\left(a(kl)\boldsymbol{d}_l - \boldsymbol{d}_m\right);\begin{bmatrix} i\\ kl\end{bmatrix} + b_s^{(kl)}\begin{bmatrix} i\\ kl\end{bmatrix};(\ )\begin{bmatrix} s\\ kl\end{bmatrix} = \boldsymbol{l}(k,l)\begin{bmatrix} i\\ kl\end{bmatrix} \qquad (53)$$

and further conversions with the “**condensor-aggregate**“

$$\boldsymbol{y}_{kl} = \frac{b_i^{(kl)}}{\boldsymbol{l}(kl)}\begin{bmatrix} i\\ kl\end{bmatrix} \qquad (54)$$

and the abbreviations

$$\bar{a}_{kl}^{-1}\boldsymbol{d}\bar{\imath} = \frac{\boldsymbol{a}_l\boldsymbol{d}_{kl}}{a(k,l)-1} - \sum_{m\neq l}\boldsymbol{a}_m\boldsymbol{d}_m = \boldsymbol{d}N_{kl} \qquad (55)$$

$${}^{+}_{-}\Lambda_{kl} = {}^{+}_{-}\boldsymbol{l}(kl)\boldsymbol{d}N_{kl}, \quad N_{kl} = \varepsilon_{kl}\,\mu;n, \quad m = \sum_{s=1}^{q}\boldsymbol{a}_s(\ )_s, \quad \boldsymbol{e}_{kl} = \frac{1}{a(kl)-q} \qquad (56)$$

one gets the first metron integral (with the integration constant C_{kl}):

$$\left(E - \boldsymbol{y}_{kl}\right)^{\Lambda_{kl}+1}\boldsymbol{y}_{kl}^{\Lambda_{kl}-1} = 2^{-2\Lambda_{kl}}C_{kl}e^{-l_{kl}m} \qquad (57)$$

λ_{kl} algebraically given by the components λ_m (k,l). ψ_{kl} correspond to correlations of components of in discrete point spectra lying in metrical steps of condensations.

Extrema: ψ_{kl} ; n = 1, reachable with:

$$(\lambda_{kl}\ ;\ n)_{extr} = \alpha + iß \ , \tag{58}$$

since then the exponent is zero:

$$e^{-a} e^{-b} = e^{-a} (\cos ß - i \sin \boldsymbol{a}) \quad \text{for } \cos ß = 0 \text{ and } \sin ß = 0$$

The imaginary series of metron numbers permits in principle 4 eigenvalue spectra:

$$ß_{+}^{(\pm)} = \pm \frac{\boldsymbol{p}}{2} (2n_{+} + 1) \ , \ ß_{-}^{(\pm)} = \pm \pi \ n \tag{59}$$

Only Im (λ_{kl} N) leads to eigenvalues in discrete point spectra.
This means that the existence of imaginary world coordinates x_4,x_5,x_6 provides metrical steps of condensations as steps in the projection in R_3 and a physical events.

Components of the fundamental selector γ_{ik} derivable from (54) :

$$\boldsymbol{y}_i = \sum_{k,l=1}^{q} \begin{bmatrix} i \\ kl \end{bmatrix} = \boldsymbol{g}^{is} \sum_{k,l=1}^{q} [skl] = \frac{1}{2} \boldsymbol{g}^{is} \sum_{k,l=1}^{q} \left(\boldsymbol{d}_k \boldsymbol{g}_{sl} + \boldsymbol{d}_l \boldsymbol{g}_{ks} - \boldsymbol{d}_s \boldsymbol{g}_{kl} \right) = \frac{1}{2} \boldsymbol{g}^{is} \left(2 \boldsymbol{d} \boldsymbol{g}_s - \boldsymbol{d}_s \boldsymbol{g} \right) \tag{60}$$

From that follows the 2. metron integral (with the integration constant A_i)

$$\sum_{k=1}^{q} \boldsymbol{g}_{ik} = A_i \exp \left(\sum_{k,l=1}^{q} c_{kl}^{(i)} S \boldsymbol{y}_{kl} \boldsymbol{d}_m \right) , \qquad \text{with} \quad c_{kl}^{(i)} b_i^{(kl)} = 2\, \boldsymbol{l}(k,l) \tag{61}$$

Extrema of the hermetric components of $\hat{g}$ coincide with eigenvalues of the linear condensor aggregates ψ_{kl} in (59). Extrema of the hermetric components of the fundamental selector $\hat{g}$ (as turning regions) with minima of the ψ_{kl}: (Fig. 3)

$$\boldsymbol{g}_{kl}^{w} \cong \boldsymbol{y}_{kl}^{(\min.)} = 0 , \qquad \boldsymbol{y}_{kl}^{(\max)} = E \tag{62}$$

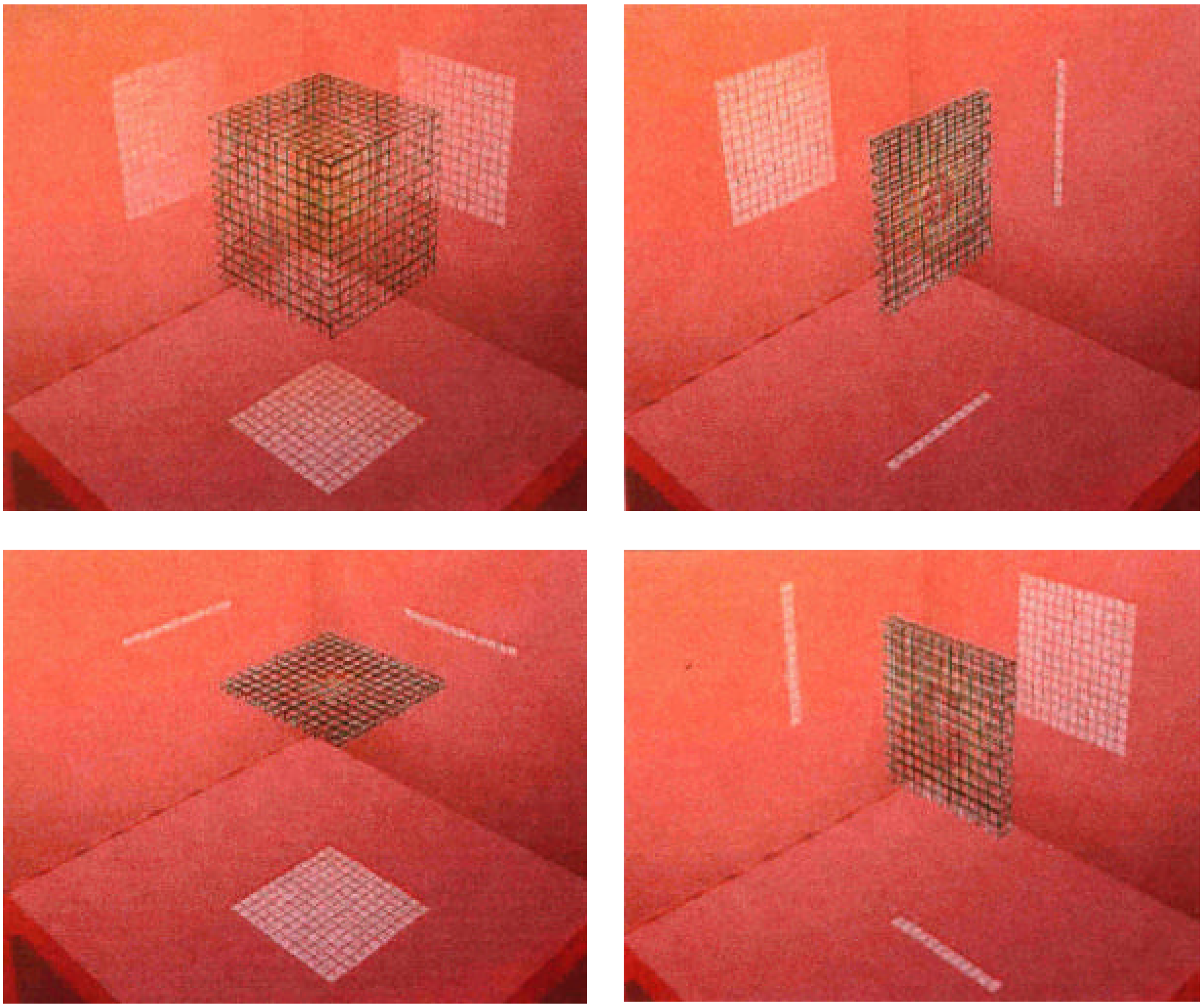

Fig. 3: Correlations of 2-dimensional projections (condensations) on 3 mutually perpendicular walls due to the compression of a flexible cube in different directions

5. Geometrical Structures of Elementary Particles, Photons, and Gravitons

By approximations from few to many metrons in (57) there result with respect to R_3 four different ranges of validity of the metrical components of the fundamental condensor.

1. "Metronic range": number of metrons low, $\lambda_{kl}\mu;n \approx \Lambda_{kl} \neq 0$.
2. Range of high number of metrons, $\lambda_{kl}\mu;n \gg \Lambda_{kl} \approx 0$. From (57) follows

$$\psi_{kl} \approx [E + C_{kl} \exp(-\lambda_{kl}\, \mu)]^{-1} \qquad (63)$$

(with $\mu = \alpha + i\beta$, $\alpha = \sqrt{t}\sum_{k=1}^{3} (\ )_k$, $i\beta = \sqrt{t}\sum_{k=4}^{6} (\ )_k$)

3. "Infinitesimal range", number of metrons $n \rightarrow \infty$ and $\tau \rightarrow 0$. Action of selectors will be the field function ψ_{kl}; $n \rightarrow \psi_{kl}(x_s)_1{}^q$

$$\psi_{kl} \approx [1 + \exp(-\lambda_{kl}\, iy)]^{-1} \qquad (64)$$

Where $y = \sqrt{r^2 - r^2}$, with $r^2 = \sum_{k=1}^{3} x_k^2$ and $r^2 = x_5^2 + x_6^2 + x_4^2$.

4. "Macroscopic range" , the fundamental condensor exponentially approximates a constant value

$$y = \left(1 + Ce^{\pm lr}\right)^{-1} \quad , \qquad \text{for } r^2 \gg \rho^2 \qquad (65)$$

The physical meaning of the hermetry forms a, b, c, d of the world structure in the single ranges of validity now can be investigated.

4.1 Gravitons

In the second range of validity and for the hermetry form $a \equiv (x_5, x_6)$,
with $k = 5$ and 6 and

$$m = i\sqrt{\left[(\ )_5 + (\ )_6\right]} \text{, it is } C_{km} = 1 \text{ and } m, n \rightarrow r \text{ , with } \rho^2 = x_5^2 + x_6^2$$

Writing the eigenvalue ratios s and t according to (45)

$$\begin{bmatrix} i \\ 55 \end{bmatrix} = s\begin{bmatrix} i \\ 56 \end{bmatrix} \text{ and } \begin{bmatrix} i \\ 66 \end{bmatrix} = t\begin{bmatrix} i \\ 56 \end{bmatrix} \text{ . Using the abbreviation } y^i = \begin{bmatrix} i \\ 55 \end{bmatrix}; n$$

than with $\lambda_1 = \lambda_6(5,5)$ and $\lambda_2 = \lambda_2(6,6)$ and a factor α which is construed from s and t (by Eq. (49)) one gets:

$$s\lambda_1\, \psi^i = \left(d_5 - sd_6\right); y^i - \frac{a}{s} y^i y^6 \qquad (66)$$

$$t\lambda_2\, \psi^i = \left(d_6 - td_5\right); y^i - \frac{a}{s} y^i y^5 \qquad (67)$$

These are 4 metron differentials for i = 5 and i = 6 . With the abbreviations $\lambda = s\lambda_1 + t\lambda_2$ and $\psi = \psi_5 + \psi_6$ one obtains

$$\lambda\psi = -\left[\ (t-1)d_5 + (s-1)d_6\ \right]; y - \frac{a}{s} y^2 \qquad (68)$$

In the 3. range of validity, there is $\psi \rightarrow \varphi'$ and $\varphi \rightarrow \alpha\varphi'/a$. With $\varphi(x_5,x_6) = \varphi(\xi)$ follows

$$\frac{dj}{dx} + j^2 = -lj \quad \text{, with } \frac{dj}{dx} = \frac{dj}{dx_5} + \frac{dj}{dx_6} \qquad (69)$$

This equation can be interpreted as metrical actions which will appear as gravitons when they intersect with space-time R_4.

5.2 Photons

Investigating the hermetry form b ≡ (x_4) yields a state function $\psi = \frac{dj}{dx}$. In the 3. range of validity the eigenvalues λ fulfil the wave equation

$$\ddot{y} + \left(\frac{lc}{2} \right)^2 y = 0 \qquad (70)$$

which characterizes the propagation law of electro-magnetic waves or photons.

5.3 Hints to Geometric Origin of Elementary Particle Masses

An analysis of the hermetry form c ≡ (x_1, x_2,x_3, x_5,x_6) , with $\boldsymbol{r}^2 = x_5^2 + x_6^2$, and $r^2 = \sum_{k=1}^{3} x_k^2$ ($\mu^2 = y^2 = \rho^2 - r^2$), from (57) one obtains

$$ß_+^{(+)} = \lambda_{kl}^+ \, y = \frac{\boldsymbol{p}}{2}(2n_+ + 1) \qquad (67)$$

or

$$\lambda_{kl}^+ \, (\rho, r) = = \frac{\boldsymbol{p}}{2}(2n_{rr} + 1) \qquad (68)$$

Forming the eigenvalue ratios

$$\frac{\boldsymbol{l}_{kl}^+(r)}{\boldsymbol{l}_{kl}^+(\boldsymbol{r})} = \frac{2n_r + 1}{2n_r + 1} = \frac{r}{\boldsymbol{r}} \qquad (69)$$

yields a connection between R_3 and coordinates x_5, x_6 in the range r < ρ by systems of quantum numbers n_r and n_ρ

$\dot{\boldsymbol{r}} = w$ and $\dot{r} = v$:

$$dy^2 = d\rho^2 - dr^2 = \left(\dot{\boldsymbol{r}}^2 - \dot{r}^2 \right) dt^2 = w^2 \left(1 - \frac{v^2}{w^2} \right) dt^2 , \qquad (70)$$

with ß = v/w :

$$y = \int w \sqrt{1 - ß^2}\, dt = \boldsymbol{r}\sqrt{1 - ß^2} + \int \boldsymbol{r} \frac{ß\dot{ß}}{\sqrt{1 - ß^2}} dt , \qquad (71)$$

For 1-ß² > 0 it is impossible to reach a geodesic zero-line in the 3. range of validity. These hermetry types mark particles. The eigenvalues λ_{kl} are quantum steps of ponderable matter.

The hermetry form c is characterised by 3 special lengths in R_3:
P1: a gravitational wave radius
P2: a matter wavelength,
P3: a gravitational wavelength

Therefore, there are three possibilities to interpret $(k,l) = \frac{x_6}{r}$: combinations (P1,P2), (P1,P3) and (P2,P3) , where the numbers stay for the 3 possibilities.

de Broglie-gravitation wavelength $\Lambda = \frac{h}{mw} = 2D$ for the field mass of gravitation

$\mu = m - m_0 = \frac{3g}{16c^2}\frac{m^2}{r_0}$ (were m_0 = nucleon mass in the distance = radius of nucleus

$$(P2) \equiv r_0 = \frac{l}{2} = \frac{h}{2mc}) \qquad (72)$$

$$(P3) \equiv D = \frac{l}{2} = \frac{h^2}{gm^3}. \qquad (73)$$

The gravitation wave radius follows from the extended gravitation law by Heim with the potential

$$j = \frac{gm}{r}\left(1 - \frac{r}{D}\right)^2 \qquad (74)$$

from which follows $$(P1) \equiv \frac{h^2}{2g} m\left(m^4 + wc\frac{h^2}{g^2}\right)^{-1}.$$

With (69) one obtains

$$r = \frac{2n_r + 1}{2n_r + 1}\sqrt{x_5^2 + x_6^2} \qquad (75)$$

n_r and n_ρ describe the course of the metronic eigenvalues in the range 0 ❄ $r^2 < \rho^2(x_5,x_6)$, were $n_r < n_\rho$. For $x_6 = 0$ one gets $r = x_5$ and from (75):

$$(k,l) = \frac{x_6}{r} = \pm 2(2n_r + 1)^{-1}\sqrt{(n_r + n_r + 1)(n_r - n_r)} = \pm\frac{2}{2n_r + 1 - 2l}\sqrt{l(2n + 1 - l)} = \pm 2 f(n,l) \qquad (76)$$

($l = n_\rho - n_r = n_\rho - n$ any whole number)

The analysis of (k,l) shows that only (2,3) yields a real mass spectrum, since only in this case the values for all quantum numbers n ✞ 0 are real numbers:

$$(2,3) = \frac{r_0}{D} = \frac{1}{2}\frac{gm^2}{hc} = 2 f(n,l) \qquad (77)$$

For n = 0 there must be m = 0. This yields for ℓ = 1 the *spectrum of masses*:

$$m(n) = 2\sqrt{\frac{ch}{g}}\,\frac{\sqrt[4]{2n}}{\sqrt{2n-1}} \qquad (78)$$

The existence of imaginary coordinates causes in R_3 the matter wavelength (P2). The x_5 -action as gravitational field wavelength (P3) describes the boundary of the attractive gravitation field. The c-hermetry form causes *neutro-particles*.

The solution of the total R_6 -hermetry d is very similar the formalism of the c-hermetry,
From the d-structure a structure is generated which fulfils an oscillation law and which propagates with light velocity in R_3. The hermetry form d can be interpreted as a space-condensation which as a consequence of the condensation of the time dimension in that condensation process is coupled to an electromagnetic field. These structures are *electrically charged particles*, which by interactions can exchange photons.

5.4 Elementary Charge and Finestructure Constant

For neutral the charge is zero: q = 0 in:

$$m(n,q) = m(n)\,\eta_q \quad , \qquad \text{with} \quad \boldsymbol{h}_q = \frac{\sqrt[4]{\boldsymbol{p}^4}}{4q^4 + \boldsymbol{p}^4} \ , \tag{79}$$

η_q is the consequence of an extremal principle, by which m(n,q) tends to take on the lowest possible values.
There must exist a minimal charge field $\boldsymbol{e}^{\pm}$, for which with the constants of nature, influence ε_0 and induction μ_0, i.e. the electromagnetic wave resistance of vacuum $R_- = \sqrt{\frac{\boldsymbol{m}_0}{\boldsymbol{e}_0}}$ and $\hbar$, it follows

$$\boldsymbol{e}_{\pm} = \pm \frac{3}{\boldsymbol{p}^2}\sqrt{\frac{\hbar}{R_-}} \tag{80}$$

For q = 1 there exists a reduced charge field e_r . The ratio of the corresponding energies of d-terms to the complementary c-terms is:

$$\frac{E(n,1)}{E(n)} = \left(\frac{e_r}{\boldsymbol{e}_{\pm}}\right)^2 = \frac{m(n,1)}{m(n)} = \boldsymbol{h}_1 \tag{81}$$

with
$$\boldsymbol{h}_1 = \boldsymbol{h} = \sqrt[4]{\frac{\boldsymbol{p}^4}{4 + \boldsymbol{p}^4}} \tag{82}$$

Reduced charge: $e_r = \boldsymbol{e}_{\pm}\sqrt{\boldsymbol{h}}$

Further component e_d = $\boldsymbol{e}_{\pm} - e_r$, and $2e_w$ = $\boldsymbol{e}_{\pm} + e_r$. From this follows the *electric elementary charge:*

$$e_{\pm} = \frac{1}{2}\sqrt{e_r^2 + e_w^2} = \frac{1}{2}\boldsymbol{e}_{\pm}\sqrt{\frac{\boldsymbol{J}}{2}} = \pm\frac{3}{4\boldsymbol{p}^2}\sqrt{\frac{2\boldsymbol{J}\hbar}{R_-}} \ , \tag{83}$$

with
$$\boldsymbol{J} = 5\boldsymbol{h} + 2\sqrt{\boldsymbol{h}} + 1, \tag{84}$$

If in the quantum-electromagnetic representation of the *Sommerfeld finestructure constant* α' ✠ $e_{\pm}^{\ 2}$ will be substituted with (83) one gets

$$\alpha' = \frac{9}{(2\boldsymbol{p})^5}\boldsymbol{J} \quad , \quad 1/\alpha' = 137{,}038 \tag{85}$$

In this approximation α' deviates by 0,015‰ from the empirical value; it will be corrected later on.

The terms in the spectrum of inertial masses m(n,q) follow each other so densely, that (79) is a *pseudo-continuum*. It contains all possible photon field masses, which is superposed by a discrete spectrum of ponderable c- and d-terms.

5.5 Separation of Discrete Point Spectra from the Pseudo-Continuum

If in an R_6 $\tilde{k}$ = 6 - r ✞ 0 coordinates are antihermetric (pseudo-euclidic) whereas r are coordinates hermitic, one gets:

$$\overset{\frown}{[\,]} = \begin{bmatrix} i \\ \tilde{k}l \end{bmatrix}_{(pq)}^{(mn)} \overset{-+}{=} g^{is}_{(mn)} : (\ ) [s\tilde{k}l]_{(pq)} = 0 \ . \qquad (86)$$

in (86) is

$$[s\tilde{k}l]_{(pq)} = ½\left(\frac{1}{a_{\tilde{k}}}\right) d_{\tilde{k}} g_{il}^{(pq)} + \frac{1}{a_l} d_l g_{\tilde{k}i}^{(pq)} - \frac{1}{a_i} d_i g_{\tilde{k}l}^{(pq)} \qquad (87)$$

$$d_{\tilde{k}} g_{il}^{(pq)} = \frac{a_{\tilde{k}}}{a_i} d_i g_{\tilde{k}l}^{(pq)} - \frac{a_{\tilde{k}}}{a_l} d_l g_{\tilde{k}l}^{(pq)} = d_{\tilde{k}} g_{-il}^{(pq)} \qquad (88)$$

and

$$d_k g_{+il}^{(pq)} = 0 \qquad (89)$$

The antihermitic components $g_{il-}^{(cd)}$ form a rotation field

$$g_{il-}^{(pq)}; n = S\left(\frac{a_{\tilde{k}}}{a_i} d_i g_{\tilde{k}l}^{(pq)} - \frac{a_{\tilde{k}}}{a_l} d_l g_{\tilde{k}l}^{(pq)}\right); n d h^{\tilde{k}} = \frac{1}{t} (ROT\ \Phi^{(pq)})_{il} \qquad (90)$$

that causes a spin structure which superposes space. The components of that spinfield selector act as components which „activate a field“. As a consequence of this field activation the non-hermitic fundamental condensors vanish:

$$\begin{bmatrix} i \\ \tilde{k}l \end{bmatrix}_{(mn)}^{(kl)} \overset{-+}{=} \begin{bmatrix} \overset{\frown}{kl} \\ \overset{-+}{mn} \end{bmatrix}_{-} = 0 \ , \qquad (91)$$

The hermitic parts $g_{i\tilde{k}+}^{(pq)}$, which are not affected by the spinfield selector, determine the condensation steps depending on the hermetric or antihermetric behaviour of the coordinates:

$$g_{i\tilde{k}+}^{(pq)} = \frac{1}{t} d_m \Phi_{\tilde{k}}^{\ (cd)} \qquad (92)$$

6. Fluctons and Protosimplexes as Dynamical Structures in Elementary Particles

In the composition field $\hat{g}_{(x)}$ (x = a,b,c,d) there exists no antihermetric vector -(or selector-) part contrary to the partial structures γ_{ik} .

The condensation structure ψ_{kl} of a system depends on the inner correlations Q_l^i respectively on the temporal course of the structure of all coupling-extrema $g_{(kl)}^{kl}$ and $Q_l^i\begin{pmatrix}kl\\mn\end{pmatrix}$ The maximum of structure deformation $y_{kl}^{(\max)} = 1$ coincides with the minimum of internal correlations $Q_l^i\begin{pmatrix}kl\\mn\end{pmatrix} \equiv \begin{pmatrix}kl\\mn\end{pmatrix}$. These correspondence maxima exchange periodically in a temporal oscillation process via the correlation minima. There come up „structure fluxes“. Only if contra- and basis-signatures of condensors are different, structure fluxes occur. If they are equal then static fields are generated which appear in quantum steps and cover in structure fluxes. In the case of a-hermetry (i.e $\hat{g}_{(a)}$) only two coupling structures

$$\begin{bmatrix}g_{11}\\k_1\end{bmatrix} \equiv \begin{bmatrix}11\\1\end{bmatrix} \text{ and } \begin{bmatrix}k_{11}\\g_{11}\end{bmatrix} \equiv \begin{bmatrix}1\\11\end{bmatrix}$$

exist, because of $\mu = \nu = \kappa = \ = 1$.
With the possible combinations of the indices κ, λ, μ, for the composition field $\hat{g}_{(x)}$ (with the hermetry forms x = a, b, c, d) several coupling selectors $Q_l^i\begin{pmatrix}kl\\mn\end{pmatrix}$ as extrema can be summarised each in a coupling-group. The coupling-groups stay in interrelations with each other. There exist hermetric and antihermetric condensor-bridges between pairs of coupling-groups, if in the two groups identical condensors $\psi_{kl} \sim \begin{bmatrix}\overset{\cap}{kl}\\ \scriptstyle{-+}\\mn\end{bmatrix}$ are located. Antihermetric condensors form condensor sinks; hermetric condensors form condensor sources. Condensor sinks cause couplings of partial structures $g_{(kl)}^{kl}$ in the composition fields $\hat{g}_{(x)}$.
For the b and c-hermetry because of ($\gamma_{\mu\rho}\,\gamma^{\mu\rho} - \gamma_{\mu\mu}\,\gamma^{\mu\mu}$): $6 \times 6 - 6 = 30$ coupling structures are possible. (Fig. 4)

Connecting the same condensors of the sources and of the sinks in the 6 groups, condensor-bridges of primary (+) and secondary kind (-) will result. With the condensation forms

$$\begin{aligned} &a \equiv (x_5,x_6)\,, && \text{“1“} \equiv (x_5,x_6) \\ &b \equiv (x_5,x_6)(x_4), && \text{“2“} \equiv (x_4) \\ &c \equiv (x_5,x_6)(x_1,x_2,x_3), && \text{“3“} \equiv (x_1,x_2,x_3), \qquad (\alpha = \text{“2“ or “3“}) \end{aligned} \tag{93}$$

(For the sake of brevity we shortly write a number with quotation marks. Inside condensor symbols there the corresponding numbers appear).

The possible condensors are, for instance

$$\begin{bmatrix}\overset{\cap}{g}_{(rl)}\\g_{(mn)}\end{bmatrix}_+ \equiv \begin{bmatrix}rl\\mn\end{bmatrix} = \begin{bmatrix}11\\1a\end{bmatrix}, \begin{bmatrix}11\\1a\end{bmatrix}, \begin{bmatrix}11\\a\end{bmatrix}, \ldots\ldots \begin{bmatrix}11\\1\end{bmatrix}, \ .. \begin{bmatrix}1\\11\end{bmatrix}, \tag{94}$$

6 coupling-groups can be integrated:

$$C1 \equiv (\text{“1“}),\quad C2 \equiv (\alpha),\quad C3 \equiv ((\text{“1“}\alpha)),\quad C4 \equiv (\text{“1“}\alpha),\quad C5 \equiv (\text{“1“}(\text{“1“}\alpha)),\quad C6 \equiv (\alpha(\text{“1“}\alpha))$$

(for instance $((1\alpha)) = \begin{bmatrix} 1 \\ 23 \end{bmatrix}$)

Setting α = “2“ the condensors from $\hat{g}_{(b)}$ coming up. For α = “3“ they consist from $\hat{g}_{(c)}$.

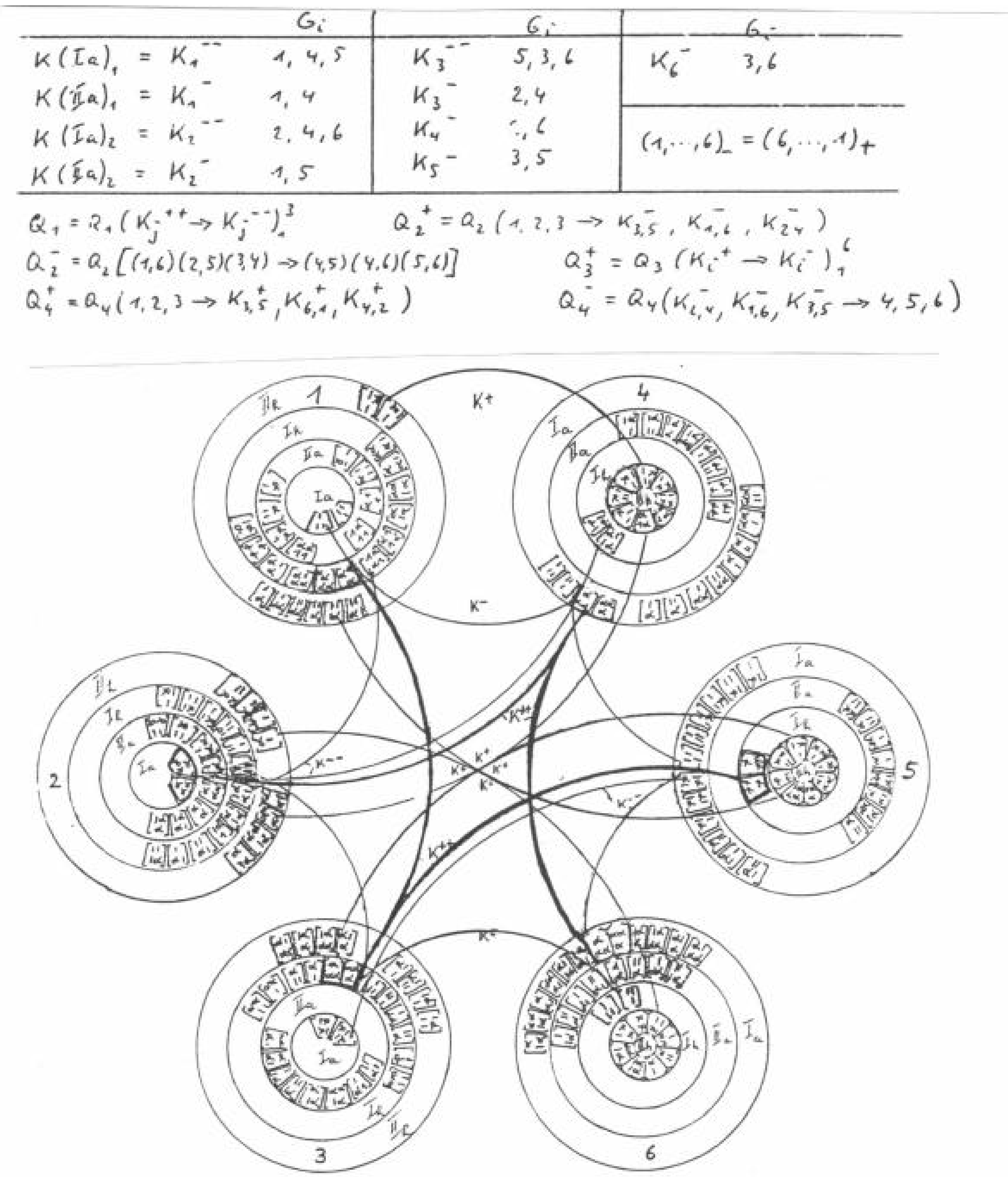

Fig. 4: Six coupling groups with condensor bridges which exchange maxima and minima of condensations in a neutral particle.

The analysis of the space-time condensations d is much more intricate since in $\hat{g}_{(d)}$ all of the 9^2 - 9 = 72 condensors make up coupling condensors. There are 18 different coupling-groups for the coupling extrema. All of the condensor-bridges form complicated systems of networks.

The coupling maxima which are defined by $\delta Q_l^i \begin{pmatrix} kl \\ mn \end{pmatrix} = 0$ and $\begin{bmatrix} mn \\ kl \end{bmatrix} = y_{kl} = 0$ are included in the definition range $l_{(kl)}^{(mn)}$;$n_- \equiv N_-$ in which lattice- and hyperselectors become proportional (flat). n_- is the minimal number of deformed metrons, n_+ is the maximal number. The condensor maxima which lay in in the definition range $l_{(kl)}^{(mn)}$;$n_+ = N_+$ define space compressors $\overline{r}_{(kl)}^{(mn)}$ which maxima are the maximal number of deformed metrons N_+ . Each space compressor attempts to reach the deepest level. Since the compressions- and condensation state in the composition field $\hat{g}_{(x)}$ remains independently of changes of the partial structures, the ranges N_+ and N_- must exchange themselves in the sense of a movement of the condensation state $\begin{bmatrix} mn \\ kl \end{bmatrix}$ in R_6 . This oscillation process between maximal and minimal condensed metrons is called by Heim a condensor flux

$$N_+ \,(\, l_{(kl)}^{(mn)} \,) N_- \qquad (95)$$

For a condensor flux come possible, there must exist for the two signatures (κλ) and (μν) antihermetric $\gamma_{(\kappa\lambda)-}$ and $\gamma_{(\mu\nu)-}$ which form a spin orientation, corresponding to (90). This is often the case in the 4 hermetry forms. Each system of condensor sources and sinks can cause a condensor flux. If in an exchange process the starting state always will be reached then the condensor flux is cyclic, i.e. the temporal change of location of a hermetric condensor maximum is periodic.

Since there are 6 classes of hermetry forms b and c, there are $z = \sum_{m=1}^{6} n! \begin{pmatrix} 6 \\ n \end{pmatrix} = 1956$ structure isomorphic flux aggregates (which not all must be cyclic). The periodic circulation defines a spin. The three partial structures $\kappa_{(1)}$, $\kappa_{(2)}$, $\kappa_{(3)}$, which form the fundamental selectors $\gamma_{\mu\nu}$ and $\hat{g}_{(x)}$ are defined by condensations of the following coordinates according to (93).

With that 6 ground fluxes for the maxima of correlations (+) and 6 for the minima (-) can deduced. Each of these k fluxes, called "fluctons", is symbolised by [k]:

$$N_x^+ \,[k]\, N_x^- \,, \qquad (x \equiv a, b, c, d) \qquad (96)$$

["1"], for instance, means the correlation $\left(\begin{bmatrix} k_1 \\ g_{11} \end{bmatrix} \right), \left(\begin{bmatrix} g_{11} \\ k_1 \end{bmatrix} \right) \equiv \begin{bmatrix} 1 \\ 11 \end{bmatrix}, \begin{bmatrix} 11 \\ 1 \end{bmatrix}$, and the additional class of correlations which form no fluctons is called a "straton" by Heim:

$$[7]: \quad \begin{bmatrix} \overset{\cap}{33} \\ 33 \end{bmatrix}, \begin{bmatrix} \overset{\cap}{3} \\ 33 \end{bmatrix}, \begin{bmatrix} \overset{\cap}{33} \\ 3 \end{bmatrix}, \begin{bmatrix} \overset{\cap}{3} \\ 3 \end{bmatrix} \equiv (\text{"3"})$$

The condensors $\left[\begin{matrix}\overset{\cap}{l\,l}\\ l\,l\end{matrix}\right]$ with 1 ❄ λ ❄ 3 form metric condensations but no correlations and therefore no ground fluxes. (“1“) ≡ $\left[\begin{matrix}\overset{\cap}{11}\\ 11\end{matrix}\right]_+$ and (“2“) ≡ $\left[\begin{matrix}\overset{\cap}{22}\\ 22\end{matrix}\right]_+$ are without correlations in d (for instance with $\left[\begin{matrix}\overset{\cap}{1}\\ 11\end{matrix}\right]_+$) with the partial structures of its own hermetry forms, but exists like in all of the other condensation types x and are sources of gravitational fields.

The space condensations (“3“) cause ponderability. . The forms a and b do not contain (“3“) and are imponderable. The symbolical denotation in formula (96) means:

$$N_x^+[k]N_x^- \equiv \left(A_{kl}^i\right)^{-1}\left\{\left[\begin{matrix}i\\ kl\end{matrix}\right]_{(\ )}^{(\ )} + Q_m^i\left[\begin{matrix}m\\ kl\end{matrix}\right]_{(\ )}^{(\ )}\right\} = \exp\left(lm - Sy_{kl}d_m\right) = e^{lk}\left[\frac{e^{lk} - e^{-l(x-k)}}{1-e^{-l(x-k)}}\right]^{-a} \tag{97}$$

with

$$y_{kl} = a^{-1}c_s\left[\begin{matrix}s\\ kl\end{matrix}\right] = \left((1-e^{-ln}\right)^{-1}, \quad x = a,b,c,d, \qquad m = \sqrt{t}\sum_{k=1}^{3} a_k\left(\ \right)_k$$

a = (“1“), b = (“1“)+(“2“), c = (“1“)+(“3“),
d = (“1“)+(“2“)+(“3“), k = (“1“), (“2“), (“3“), (“1“)+(“2“)

For the special flux [23] ≡ [“2““3“]of the hermetry form d of charged particles follows

$$N_a^+[23]N_a^- = e^{l\{(2)+(3)\}}\left[\frac{e^{l\{(2)+(3)\}} - e^{-l(1)}}{1-e^{-l(1)}}\right]^{-a}, \tag{98}$$

with $(“1“) \equiv i\sqrt{t}\left[\left(\ \right)_5 + \left(\ \right)_6\right], \quad (2) \equiv i\sqrt{t}\left(\ \right)_4, \quad (3) \equiv i\sqrt{t}\left[\left(\ \right)_1 + \left(\ \right)_2 + \left(\ \right)_3\right]$

In the approximation r = $\lim\limits_{t\to 0} l;n$ and a > λ_{kl} the straton (“3“) yields a field with decreased exponential with the distance r:

$$y_{kl} = e^{l_{kl}r} = e^{-ar} \tag{99}$$

The maxima and minima of flux classes calls Heim “<u>protosimplexes</u>“ p_x = [± k].

Positive condensor fluxes designate static fields (so-called screen fields) +k = (+[1],[2],...,[5]), and the negative ones are called dynamic fluctons -k = (-[1],[2],...,[5]).

For the classes k = “-6“ there exists no such screen field, since in p_d[-k] = $N_d^+[123]N_d^-$ all the structure units correlate. [-6] is called the <u>“world flucton“</u>. Contrary to it no flucton exists to the straton [7]. All of the other 5 protosimplexes have in the concerning sub-spaces of R_6 a flucton as well as a screen field which envelops it.

Particles	x \ k	[1]	[2]	[3]	[4]	[5]	[6]	[7]	proto-simplexes
gravitons	a	(1)							$p[1] \equiv [\pm 1]_a$
photons	b	(1)	(2)	(1,2)					$p[123] \equiv [\pm 123)_b$
neutral particles	c	(1)	-	-	(1,3)	-	-	(3)	$p[14][7] \equiv [\pm 14]_c, [+7]_c$
charged particles	d	-	-	(1,2)	(1,3)	(2,3)	(1,2,3)	(3)	$p[123][4567] \equiv [+127]_d, [\pm 345]_d$, $[-6]_d$
		$(x_5 x_6)$ trans-	(x_4) time-					$(x_1 x_2 x_3)$ space-	condensations
		x			x			x	inertia field
			x	x		x	x		charge field
							world flucton	straton	

Table 1: Seven classes of fluctons as structure parts of the four kinds of matter field quanta (hermetry forms a, b, c, d)

The simple protosimplexes have yet no physical properties. Therefore further couplings are required. Several ground flux aggregates are linked together by common structure units κ_μ (so-called "conjunctors"), symbolised by

$$\{\pm p\} \;—(\kappa_\mu)—\; \{\pm q\} \;, \qquad (100)$$

were p and q characterise different protosimplexes. The protosimplex $p_a[1]$ has no conjunctor between the two possible condensor fluxes, while $p_b[123]$ of the photons is determined only by correlation conjunctives:

$$[\pm 1]_b \;—(\kappa_1)—\; [\pm 3]_b \;—(\kappa_2)—\; [\pm 2]_b \;, \qquad (101)$$

In neutral particles protosimplexes $p_c[14],[7]$ act, which are coupled by a straton conjunctive κ_3 and a correlation conjunctive κ_1

$$[\pm 1]_c \;—(\kappa_1)—\; [\pm 4]_c \;—(\kappa_3)—\; [+7]_c \;, \qquad (102)$$

In charged particles there are in addition two further conjunctives (because of the influence by [-6] on +[127]:

$$\underbrace{[+1]_d —(\kappa_1)— [\pm 3]_d —(\kappa_2)— [+2]_d —(\kappa_2)— [\pm 5]_c —(\kappa_3)— [+7]_c —(\kappa_3)— [\pm 4]_d}_{(\kappa_1)}$$

$$[+1]_d —(\kappa_1)— [-6]_d —(\kappa_2)— [+2]_d \qquad (103)$$

$$[-6]_d —(\kappa_3)— [+7]_d$$

Each simplex $\{\pm p\}_x$ causes a condensation state $N_+ = \ l^{(kl)}_{(mn)}$ (a „protosimplex charge"). The correlation minima N_- are also maxima of the fundamental condensations which are centres of maximal acceleration actions. The number of sources of the accelerations corresponds to the number of fundamental condensors which form no screen field.
The $l^{(kl)}_{(mn)}$ are matter field quanta which are caused by internal correlations and appear by correspondences in external ranges as interactions. In a protosimplex table the qualitative physical properties of the single parts of systems of condensor fluxes cam be arranged.

Geometrical structures which reach into the transregions of our world ("trans" regarding to space-time) interact with photons and gravitons and cause actions, which depending on the experimental device can either be interpreted as waves (which can interfere) or as particles (which can transfer momentum). No electromagnetic radiation (b) can be considered as a state change of space.

7. The Sources of Inertia in Heim's Theory

Since the work by Rueda, Haisch and Puthoff (1994) most physicists are convinced that inertia must have a local cause and is not generated via Mach's principle.

For movements of bodies in R_6 the metronic geodesic equation holds

$$\ddot{C}^i + \begin{bmatrix} i \\ kl \end{bmatrix}^{(mn)}_{(\overset{-}{k}\ \overset{+}{l})} \dot{C}^k \dot{C}^l = 0 \ , \qquad (104)$$

were C^i are the components of a lattice selector according to (27) and a dot means time derivation. For each element $(\kappa\lambda)$ from $\hat{g}$ a geodetic reference system $A_{(\kappa\lambda)} = A_{(\lambda\kappa)}$ can be found, relative to which in $\ddot{C}^i = 0$. (For each other element the geodesy requirement from $\hat{g}$ by $A_{(\kappa\lambda)}$ does not hold). If $\hat{g}$ consists of several structure units (a,b,c,d), then the condensations can not be transformed away. Only the condensations, respectively hermetry form, a, consist of only one single structure unit respectively lattice core ${}^2\kappa_{(1)}$. Relative to a system $A_{(11)}$ all actions which are based on ${}^2\gamma_{(11)}$ can be transformed away. That is the reason why the gravitation appears as no real force, although the source of gravitation remains conserved further on. This can be explained only by the condensations of the classes b, c, and d. (If only linear transformations are allowed, then also the gravitational field can no more be transformed away).

All hermetry forms have to behave inertial against changes of movements. The hermetry forms consist of structure compressions in subspaces with following coordinates:

a (gravitons) in $(x_5,x_6) \equiv [1]$,
c (photons) in $(x_4) = t \equiv [2]$ and in $(x_5,x_6) \equiv [1]$,
c (neutral particles) in $(x_1,x_2,x_3) = R_3 \equiv [3]$ and in $(x_5,x_6) \equiv [1]$, and
d (charged particles) in all coordinates of R_6 , i.e. in [1], [2] and [3]

The condensors $\begin{bmatrix} \overset{\cap}{nn} \\ nn \end{bmatrix}$ (with n = [1], [2], [3]) which are determined by a single hermetry form are free of correlations. They form no structure fluxes but fields of quantized space compressions. The hermetry forms c and d are escorted by real condensors of the type n = [3]
and therefore they are ponderable, contrary to a and b. Since all hermetry forma contain the condensor $\begin{bmatrix} \overset{\cap}{nn} \\ nn \end{bmatrix}$ all hermetry forms are sources of gravitational fields. This condensor appears in each projection into R_3 as a gravitative field structure of space.

The cause of inertia can deduced from the worldselector equation. If (48) is multiplied by $\dot{C}^k \dot{C}^l \dot{C}^m$ and summed up over q = 6 hermetric coordinates, one gets

$$\boldsymbol{l}_m(k,l)\begin{bmatrix} i \\ kl \end{bmatrix}\dot{C}^k \dot{C}^l \dot{C}^m = \left(\boldsymbol{d}_l\begin{bmatrix} i \\ km \end{bmatrix} - \boldsymbol{d}_m\begin{bmatrix} i \\ kl \end{bmatrix}\right)\dot{C}^k \dot{C}^l \dot{C}^m + \left(\begin{bmatrix} i \\ sl \end{bmatrix}\begin{bmatrix} s \\ km \end{bmatrix} - \begin{bmatrix} i \\ sm \end{bmatrix}\begin{bmatrix} s \\ kl \end{bmatrix}\right)\dot{C}^k \dot{C}^l \dot{C}^m =$$

$$= -\begin{bmatrix} i \\ km \end{bmatrix}\dot{C}^l \boldsymbol{d}_l\left(\dot{C}^k \dot{C}^m\right) + \dot{C}^l \boldsymbol{d}_l\begin{bmatrix} i \\ km \end{bmatrix}\sum_{l=1}^{q}\boldsymbol{d}_l(\dot{C}^k \dot{C}^m) + \begin{bmatrix} i \\ kl \end{bmatrix}\dot{C}^m \boldsymbol{d}_m(\dot{C}^k \dot{C}^l) - \dot{C}^m \boldsymbol{d}_m\begin{bmatrix} i \\ kl \end{bmatrix}\sum_{m=1}^{q}\boldsymbol{d}_m(\dot{C}^k \dot{C}^l) -$$

$$-\left(\dot{C}^l\begin{bmatrix} i \\ sl \end{bmatrix}\ddot{C}^s - \dot{C}^m\begin{bmatrix} i \\ sm \end{bmatrix}\ddot{C}^s\right) = 0 \qquad (105)$$

With the geodesy formula (104) and the considering that here not the polymetric term $\begin{bmatrix} i \\ kl \end{bmatrix}^{(\boldsymbol{mn})}_{(\boldsymbol{kl})}{}_{-+}$ is used but the compositive term $[{}^{\,i}_{k\,l}]$ it follow s:

$$\boldsymbol{l}_m(k,l)\begin{bmatrix} i \\ kl \end{bmatrix}\dot{C}^k \dot{C}^l \dot{C}^m = -\ddot{C}^i\, \boldsymbol{l}_m(kl)\dot{C}^m = -\ddot{C}^i\, \overline{\boldsymbol{l}}\,(kl)\dot{\overline{C}}^{-1} = -\ddot{C}^i\, \overline{\boldsymbol{l}}\,\dot{\overline{C}}^{-1}$$

(106)

with $\ddot{C}^i \neq 0$ and $[{}^{\,i}_{k\,l}] \neq 0$. Therefore the product $\overline{\boldsymbol{l}}\,\dot{\overline{C}}^{-1} = 0$ must be zero to fulfil (105). Since also $\overline{\boldsymbol{l}} \neq 0$ and $\dot{\overline{C}}^{-1} \neq 0$ the vanishing can be reached only by orthogonality of the vectors: $\overline{\boldsymbol{l}} \perp \dot{\overline{C}}$.
Since the $C_k = \alpha_k(\,)_k$ are the components of the lattice selector of the empty world, the time derivative is

$$\dot{\overline{C}};n \rightarrow \sum_{i=1}^{q}\dot{\overline{x}}_i = \overline{Y}(q)\,, \qquad (107)$$

where

$$\overline{Y}(q) = \overline{Y}(6) = \overline{v} + i\overline{w}\ , \qquad (\overline{w}^2 = c^2 + \dot{\boldsymbol{e}}^2 + \dot{\boldsymbol{h}}^2)$$

is the complex world velocity in R_6 with which the universe expands, when $\varepsilon = x_5$ and $\eta = x_6$.
A movement of the condensations in space with $\dot{\overline{v}} \neq 0$ acts in such a way, that the vectors of compositive condensation steps $\overline{\boldsymbol{l}}$ and $\boldsymbol{l}^{(kl)}_{(mn)}$ must newly orient themselves, which means a complex rotation in R_6 which depends on $\vec{v}$. The new positioning takes places during the duration of the

action of $\dot{v} \neq 0$ and generates a resistance against the violation of orthogonality, which appears as inertia for all structure units in the same way.
For the integral $\overline{l}$ -terms (matterfield quanta), which come up by internal correlations and interactions act to the extern, inertia and gravitation are equivalent. But for the matterfield quanta with the internal partial structures $l_{(mn)}^{(kl)}$ there is no equivalence any more.
Inertia is a consequence of the expansion of the universe. Gravitation is a force field which is caused by the condensor with the hermetry form a.

8. Mass Spectrum of Elementary Particles

8.1 Way of Deduction

The $l_{(mn)}^{(kl)}$ assign to each protosimplex $(\pm p)_x$ an action of inertia as mass. They define metrical condensation steps by the measure of curvature ε of the subspace V_r of the R_6 (r = number of hermetric coordinates): $e = \frac{1}{\left| l_{(mn)}^{(kl)} \right|}$.
The radii of the condensation steps are $r_\mu = n\, \varepsilon_\mu$. The cyclic condensor flux, i.e. the spin, assigns to each compositive condensation an eigenfrequency f, which defines the wave length λ', respectively the diameter of the aggregate , with the rotation velocity u = const.

Condensor maxima N_+ define space compressors $r_{(mn)}^{(kl)}$. The internal mass m of condensations is proportional to the space compressor. The frequency of the cyclic flux increases because of the compression isostasy. It is m ~ f ~ 1/λ' or λ' = h/cm , i.e. the larger the mass, the smaller the range in which structure condensations appear.
The flux velocity in the photons is v = f λ'= c. For the imaginary condensation type a, (gravitons), there is u = w>c, since $\dot{w}^2 = \dot{x}_4^2 + \dot{x}_5^2 + \dot{x}_6^2 = c^2 + \dot{e}^2 + \dot{h}^2$, and $\dot{e}^2 + \dot{h}^2 > 0$.
The imaginary part of the world velocity w is identical with the general cosmological expansion. According to the compressor isostasy the product of aggregate diameter λ' and the inertial mass is constant. If λ_0' signifies the unit condensation one obtains

$$m\lambda_{(cd)} = \overline{m}\, l_0' = \text{const}, \qquad \text{where } \overline{m} = \sqrt{\frac{ch}{g}}$$

is the condensor constant of mass spectrum of the hermetry forms c and d. The ration of the aggregate diameters is

$$\frac{l_{(c,d)}}{l_0} = \frac{\overline{m}}{m} = \sqrt[4]{\frac{2n-1}{2n}}\,\frac{1}{h_{qe}}\,, \qquad h_{qe} = \sqrt[4]{\frac{p^4}{p^4 + 4q_e^4}}\ . \qquad (108)$$

(q_e = elementary charge)

For each flux class k there are k! structure isomeries to which it gives at least one special mirror-symmetrical aggregate, and there are $\binom{6}{k}$ different flux aggregates:

$$z = \sum_{k=1}^{6} k!\binom{6}{k} = 1956$$

This number z is reduced, if one requires that only flux aggregates shall count which exist for a special minimum time. There exists a term-selector T, which carries out a selection of ponderable masse terms M of discrete spectrum of the c- and d-condensations, according to

$$T;m(c,d) = M(c,d). \qquad (109)$$

M(c,d) are the possible terms. Only terms with a distinct life time are comparable with empirical elementary particles. In M(c,d) all four partial structures of each x-hermetry overlay, which again are formed from protosimplexes $(\pm p)_x$ by conjunctor laws.

An element [k] in $(\pm p)_x$ causes a condensation state $\boldsymbol{l}_{(mn)}^{(kl)}$, which establishes the inertia principle $\boldsymbol{l}_{(mn)}^{(kl)} \perp \overline{Y}$, with the complex world-velocity $\overline{Y} = \overline{v} + i\overline{w}$. A protosimplex-charge $\underline{N}$ is in each case a multiple of a unit condensation $\underline{\lambda}_\rho(k)$. It is

$$\boldsymbol{l}_{(mn)}^{(kl)} = \underline{N}\ \underline{\lambda_0}(k) \perp \overline{Y}, \qquad \underline{\lambda_0}(k) = \boldsymbol{l}_{(mn)}^{(kl)} \qquad (110)$$

$$\underline{N} = N_{(mn)}^{(kl)}$$

The lower limits of the partial structures c and d bear the protosimplex charges $\underline{N} = 1$.
The term M(c,d) consist of components M_p of protosimplexes $(\pm p)_x$ of M_S the spin configuration, and of the part of a possible charge field M_q :

$$M = M_p + M_s + M_q \qquad (111)$$

According to the worldselector equation

$$\mathrm{tr}\ L_{(mn)}^{(kl)};\hat{\Gamma}_{kl}^{i} = \boldsymbol{l}_{(mn)}^{(kl)}\hat{\Gamma}_{kl}^{i} \sim W_{(kl)}^{(mn)} \qquad (112)$$

the energy density selector $W_{(kl)}^{(mn)}$ can be expressed by a metronic derivation $\delta_V = \delta/\delta V$ of the mass selector :

$$W_{(kl)}^{(mn)} \sim \delta_V\, M_{(kl)}^{(mn)} \sim \boldsymbol{l}_{(mn)}^{(kl)}\,\hat{\Gamma}_{kl}^{i}, \qquad (113)$$

and the derivation of this energy selector is proportional to the selector of changes $P_{(kl)}^{(mn)}$.

$$\delta_V = \{\boldsymbol{l}_{(mn)}^{(kl)}\,\hat{\Gamma}_{kl}^{i}\} \sim \mu_+\ P_{(kl)}^{(mn)}, \qquad (114)$$

with

$$\mu_+ = 4\,\mu'\,\alpha_+, \qquad m' = \frac{1}{cs_0}\sqrt[4]{p}\sqrt[3]{3ps_0g\hbar}\sqrt{\frac{c\hbar}{3g}}, \qquad (115)$$

$$\alpha_+ = \frac{1}{m\sqrt[3]{h}}\left[1 - 1/3\left(1+\sqrt{5}\right)h^2\left(1-\sqrt{5}\right)\right]^{-1}, \tag{116}$$

$$h = \sqrt[4]{p^4 / (p^4 + 1)}\,, \qquad s_0 = 1\,[\mathrm{m}], \qquad \alpha_- = \eta\ \alpha_+\,. \tag{117}$$

The selector $P^{(mn)}_{(kl)}$ consists of a real $A^{(mn)}_{(kl)}$ and an imaginary part $F^{(mn)}_{(kl)}$:

$$P^{(mn)}_{(kl)}\,;\,\mathrm{N} = A^{(mn)}_{(kl)} + \mathrm{i}\ F^{(mn)}_{(kl)}\,, \tag{118}$$

The real part $A^{(mn)}_{(kl)}$ yields static mass values. The imaginary part $F^{(mn)}_{(kl)}$ describes bandwidths, respectively life times, of the mass terms M(c,d). These life times were calculated by Heim only for the ground states of elementary particles and not yet for excited states (resonances). The mass spectrum of elementary particles can be deduced with the following formula:

$$\delta\delta_{\mathrm{V}}\ M^{(mn)}_{(kl)}\ \sim\ \Re\left\{d\left(\ l^{(kl)}_{(mn)}\hat{\Gamma}^{i}_{kl}\ \right)\right\}\sim\ \Re\,(\mu_+\,P^{(mn)}_{(kl)})\ =\ \mu_+\ A^{(mn)}_{(kl)} \tag{119}$$

The theoretical values are in excellent agreement with measured values. Additionally there appear three pairs of neutrinos with small masses and a neutral electron. The inertia of elementary particles consist of 4 zones with differently degrees of steps of condensation, respectively densities. The dense zones (two in mesons and three in baryons) can be interpreted as quarks, since high energetic particles will be scattered by them. (Tab. 2, Tab. 3a and b, Tab. 4)

Part.	k	n	m	p	σ	P	Q	ϵq_1	ϵC	$\varkappa$
η	1	18	22	17	14	0	0	0	0	0
K	1	17	26	30	28	1	0	1	1	1
K	1	18	5	5	2	1	0	0	1	1
e	1	0	0	0	0	1	1	- 1	0	0
e	1	0	0	0	1	1	1	0	0	0
μ	1	11	6	11	6	1	1	-1	0	1
π	1	12	9	2	3	2	0	±1	0	0
π	1	12	3	6	4	2	0	0	0	0
Λ	2	1	3	0	-11	0	1	0	-1	0
Ω	2	4	4	-1	-15	0	3	-1	-3	0
p	2	0	0	0	0	1	1	1	0	0
n	2	0	0	-2	17	1	1	0	0	0
Ξ	2	2	7	-17	2	1	1	-1	-2	1
Ξ	2	2	6	- 1	6	1	1	0	-2	1
Σ	2	2	-7	-12	10	2	1	1	-1	0
Σ	2	2	- 7	-14	- 2	2	1	0	-1	0
Σ	2	2	- 6	- 5	- 8	2	1	-1	-1	0
o	2	2	1	- 8	-13	3	3	2	0	0
o	2	2	-1	- 1	- 6	3	3	1	0	0
o	2	2	±1	-10	2	3	3	0	0	0
ρ	2	2	-1	-16	-15	3	3	-1	0	0
ν_1	1	-3	-3	- 2	- 1	0	1	0	0	0
ν_2	1	-3	-3	- 2	- 1	1	1	0	0	0
ν_3	2	-24	-31	-34	-15	1	1	0	0	0
ν_4	2	-24	-31	-34	±15	3	3	0	0	0
ν_2'	1	- 3	- 3	- 2	- 1	1	1	0	0	1
ν_3'	2	-24	-31	-34	-15	1	1	0	-2	1

Table 2: Quantum numbers of possible ground states, N = 0

Theoretical Values

elementary charge: $e_{\pm} = \pm 1{,}602188 \cdot 10^{-19} [As]$
finestructure constante: $\alpha = 1/137{,}03596147$

Quantum Numbers of Invariante Ground States

name of particle: quantum numbers $(BPQ\kappa)\varepsilon C(\varepsilon q_x)$

η:(0000)0(0) e_0:(0110)0(0) e^-:(0110)0(−1) μ^-:(0111)0(−1)
K^0:(0101)1(0) K^+:(0101)1(+1) π^0:(0200)0(0) $\pi^\pm$:(0200)0(±1)
Λ:(1010)−1(0) Ω^-:(1030)−3(−1) p:(1110)0(+1) n:(1110)0(0)
Ξ^0:(1111)−2(0) Ξ^-:(1111)−2(−1) Σ^+:(1210)−1(+1)
Σ^0:(1210)−1(0) Σ^-:(1210)−1(−1) o^+:(1310)−2(+1)
o^0:(1310)−2(0) o^-:(1310)−2(−1) o^{--}:(1310)−2(−2)
Δ^{++}:(1330)0(+2) Δ^+:(1330)0(+1) Δ^0:(1330)0(0)
Δ^-:(1330)0(−1)

Invariante masses of ground patterns with description of the configurations-zone parameters

name of particles: (n_1, n_2, n_3, n_4) $M_x(N=0)$ in MeV

η(18,22,17,16) 548,8072 e_0(0,0,0,0) 0,5068833
e^-(0,0,0,0) 0,5110034 μ^-(11,6,11,6) 105,6595
K^0(18,5,5,2) 497,6736 K^+(17,26,30,18) 493,6675
π^0(12,3,6,4) 134,9627 $\pi^\pm$(12,9,2,3) 139,5670
Λ(1,3,0,−11) 1115,601 Ω^-(4,4,−2,15) 1672,375
p(0,0,0,0) 938,2797 n(0,0,−2,17) 939,5731
Ξ^0(2,6,−1,6) 1314,784 Ξ^-(2,7,−17,1) 1321,315
Σ^+(2,−7,−12,9) 1189,357 Σ^0(2,−7,−14,−2) 1192,447
Σ^-(2,−6,−5,−5) 1197,315 o^+(4,−15,−23,−1) 1540,245
o^0(4,−14,−16,−10) 1549,661 o^-(4,−20,−20,3) 1531,420
o^{--}(4,−6,0,−10) 1534,580 Δ^{++}(2,1,5,1) 1230,878
Δ^+(2,−1,−22,−4) 1230,183
Δ^0(2,−2,0,−9) 1231,233 Δ^-(2,−1,−1,−9) 1235,966

Boundaries of Resonances

$M_{max}(L_N)$

η:35354,49(2488) e_0, e^- sates which can not be to exited
μ^-:25217,25(9056) K^0:201411,6(15039) K^+:192657,0(13718)
π^0:102261,2(12106) $\pi^\pm$:107063,5(8434) Λ:64007,70(1095)

Ω^-:107015,0(2357) p:123420,8(2636) n:123916,1(2896)
Ξ^0:193135,4(13474) Ξ^-:192248,1(14879) Σ^+:286615,8(3198)
Σ^0:287486,5(3528) Σ^-:297682,6(3280) o^+:592729,1(4011)
o^0:614125,6(4523) o^-:592729,1(4036) o^{--}:607341,4(3723)
Δ^{++}:454169,4(4996) Δ^+:441567,5(5371) Δ^0:442931,2(5946)
Δ^-:456386,6(5496)

Table 3a: Mass values from Heim's formula, calculated by Dr. H.D. Schulz (DESY, Hamburg) on July 26th, 1982

Resonances of mesons $M_x(N)$ in MeV

η - states::
(* = measured value taken as average value)

782,3705(2) 956,8302(6) 956,8302(6)* 981,0233(9)*
1019,537(12) 1196,644(21) 1267,802(35) 1282,662(36)
1297,725(37) 1426,984(56) 1447,565(57) 1518,788(62)
1534,019(71) 1670,578(70) 1671,906(84) 1689,793(85)
1858,039(108) 2024,828(130) 2979,308(235) 3097,033(244)
3413,057(279) 3510,516(285) 3549,922(287)* 3563,035(266)*
3686,592(307) 3774,142(317) 4039,635(333) 4153,663(355)*
4163,071(356)* 4414,214(373) 9452,464(813)* 9468,845(814)*
10024,11(838) 10254,49(845) 10267,12(880)

μ^- - states: τ: 1783,430(2)

K^0 - states:

891,3944(2) 1347,255(22)* 1354,072(23)* 1406,359(28)
1417,076(29)* 1431,685(30)* 1769,525(90) 1779,314(76)
2060,511(140) D^0:1863,641(103) 2006,329(116)
B^0:5275,751(591)

K^+ - states

892,916(2) 1350,302(18) 1403,255(22) 1419,573(23)*
1430,986(24)* 1767,353(64) 1782,046(80) 2065,257(105)
D^+:1869,265(90) 2008,041(116)* 2012,455(117)*
B^+:5266,139(582)

π^0 - states:

776,4932(2) 1230,172(7) 1305,184(8) 1585,481(32)
1684,157(42) 1694,819(43) 3770,438(516) 4036,228(548)
4157,434(598)* 4161,781(599)* 4415,980(634)

$\pi^\pm$ - states:

775,2314(2) 1239,816(7) 1318,468(8) 1587,855(27)
1685,825(33) 1691,956(34) 4030,651(371) 4158,838(405)
9919,214(1112) 10023,80(1088) 10256,06(1147)
10275,25(1149) 10371,00(1155)
10375,75(1156)

Resonances ob baryons in MeV

Λ - states:

1404,871(3) 1523,089(4)

Ξ^0 - states:

1531,807(2) 1826,918(15) 2024,966(42)

Ξ^- - states:

1535,251(2) 1827,252(14) 2024,255(43)

Σ - states:

Σ^+:1381,950(2) Σ^0:1381,446(2) Σ^-:1387,391(2)

For bosons there exist only the probabilities $\alpha(Z)$:
P = 1, q = 0
ß(Z): P = 2, q = 0 , α(W): P = 1, q = 0 and
ß(W): P = 2, q = 1.

Possible ζ - values for the cases: a: 8323,494(726)
b:8321,375(2224) c:8320,636(1025) d:8322,912(961)
e:8320,069(1380) f:8321,849(932)

Possible mass values of $W^\pm$ and Z for the cases:

$\alpha(W)$:80810,27(6815) $\beta(W)$:80815,37(6823)
$\alpha(Z)$:92901,85(8091) $\beta(Z)$:92901,28(11366)

Neutrino masses of the as freee neutrino radiation in R_3 possible neutrino states

name of neutrino: m to ν_s in [eV] otherwise in [keV]

ν_R:2,003 ν_P:2,03 ν_β:4,006 $\nu(e_0)$:5,375675
ν_μ:11,28781 ν_τ:1,441793

Table 3b: Mass values from Heim's formula, calculated by Dr. H.D. Schulz (DESY, Hamburg) on July 26th, 1982

particle	W (N = 0)	theoretical masses in MeV	$\Delta_{(m)}$ %	$\Delta_T (m \pm \delta m)$ %
$\eta, \bar{\eta}$	9905,00673537	548,79663770	$-6,1 \cdot 10^{-4}$	0
$K_+, \bar{K}_-$	8857,95768762	493,81796070	$-4,1 \cdot 10^{-4}$	0
$K_0, \bar{K}_0$	9332,36787769	497,75763603	$-4,8 \cdot 10^{-4}$	0
$e_-, \bar{e}_+$	38 ,70297458	0,51100406	$-7,8 \cdot 10^{-6}$	0
$e_0, \bar{e}_0$	38,51341629	0,51802856	—	—
$\mu_-, \bar{\mu}_+$	2830,28173706	105,65997056	$6,7 \cdot 10^{-5}$	0
$\pi_\pm, \bar{\pi}_\mp$	3514,46584100	139,57872563	$-2 \cdot 10^{-4}$	0
$\pi_0, \bar{\pi}_0$	3419,18887376	134,97646756	10^{-3}	0
$\Lambda, \bar{\Lambda}$	16827,97671291	1115,60379624	$3,4 \cdot 10^{-4}$	0
$\Omega_-, \bar{\Omega}_+$	23157,62019351	1672,49541796	$-2,7 \cdot 10^{-4}$	0
$p, \bar{p}$	14792,56448662	938,25920090	10^{-7}	0
$n, \bar{n}$	14828,61093630	939,55269997	0	0
$\Xi_-, \bar{\Xi}_+$	18998,73584190	1321,24647590	$-2,7 \cdot 10^{-4}$	0
$\Xi_0, \bar{\Xi}_0$	18990,09824364	1314,68747907	$-1,9 \cdot 10^{-4}$	0
$\Sigma_+, \bar{\Sigma}_-$	18124,03158923	1189,39744159	$-2,2 \cdot 10^{-4}$	0
$\Sigma_0, \bar{\Sigma}_0$	18179,60316399	1192,45508108	$-4,1 \cdot 10^{-4}$	0
$\Sigma_-, \bar{\Sigma}_+$	18183,30339661	1197,31639333	$-3 \cdot 10^{-4}$	0
$o_{++}, \bar{o}_{--}$	18097,94658246	1230,00467043	—	—
$o_+, \bar{o}_-$	18467,56302624	1236,00115592	—	—
$o_0, \bar{o}_0$	18508,94132965	1235,99369113	—	—
$o_-, \bar{o}_+$	18448,52307770	1231,20405197	—	—
$\gamma_1, \bar{\gamma}_1$	—	$0,00000393 \cdot 10^{-3}$	—	—
$(\gamma,\gamma')_2, (\bar{\gamma},\bar{\gamma}')_2$	—	$5,37605502 \cdot 10^{-3}$	—	—
$(\gamma,\gamma')_3, (\bar{\gamma},\bar{\gamma}')_3$	—	$4,88879489 \cdot 10^{-3}$	—	—
$\gamma_4, \bar{\gamma}_4$	—	$45,46091250 \cdot 10^{-3}$	—	—

Table 4: Calculated masses of ground states according to Heim's theory

8.2 Unification of Quantum Theory with Metron Geometry

Since the operators C_p in the eigenvalue equations (14) are strongly non-linear $\varphi^p{}_{km}$ cannot be interpreted as a probability field and the solutions of (14) cannot superpose. Therefore, in the metron theory there exists no probability field and yet no unification with quantum theory.
Supposing that, at least for a moment, an operator C_p' exists, which superposes C_p , then a linear operator $C_p'' = C_p + C_p'$ can be found. Only for C_p there exist geometrical symmetries, which will let the special eigenvalues of $\lambda_p(k,m)$ in (14) to be zero. With the existence of the linear operator C_p'' all of the 64 eigenvalues and energy densities in (15) are $\neq 0$. The $\lambda_{(p)}\ \varphi^p{}_{km}$
$\rightarrow T_{rs}$ (with r,s = 1,...,8) define a R_8. If the hermetry form of the x_7,x_8 - coordinates is interpreted as a probability field $\kappa^{(0)}{}_{ik}(x_7,x_8)$ the quantization can be unified with the half-classic structure theory.

From a dimension law Droescher and Heim (1996) could deduce that a 12-dimensional hyperspace R_{12} must exist (but no higher-dimensional one). According to Heim processes in the dimensions $x_7,...,x_{12}$ influence physical events in R_6. Set theoretical analyses show that the in physical space R_6 projecting structures of the hyperspaces $G_4(x_9,...,x_{12})$ appear as superposition and interference capable probability amplitudes, and cause the phenomena of indeterministic quantum theory.

With methods of the abstract set theory for the starting state of universe (symmetry breaking at t = 0) one can deduced an algebraic structured primeval set consisting of pure numbers, which are probabilities for all possible interactions. Therefore, all of the observable and further yet unknown interaction constant can determined as pure numbers.

9. Possible Ways to Generate Gravitational Fields and Gravitational Waves

9.1 Theoretical Possibility to Generate Gravitons from Neutrons

In all condensor types there appear $(1) = \overset{\cap}{\begin{bmatrix}11\\11\end{bmatrix}}$ or $\overset{\cap}{\begin{bmatrix}1\\1\end{bmatrix}}$, which as projections into space behave as gravitational fields. The fluctons {4} and {5} in the protosimplex p[123][4567] are responsible for the coupling of an electromagnetic field onto matter. The flucton {4} in charged particles under special conditions (accelerations) can separated from them as photons. Heim assumes that in the same way gravitons can be separated from neutral particles by acceleration. The special property of (x_5,x_6) streams as organising coordinates requires an highly organised structure for neutral particles, if fluctons {1} can separated from them. The same condition also holds for a separation process in photons.

Investigations were carried out to find whether the required organisation level of neutron packings in cores in the Trans-Uranium with an order number of 115 could fulfil that condition, since in this case the internal core shell is complemented in a highly organised structure.

9.2 The Generation of Acceleration Field

In Heim's theory there exists a 6-dimensional electromagnetic/gravitational field tensor which is not explicitly shown by Heim. From this Heim deduced an 4-dimensional tensor which can be interpreted physically. Heim starts out from a set of relations very similar to Maxwell's equations, describing the interrelations between electric, magnetic, and gravitational fields, including a new mesofield. The mesofield only acts on moving masses and bears about the same relation to the gravitational field as the magnetic field does the electric field.

For further discussions following definitions are used:
$\vec{E}$ = electric field
$\vec{H}$ = magnetic field in vacuum
$\vec{B}_0$ = magnetic field inside the core
$\vec{\Gamma}$ = gravitational field
$\vec{m}$ = mesofield
ε_0 = vacuum permittivity ($\varepsilon_0 = 8.854 \times 10^{-12}$ farad/m)
μ_0 = vacuum permeability ($\mu_0 = 4\pi \times 10^{-7}$ henry/m)
α = permittivity of space to gravity ($\alpha = 1/4\pi\gamma = 1.19 \times 10^{9}$ s²kg/m³)
γ = gravitational constant ($\gamma = 6.67422 \times 10^{-11}$ m³/s² kg)
ß = $1/\alpha c^2$ (ß = 9.34×10^{-27} m/kg)
c = velocity of light (c = 3×10^{8} ms)
$\vec{j}$ = current densities ($\vec{j}_e$ = electric current density, $\vec{j}_m$ = mass current density)

The unified field theory yields a connection between the fields $\vec{E}$ and $\vec{H}$ with $\vec{\Gamma}$ and $\vec{m}$:

$$\nabla \times \left(\vec{E} + \sqrt{\frac{\alpha}{\varepsilon_0}}\vec{\Gamma} \right) = -\mu_0 \frac{\partial}{\partial t}\left(\vec{H} + \sqrt{\frac{\beta}{\mu_0}}\vec{m} \right) \quad , \tag{120}$$

$$\nabla \times \left(\vec{H} + \sqrt{\frac{\beta}{\mu_0}}\vec{m} \right) = \vec{j}_e + \sqrt{\frac{\beta}{\mu_0}}\vec{j}_m + \varepsilon_0 \frac{\partial}{\partial t}\left(\vec{E} + \sqrt{\frac{\alpha}{\varepsilon_0}}\vec{\Gamma} \right) \quad , \tag{121}$$

(the sign $\nabla \times$ stands for rotation operation).

Since the mesofield is very weak it can be dropped away. Equation (121) means that a rotating magnetic field will generate an electrical and a gravitational field, whilst a rotating gravitational field corresponding to equation (120) shall generate a magnetic field.

In 1985, the company MBB in Ottobrunn proposed to test equation (120) in a laboratory experiment. The experimenters were encouraged by the empirical discovery, made by Barnett (1935) and confirmed by Sirag (1979), that rotating stars generate a magnetic field.

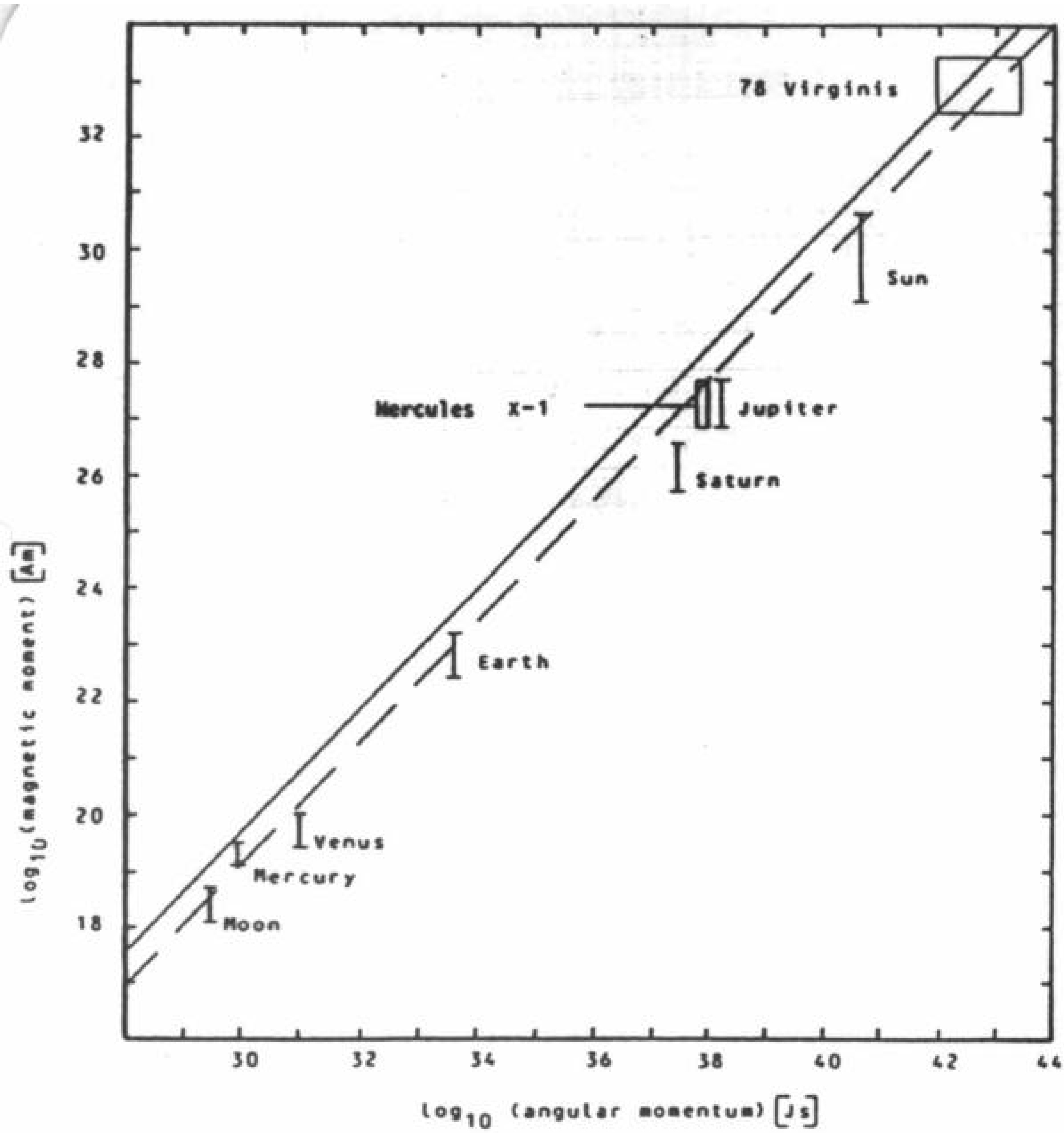

Fig. 5: Angular momentum versus magnetic moment for various stellar objects. The dotted line is a regression line for experimental data. The continuous line corresponds to Blackett's relation. It is also equivalent to the maximum of the radial field, according to Heim's differential equation (118). (Sirag 1979)

Figure 5 shows the angular momentum versus the magnetic moment of various stars. This linear relationship has stimulated Blackett (1947) to set up the gravi-magnetic hypothesis that a rotating mass measured in gravitational units has the same effect as a rotating charge measured in electrical units:

$$\sqrt{\gamma}\, m = \sqrt{\frac{1}{4\pi\varepsilon_0}} q_e \qquad \text{(for a rotating body with mass m)} \qquad (122)$$

After some calculation one finds that the ration of magnetic moment is a constant, leading to Blackett's equation

$$\frac{m_{mag}}{L} = \frac{\frac{1}{2}\frac{4\pi}{\mu_0} B r_{0^3}}{\frac{2}{5} m_0{}^2 \omega} = \frac{1}{2}\frac{\sqrt{\gamma}}{\sqrt{1/4\pi\varepsilon_0}} \quad , \qquad (123)$$

(m_{mag} = magnetic moment, L = angular momentum, ω = angular velocity, m = mass, r_0 = radius of the rotating body)
The astrophysical data can actually be fitted very well by a regression line close to

$$m = \left(\sqrt{\gamma} \,/\, 2\sqrt{(4\pi\varepsilon)^{-1}}\right) L \, .$$

With the availability of SQUID magnetometers, there is a real chance of measuring such an effect, if it exists at all. Heim gives a theoretical explanation for the Barnett effect which follows from equation (121) in the absence of electrical current. For the radial component the magnetic field is

$$B_r(r_0,a) = \frac{3}{10\pi}\frac{\sqrt{ß\mu_0}}{1+2/\mu}\omega m \frac{\sin\alpha}{r_0} \quad , \qquad (124)$$

and for the tangential component

$$B_t(r_0,a) = \frac{3}{20\pi}\frac{\sqrt{ß\mu_0}}{1+2/\mu}\omega m \frac{\cos\alpha}{r_0} \quad , \qquad (125)$$

(µ = relative permeability, a = geographic latitude, $ß = 4\pi\gamma/c^2$)

Blackett's relation (123) can only be valid on the surface of a rotating body and not in its interior. By assuming that our SQUID magnetometer can resolve 10^{-13} Tesla the rotational frequency for a body with the density ρ_m = 5000 kg/m³ should be greater than 300 cps.
One version of a possible set-up is shown in Figure 6.

The rotating mass is contained in a vacuum chamber. A loop shaped-superconducting shield to confine the field lines is inserted into a hole in the centre of a rotating cylinder. The SQUID magnetometer can be mounted anywhere along the loop. The bearings are pneumatic to avoid magnetic interactions. The total assembly can be cooled to Helium temperature.

Since the magnetic field has a maximum on the axis, the aim of our experiment was to measure the field in the centre of the rotating body. The body itself should not exhibit the Barnett effect. Hence, materials with non-saturated spin moments such as conductors or ferro magnets have to not suitable.

The cost should be about one million dollars. Since the company MBB could not pay for this sum, a cheaper experiment was searched.

Auerbach (Beck 1993) proposed to test Eq. (121). Neglecting the mesofield and the action of an electric field this formula becomes:

$$\nabla \times \vec{\Gamma} = -\sqrt{\frac{\varepsilon_0}{\alpha}}\frac{\partial \vec{B}}{\partial t} \quad , \qquad (126)$$

Since $\sqrt{\frac{e_0}{a}} = 8.6 \times 10^{-11}$ coul/kg this coupling constant between the magnetic field $\vec{B}$ and the gravitational field $\vec{\Gamma}$ is extremely small, so that even a strong magnetic field will induce a vanishingly small gravitational field.
Equation (126) can be solved after deciding an a magnetic field suitable for generating gravity.
$\vec{B}$ is produced by an alternating current, since it has to be time-dependent. The field lines of $\vec{B}$ are known to be perpendicular to the current, while the field lines of $\vec{\Gamma}$ are perpendicular to those of $\vec{B}$.

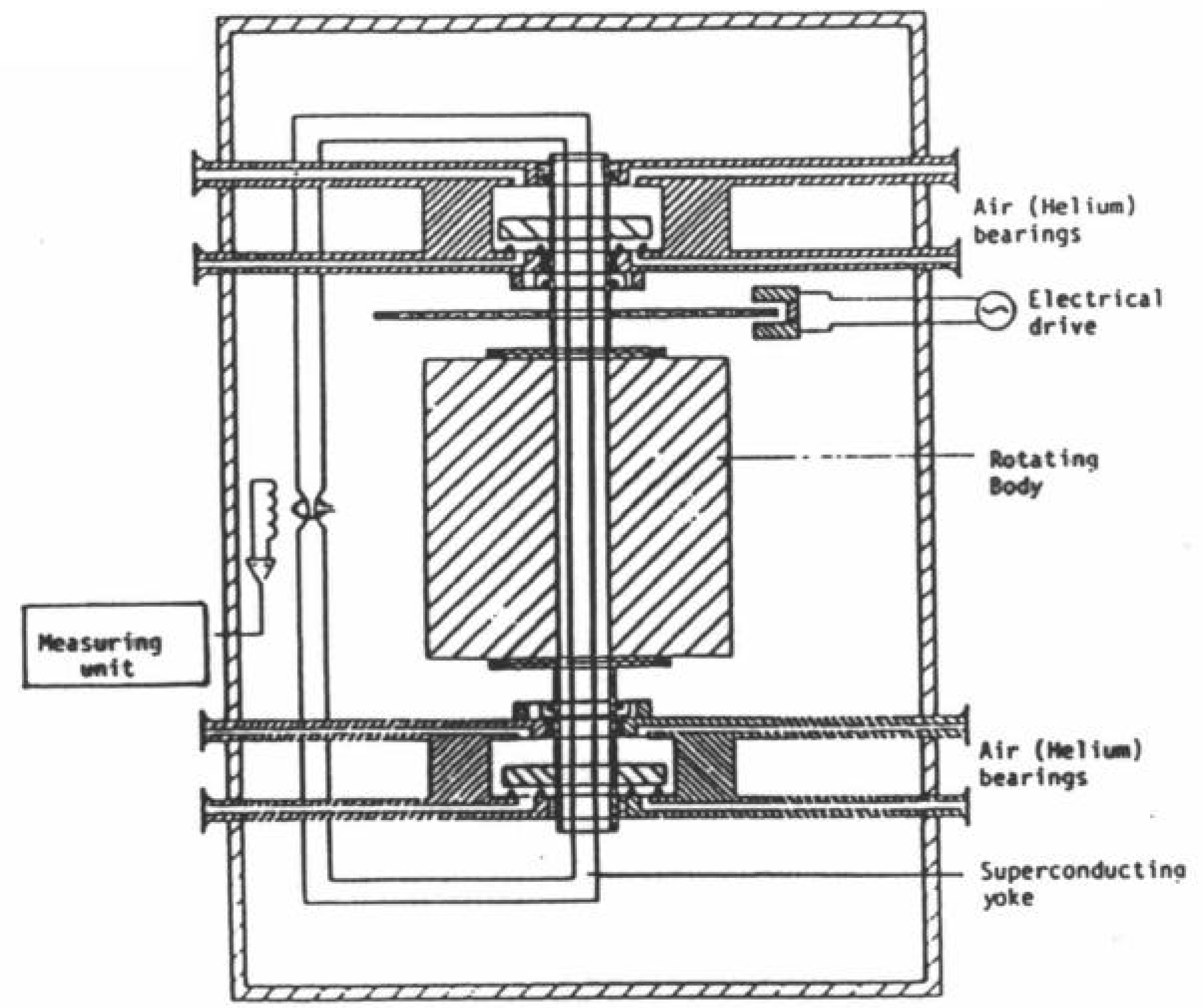

Fig. 6: Schematic diagram of the experimental set-up for the measurement of the weak magnetic field generated by a rotating crystal (Harasim et al 1985)

An exact solution of equation (126) for a gravitational field $\vec{\Gamma}$ induced by magnetic fields may be derived in the form of an infinite series. If the height of a device above the earth's surface is large compared to the dimensions of the magnet, which usually is the case, the first two terms of the series express the solution with sufficient accuracy. The gravitational field resulting from this approximation is known as a dipole field.

The vertical component of gravitational dipole field is given by the expression:

$$\Gamma_z = -\frac{\beta\mu_0\, 3\cos^2\Theta - 1}{16\pi^2 r^3} V \frac{\mu}{\mu_0}\frac{dI}{dt} \quad , \tag{127}$$

where τ and Θ are the coordinates of the point at which Γ_z is evaluated; V is the volume of the magnet, μ/μ_0 is the relative permeability of the iron core. I is the current producing the magnetic field, and dI/dt is the time derivative of I.
The current must be alternating. Taking a sinusoidal one: $I = I_0 \sin \omega t$ (with $\omega = 2\pi f$ and f = frequency of oscillations) would yield an alternating gravitational field which could not be used to reduce the weight of bodies, since the average value is zero. A solution would be to let the magnet rotate about a horizontal axis, together with its gravitational field. The rotational frequency must be the same as the current frequency, with the magnet rotating as $\cos \omega t$. As a result of rotation, an additional factor $\cos \omega t$ appears in (127). Both the field and the force F now become proportional to $\cos^2\omega t$,

$$F = \omega \cos^2 \omega t \quad , \tag{128}$$

Now the force vector never changes sign. A second term resulting from the integration is proportional to $(1/\omega) \sin 2\omega t$. This term is small because of the factor $1/\omega$. Auerbach proposed to take two rotating magnets whereas one of them rotates in the opposite direction. This would eliminate the gyroscope effect. Both magnets rotate with equal angular frequency ω, which must be the same as the current frequency. The second magnet is required to have a definite phase relation with respect to the first. When the two fields are added together the resulting force is proportional to

$$F = \omega(\sin^2\omega t + \cos^2\omega t) = \omega \quad , \tag{129}$$

The total gravitational force now becomes

$$F = -3.16 \times 10^{-14} \frac{R^3}{(R+h)^3} V \frac{\mu}{\mu_0} I_0 \omega \quad , \tag{130}$$

($R = 6.3 \times 10^6$ m, the earth radius; h is height of the magnet above the earth's surface; V = volume of one of the magnets). (Fig. 7)

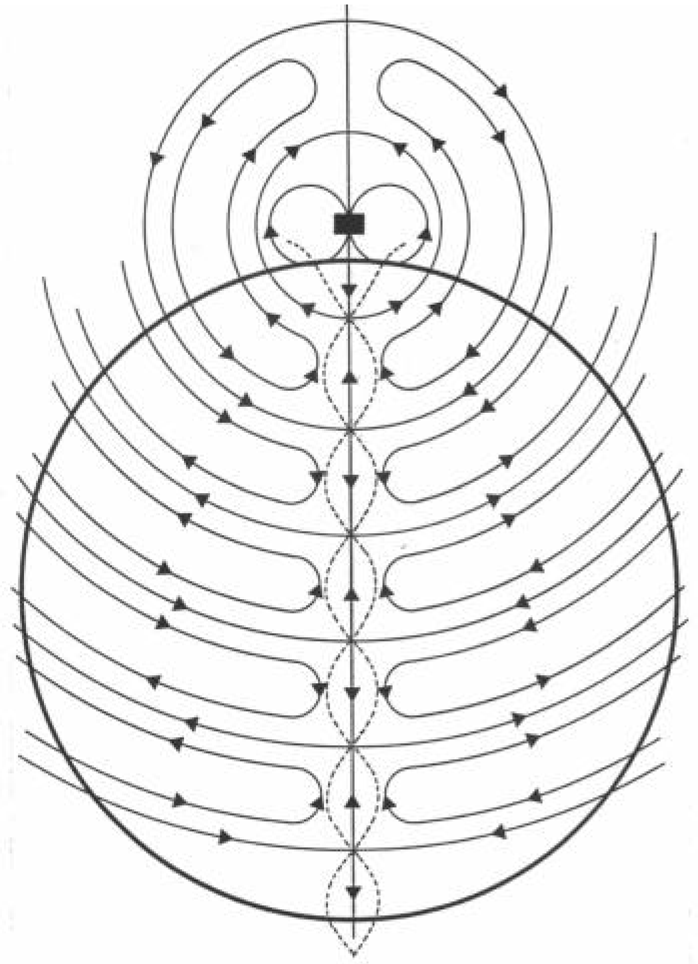

Fig. 7: Schematic view of gravitational field lines in the y-z-plane due to magnets counter rotating at 75 Hz. The wavelength is 4.0×10^6 m.

The second equation, which has not yet been solved, states that time-dependent gravitational and electrical fields in turn induce a time-dependent magnetic field. The two equations are coupled, since the same fields appear in both. It is, therefore, not permissible to solve just one of them and to ignore the other.

Equation (120) shows that the generation of gravitation always is accompanied by electric fields. The electric field turns out to be very strong and should result in strong electromagnetic disturbances near the rotating magnets. The real situation must consider this situation. (Fig. 8)

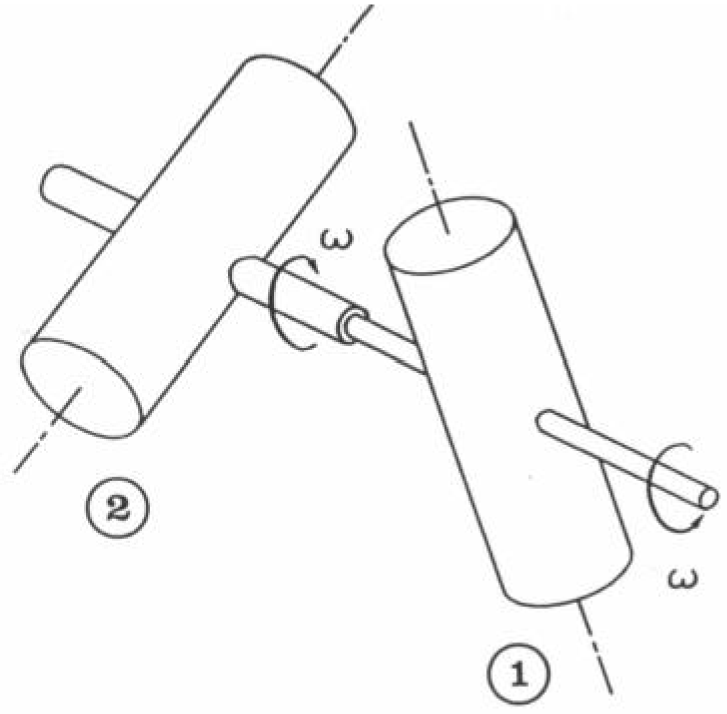

Fig. 8: The counter rotating magnets

For the gravitational force Auerbach gets the expression

$$F = -3.55 \times 10^{-6}\, V\, \frac{m}{m_0} I_0 g(k,h) \ , \qquad (131)$$

$$g(k,h) = \frac{1}{(R+h)^3}\{-D(D + 2h)[\sin kh + \sin k(D+h)] + \frac{4}{k}[h\cos kh - (D+h)\cos k(D+h)] -$$
$$- \frac{4}{k^2}[\sin kh - \sin k(D+h)]\}$$

(with the wave number $k = \frac{w}{c}$ and h = height over ground)

The dependence of g(k,h) on h is so weak that up to, say h = 100 km that g(k,h) may be regarded as essential independent of h.

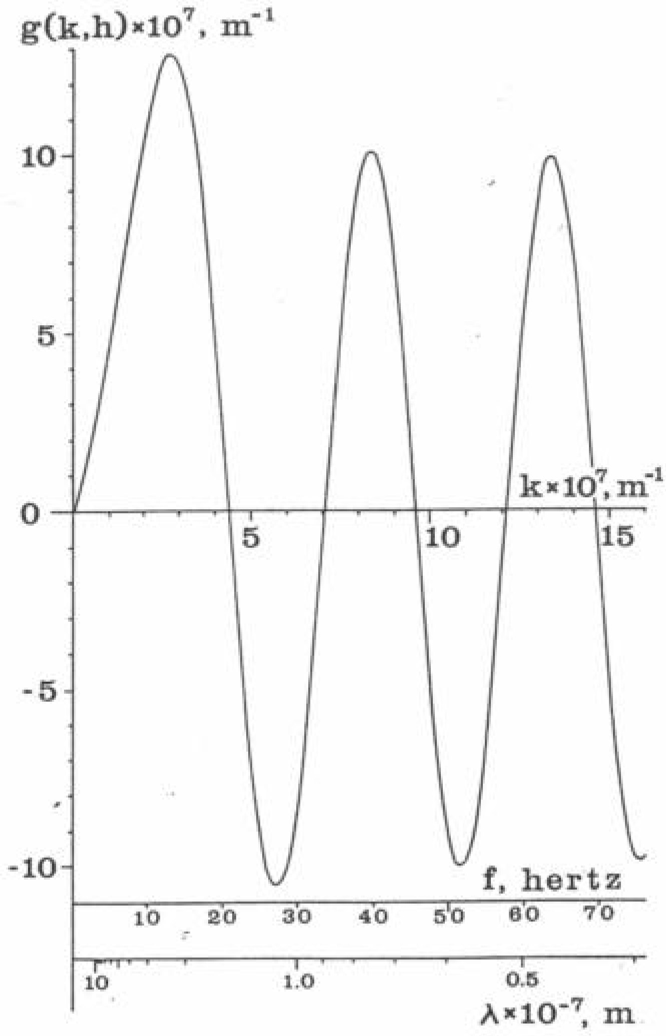

Fig. 9: The equation g(k,h), plotted against wave number k, frequency f and wavelength λ. (Beck 1993)

In Fig. 9 positive values of g(k,h) lead to antigravitation, negative ones to gravitation. When $k = 0$, the force is zero. Very close to $k = 0$ the force has the form of equation (130), which is thus seen to be valid at very low frequencies only. As k and the frequency increase, g(k,h) reaches a first antigravitational maximum at $k = 2.73 \times 10^{-7}$ m^{-1} when the wavelength λ is 2.3×10^{7} m^{-1} or close to twice the earth diameter.
Except at extremely small values of k the expression in the first set of square brackets in Eq. (131) dominates the rest of g(k,h) because it is multiplied by the large factor D(D+h).
Eq. (130) led one to believe that F would rise indefinitely with growing frequency. Actually, as seen in Fig. 9 Eq. (130) is only valid for very low frequencies. Only the first peak in Fig.9 is intensive to variations in ω and has the further advantage of mechanical stability due to low rotational speed.

A numerical example will illustrate the size of the antigravitational force one could get with two rotating magnets. In view of the smallness of the gravitational force all factors in Eq. (131) should be made as large as possible. The values chosen for the example are:

$$V = 1\ \mathrm{m}^3, \qquad \frac{m}{m_0} = 100{,}000\ , \qquad I_0 = 600{,}000 \text{ ampere turns.}$$

(60 amps per wire of 1 mm² cross-sectional area and 10,000 windings)
Substituting the numbers of Eq. (131) gives

$$F = -2.13 \times 10^5 \ g(k,h) \ , \tag{132}$$

For g(k,h) it is best to choose the first maximum reached at a frequency of 13.03 cycle (Fig. 9) This frequency of rotation is attainable even by large magnets. The maximum of the g-function at h = 100 m and $k = 2.73 \times 10^{-7}\ \mathrm{m}^{-1}$, corresponding to a frequency of 13.03 cps, is $g(k,h) = 8.18 \times 10^{-7}\ \mathrm{m}^{-1}$. When this figure is substituted into Eq. (132) the final result is

$$\begin{aligned} &F = 0.175 \text{ Newton} \\ \text{or} \quad &F = 17.5 \ \text{gram-weight} \end{aligned} \tag{133}$$

With rotating magnetic fields it seems impossible to generate gravitation fields. But it is hoped, that in a near future someone will find out how to bring free ions into rotations in crystals, which will yield a sufficient strength of magnetic fields. Instead of rotating magnetic coils one could think to use time-dependable curves like linear increasing short-cut currents which are used in rail-guns. In a device to generate high magnetic field pulses the rails could form in a spiral in a flat cylinder. To get an effective acceleration field it would be required to have a sandwich-pack of several of such plates in which the pulses are generated time-displaced.

9.3 Testing the Contrabaric Effect

According to the principle of equivalence in General Relativity, it is the total energy of a particle which interacts gravitationally. Therefore, the source m_0 in a sphere with a radius r_0 and the field energy in the exterior of a particle $r > r_0$ must be considered: $m = m_0 + \mu_g$, where μ_g is the field mass, given by

$$m_g = -\frac{2am_0^2}{r_0} \ , \tag{134}$$

with $a = \gamma/c^2$. The field mass is negative. The positive corresponding is not the field source m_0 , since μ_g ✞ m_0 , but a field between, a so-called mesofield $\vec{m}$, which field mass is positive:

$$+\frac{2am_0^2}{r_0} \ . \tag{135}$$

This field is defined in the exterior of m_0.

$$\operatorname{div} \vec{m} = c\,(\rho_0 - \rho)\ , \tag{136}$$

and the total gravitational field is

$$\vec{g} = \vec{\Gamma} + \frac{\vec{m}}{\boldsymbol{a}c} \ , \tag{137}$$

where c is the velocity of gravitational disturbances and $\alpha = 1/4\pi\gamma$.

In the same way like the vector of the magnetic field $\vec{H}$ is orthogonal to the time derivative of the electrical field $\dot{\vec{E}}$, i.e. $\vec{H} \perp \dot{\vec{E}}$, the mesofield vector $\vec{m}$ is orthogonal to the time derivative of the gravitational field $\dot{\vec{g}}$, i.e. $\vec{m} \perp \dot{\vec{g}}$.
The conservative total energy E_m of a matter field quantum m(r) is

$$E_m = m(r)c^2 + \frac{\boldsymbol{a}}{2}\int \vec{\Gamma}^2 dV \quad , \quad \text{with } \alpha = 1/4\pi\gamma \, , \tag{138}$$

and

$$\vec{\Gamma} = grad\,\boldsymbol{j} = g\left(\frac{1}{2}\frac{\P m}{\P r} - \frac{m}{r^2}\right) \ , \tag{139}$$

From Eq. (138) follows the differential equation for m= m (r) with a = $4\pi\alpha\gamma^2/c^2$:

$$a\left(\frac{dm}{dr}\right)^2 + \frac{dm}{dr}\left(1 - \frac{2am}{r}\right) + \frac{am^2}{r^2} = 0 \quad . \tag{140}$$

Its solution is

$$m(r) = \frac{r}{2a}\left(1 - \sqrt{1 - 4ad/r}\right), \tag{141}$$

$$d = m_0\,(1 - m_0/r_0) = m\,(1 - am/r) = \text{const.} \tag{142}$$

(these equations are given also by Arnowitt, Deser, and Misner, 1962).
The field energy of the gravitational field E_g expressed by the stationary energy $E = mc^2$ is:

$$E_g = \gamma m^2/r = \gamma\, E / c^4 r \ . \tag{143}$$

Therefore, the total differential can be written as

$$dE_g = \gamma/c^4\,[-(E/r)\,dr + (2E/r)\,dE] = c^2\,dm \ . \tag{144}$$

From (142) follows:

$$r = \frac{am^2}{m-d} \qquad \text{and} \qquad \frac{dr}{dm} = r\,\frac{1 - 2d/m}{m-d} \quad . \tag{145}$$

Eq. (144) with Eq. (145) becomes:

$$2E\frac{dE}{dm} - \frac{1}{m}\frac{m-2d}{m-d}E^2 = \frac{mc^4}{m-d} \, . \tag{146}$$

$$E = \pm\sqrt{r\left(c^6 m / g + k\right)} \text{ , with } k = \frac{E_0^2}{r_0} - \frac{c^6}{g} m_0 \qquad (147)$$

For the approximation κ→0 follows

$$\mathrm{E} = \frac{c^3 r}{g}\sqrt{j_g} = \frac{c^3 r}{g}\Phi_g \text{ ,} \qquad \Phi_g = \sqrt{j_g} \text{ .} \qquad (148)$$

Then, the energy density η can be written as a function of the gravitation potential:

$$h = \frac{dE}{dV} = \frac{1}{4pr^2}\frac{dE}{dr} = \frac{c^3}{4pg}\frac{1}{r^2}\left(\Phi_g + r\frac{d\Phi_g}{dr}\right). \qquad (149)$$

The temporal change of the energy density of the electromagnetic field is defined by:

$$\dot{h} = div(\vec{E} \times \vec{H}) \qquad (150)$$

The temporal change of the force density ξ leads with Eqs. (149) and (150) to the <u>contrabaric equation</u> (Heim 1959):

$$\dot{x} = grad\, h = grad \;\; div(\vec{E} \times \vec{H}) = \frac{c^3}{4pg}\frac{d}{dt}\left[\frac{1}{r^2}\left(\Phi_g + r\frac{d\Phi_g}{dr}\right)\right]. \qquad (151)$$

By applying an operator to the force density of the electromagnetic radiation vector a mechanical ponderomotoric effect must be generated:

$$x = \frac{d\vec{K}}{dV} = rot \;\; rot(\vec{E} \times \vec{H}) + div \;\; grad(\vec{E} \times \vec{H}) = \frac{c^3}{4pg} grad\left[\frac{1}{r^2}\left(\Phi_g + r\frac{d\Phi_g}{dr}\right)\right]. \qquad (152)$$

(B. Heim has not shown the explicit meaning of the operators in his paper, but denoted it by M = J; M' , which is of course the operator grad div ( ) = rot rot ( ) + div grad ( )).

The temporal change of the force is

$$\dot{K} = \iiint grad\, h\, d\vec{f} d\vec{s} = \iiint grad \;\; div(\vec{E} \times \vec{H}) d\vec{f} d\vec{s} = \qquad (153)$$
$$= -2pr\dot{h}\int ds$$

If the electromagnetic power L_ω is introduced into the device from outside it has an efficiency ε and Eq. (153) will become

$$\ddot{b} = -\frac{2pL_w e}{m_0 n V}\int b dt \text{ , since } \dot{s} = \int b dt \qquad (154)$$

(n is the number of rings in which the transformation happens, V is the volume and m_0 is the mass of one of these rings with the radius r).

In Eq. (154) the constant of device A is

$$\mathrm{A} = \frac{2 prLe}{m_0 nV} , \qquad (155)$$

and from Eq. (155) one gets the differential equation

$$\dddot{b} = -A \int b dt . \qquad (156)$$

The solution of the contrabaric equation is

$$b(k,t) = \frac{4g}{21k^2 t}\left[e^{-kt} - e^{1/2kt}\left(\cos kt\sqrt{3} - 1/2\sqrt{3}\sin kt\sqrt{3}\right)\right] , \qquad (157)$$

with k = $\sqrt[3]{A}$ and τ = 4.3/c =1.43 10^{-8} sec.

The contrabaric disturbance oscillates and has an effect upon air as an acoustic oscillation source. Its oscillation consists of a decreasing part and of an amplitude modulated harmonic oscillation.
Heim attempted to fulfil the requirements from equation (19) for the construction of the test device. If an electromagnetic cm-wave will be coupled into microwave guides, which consist of rings (r = 8.14 cm), and if the rings are arranged in parallel such that several of these rings build up a bigger ring (r' = 60 cm), then the electromagnetic energy should vanish and appear in a mechanical-kinetic form.

In the surroundings of the device, which Heim called a contrabator, there should appear an acceleration field b(k,t), which should alter the weight of a test body, according to the temporal variation of the field b(k,t). Heim used 3cm waves and 200 Watt. A newly developed gravimeter with a sensitivity of 10^{-8} % of earth acceleration should measure the computed oscillations.

The frequency f depends much on the constant of device:

$$\mathrm{f} = c_0/\lambda = \frac{6}{p}\sqrt{\frac{2\sqrt{3}}{c_0 p} A} , \qquad (158)$$

where c_0 is the velocity of sound, and λ the sound wave length.
It was found that the efficiency ε was very small and that the action of the apparatus yielded too many disturbances, and hence the registration with a microphone was problematical. Therefore, an other construction was planned. Since co-workers could not be paid by Heim, these experiments were finished without positive or negative results.

9.4 Changing Inertia by 8-dimensional Probability Fields?

Last December the author received a paper with calculations about interaction constants from Walter Droescher (co-author of Heim) which he deduced from symmetry laws in form of cardinal number complexes. Droescher has investigated the effect of the (x_7,x_8)-hermetry in Heim's theory. It should be possible to generate probability fields by photons in an energy range between about 27 to 113 keV, which act on partial structures such that the orthogonality requirement according to Eq.(106)

for several of the λ_{kl} is no longer valid. As a consequence the inertia of particles under the influence of the probability field should be lowered. This information is too new to be more precise presented.

Two new effects predicted by Heim's theory - antigravity, separating gravitational waves from neutrons and lowering of inertia by an 8-dimensional probability field - have yet to be investigated.

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