Extended Heim Theory, Physics of Spacetime, and Field Propulsion

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In this non-mathematical overview we present a very brief introduction to some of the basic physical assumptions of *Extended Heim Theory* (*EHT)* as developed by Heim and Dröscher. We also explain the ***differences*** to the ***original 6-dimensional theory of Heim***. These differences may be substantial, and we will show that ***a completely different picture of physical interactions*** is the result. *EHT* predicts *six fundamental physical interactions*. Heim had adopted Dröscher's idea of a 12-dimensional internal symmetry space from which the polymetric tensor, describing physical interactions, has to be constructed. Together with Dröscher, he published the book *Strukturen der physikalischen Welt und ihrer nichtmateriellen Seite, Resch Verlag, 1996, Innsbruck,* in which the physical consequences of this 12-dimensional internal space are discussed. Unfortunately, because of his failing health, Heim could not any more accomplish the task of rewriting his first two volumes on *Elementarstrukturen der Materie*, Resch Verlag, Innsbruck. The notes below are an excerpt from a forthcoming paper and are only a beginning.

Physical Concepts of Field Propulsion Based on Extended Heim Theory[1]

Current physical laws severely limit spaceflight. The German physicist B. Heim, in the fifties and sixties of the last century developed a unified field theory based on the *geometrization principle* of Einstein (see below) introducing the concept of a quantized spacetime, but using the equations of *GR* and introducing *QM*. This same idea has recently been used in quantum gravity. Heim went beyond general relativity and asked the question: if the effects of the gravitational field can be described by a connection (Christoffel symbols) in spacetime that describes the relative orientation between local coordinate frames in spacetime, can all other forces of nature such as electromagnetism, the weak force, and the strong force be associated with respective connections or an equivalent metric tensor. Clearly, this must lead to a higher dimensional space, since in *GR* spacetime gives rise to only one interaction, which is gravity. Furthermore, the assumption of locality for all physical interactions is of greatest importance and determines the general structure of a unified theory as well as the number of fundamental physical interactions. In the following sections, this approach is presented in detail, devising a framework for a unified theory.

Physical Postulates of Extended Heim Theory

It is said that Einstein did not accept the consequences of quantum theory, because he felt that *GOD does not play dice*. In contrast, one can say, in analogy to Einstein, that Heim assumes that *GOD quantizes.* Einstein's assumption of a continuous spacetime is *not correct*. Spacetime *must be discrete* that means there exists an (elemental) smallest surface and an elemental time, termed *metron (roughly Planck length squared) and Planck time*. There is *no physics* below these Planck scales. As will be shown below, this fact has dramatic consequences, and leads to the concept of parallel (or hyper) space, in which the speed of light has a value of *nc* where *n* is an integer larger than one and *c* denotes the vacuum speed of light (see our papers). Any physical theory that wants to describe all physical interactions in a unified framework needs to be based on fundamental, generally accepted observations and the physical principles derived from those. In contrast to Einstein, *EHT* is based on the following four simple and general principles, termed the ***GOD Q*** principle of *Nature:*

1 For explanation of terminology see the document *Glossary*, available from www.hpcc-space.com

i. ***Geometrization principle for all physical interactions,***
ii. ***Optimization (Nature employs an extremum principle),***
iii. ***Dualization (duality, symmetry) principle (Nature dualizes or is asymmetric, bits),***
iv. ***Quantization principle (Nature uses integers only, discrete quantities).***

The conclusions obtained from these four principles are now being discussed.

- The *geometrization principle*, introduced by Einstein to describe gravity, is extended to *give rise to all physical interactions* which are described by a so called *polymetric.* The form of this polymetric tensor is fixed by the relationship of internal symmetry space and Lorentzian spacetime (assumed to be a *manifold* rather than a flat space). *Individual metric tensors, describing physical interactions, are derived from this polymetric.* Physical quantities (tensors in general) are connected by a specific geometrical structure, termed affine connections that define parallel transport from one point in space to another.

- The optimization principle (Lagrangian densities). The departure from flat space, i.e., connection coefficients are nonzero (*spacetime is a manifold*), leads to a principle of least action.

- From the *duality principle*, the existence of *additional internal symmetries in Nature* is deduced, and thus a *higher dimensional internal symmetry space* should exist. The *duality principle* also determines the relationship of internal symmetry space with Lorentzian four-dimensional spacetime.

- The *quantization principle* leads to a *discrete or quantized spacetime* that requires the existence of an elemental surface, termed *metron* by Heim, which is proportional to the square of the Planck length, and thus explains spacetime as a quantized field, like any other physical field.

Having briefly specified the *GOD Q principle* as realized in *Nature*, according to *EHT*, it serves as the basis for the program of a unified field theory, describing *all* physical interactions. This program, outlined in detail in this chapter, has, as one of its most important consequences, the prediction of two additional, gravitational like interactions and the existence of two messenger particles, termed *gravitophoton* and *quintessence*. The name *gravitophoton* has been chosen because of the type of interaction, namely a *transformation of the electromagnetic field (photon) into the gravitational field (gravitophoton)*. The theory postulates an internal space, termed Heim space H^8, with 8 dimensions, see following section, that governs physical events in our spacetime $\mathbb{R}^4$. Here it *should be understood that spacetime is a manifold* and not a flat Euclidean space, so mathematically speaking symbols M^3 or M^4 should be used instead. However, since the most of the readers are not mathematicians[2], the widely known symbols $\mathbb{R}^3$ or $\mathbb{R}^4$ are used. The exact meaning will be clear from the context and the physics. In case the internal symmetry space is not considered, *EHT* is reduced to *GR*.

The Role of Spacetime Dimensionality in Extended Heim Theory

Heim and Dröscher developed a unified theory introducing a 12-dimensional internal space. They found that this space comprised the subspaces $\mathbb{R}^3$, T^1, S^2, I^2, and G^4 where space G^4 governs events in our spacetime, without the use of energy by directly changing possibilities (probabilities). It was found that G^4 is not needed to describing physical interactions and therefore an internal symmetry space H^8 is sufficient. It is, however, important to note that according to *EHT*, no direct transformation of photons into gravitons seems to be possible. Instead, in *EHT*, the interaction

2 A mathematician or mathematical physicist should replace $\mathbb{R}$ by M (manifold) whenever deemed to be necessary to express a non-flat space.

between the electromagnetic and gravitational fields occurs through the conversion of *photons* into *gravitophotons*. This is in contradiction to Heim's original theory, where a direct coupling between Maxwell equations and gravitation was obtained. However, this is not surprising, since Heim's original six dimensions did not consider subspace I^2, see *Table 2*, which is the carrier space for information waves. From *Table 2* it is directly obvious that, disregarding subspace I^2, the metric for the gravitophoton, H_5, degenerates into the metric of the graviton, H_1. As a consequence, a six-dimensional internal space leads to *qualitatively different physics*, i.e., there exist physical phenomena observable in eight dimensions, which are not present in the lower six-dimensional realm. Going one step further, and also doing away with organizational space S^2, it becomes immediately clear from *Table 2* that gravity cannot be unified with the other three remaining forces (strong, electromagnetic, weak), since the metric of the graviton *cannot be represented in space* $\mathbb{R}^4$, because it only exists in subspace S^2. Furthermore, from *Table 2* it is clear that in spacetime $\mathbb{R}^4$ neither the gravitophoton nor the quintessenece (or vacuum) particles exist, since their metric comprises subspaces S^2 and I^2 only. Looking at the column for the symmetry groups in *Table 2*, the 8-dimensional group of general coordinate transformations in H^8 that unifies all six interactions can be best understood by (spontaneous, i.e., action is invariant, currents are conserved) symmetry breaking, because it can be expressed as the product of the four symmetry groups of the subspaces $\mathbb{R}^4$, T^1, S^2, and I^2. In H^8 the full symmetry group is given by SU(3)×U(1)×SU(2)×U(1)×U(1). It is evident from this column of symmetry groups that in $\mathbb{R}^4$ only the symmetry group product SU(3)× U(1)×SU(2) can be retained that describes the strong, electromagnetic and weak interactions. Thus, in $\mathbb{R}^4$ the unification of physical interactions is inevitably lost.

The Structure of Internal Symmetry Space and Spacetime

In this section the structure (coordinates) of the internal symmetry space, as realized in *Nature*, and its relationship to our four-dimensional spacetime, in which all physical events take place, is given. As long as quantization of spacetime is not considered, both *internal symmetry space,* denoted as *Heim space* H^8 (see below), and spacetime of *GR* can be conceived as *manifolds equipped with a metric*.

The **fundamental difference to *GR*** is the existence of the space H^8, and its influence on and steering of events in $\mathbb{R}^4$. In *GR* there exists only one metric leading to gravity. All other interactions cannot be described by a metric in $\mathbb{R}^4$. In contrast, since internal symmetry space is steering events in $\mathbb{R}^4$, the following (double) mapping, namely $M^4 \rightarrow H^8 \rightarrow \mathbb{R}^4$, has to replace the usual mapping $M^4 \rightarrow \mathbb{R}^4$ of *GR*. This double mapping is the source of the polymetric describing all physical interactions that can exist in *Nature*. The coordinate structure of H^8 is therefore crucial for the physical character of the unified field theory. This structure needs to be established from basic physical features and follows directly from the *GODQ* principle. Once the structure of H^8 is known, a prediction of the *number and nature* of physical interactions is possible.

In *GR* there exists a four dimensional spacetime, comprising three spatial coordinates, x^1, x^2, x^3 with positive signature (+) and the time coordinate x^4 with negative signature (-). It should be remembered that the *Lorentzian* metric of $\mathbb{R}^4$ (actually spacetime is a manifold M^4) has three spatial (+ signature) and one time-like coordinate (- signature) (Carroll 2004). The plus and minus signs refer to the metric that is, the spatial components are taken to be positive and the time coordinate is negative. Therefore, the squared proper time interval is taken to be positive if the separation of two events is less than their spatial distance divided by *c*. Hence a *general coordinate system* in $\mathbb{R}^4$ (M^4) comprises the curvilinear coordinates[3] x^μ with μ=1,..,4.

Next, the coordinate structure of H^8 is determined. Coordinates in H^8 are denoted as ξ^i and are

3 coordinates x^μ can also be Cartesian. Meaning of coordinates will be clear from the context.

termed internal coordinates with $\nu=1,\ldots,8$. This set of 8 coordinates will now be determined by utilizing the *GODQ principle* introduced above. To this end, the second law of thermodynamics is considered, which predicts the increase of entropy. Everywhere in *Nature,* however*,* highly organized structures can be found like galaxies, solar systems, planets, plants etc., which, according to the duality principle, have to be introduced into a unified theory. A description of *Nature* that *only* provides a route to decay or to lower organizational structures is in contradiction to observation. Therefore, an additional, internal (negative signature -) coordinate, termed ***entelechial*** coordinate, ξ^5, is introduced. The entelechial dimension can be interpreted as a ***measure of the quality of time varying organizational structure*** (inverse or dual to entropy). It should be mentioned that all other additional coordinates have *negative* signature, too. Second, when the universe was set into motion, it followed a path marked by a state of great order. Therefore, to reflect this generic behavior in *Nature*, the ***aeonic*** dimension, ξ^6 , is introduced that is interpreted as a ***steering coordinate toward a dynamically stable state***. On the other hand, the entropy principle is firmly established in physics, for instance in β- decay. Entropy is directly connected to probability, which in turn is related to information. Therefore, two additional coordinates ξ^7, ξ^8 are needed to reflect this behavior of *Nature*, termed ***information coordinates*** that are describing information waves. Finally, since both space and time are essential in the evolution and decay of structures, the internal symmetry space possesses a total of 8 coordinates. In summary, coordinates ξ^ν with $\nu=1,\ldots,4$ denote spatial and temporal coordinates, ξ^ν with $\nu=5,6$ denote entelechial and aeonic coordinates, and ξ^ν with $\nu=7,8$ denote information coordinates in H^8. It should be noted that a dimensional law can be derived that does not permit the construction of, for instance, a space H^7.

The Discrete Nature of Spacetime

Heisenberg´s indeterminacy (uncertaintity) relation, for instance relating time and energy indeterminacies, $\Delta t \Delta E > \hbar$, allows for arbitrarily small Δt by making the energy uncertainty arbitrarily large. However, this is not the case in the real physical world. It is straightforward to prove the discreteness of spacetime. To prove the discrete nature of spacetime, the time measurement process using clocks is analyzed. Einstein's *GR* itself is used to disprove the existence of continuous spacetime. According to Einstein, the energy of any material object is $E = mc^2$. The smallest time interval, δt, that can be measured must of course be larger than the time uncertainty required to satisfy Heisenberg's uncertainty relation that is $\delta t > \Delta t = \hbar / \Delta E$. A clock of mass m cannot have an energy uncertainty $\Delta E > mc^2$, because this would lead to the creation of additional clocks, hence $\delta t > \Delta t = \hbar / m c^2$. A clock of length l needs a measuring time $c\delta t > l$ in order to receive the measuring signal. A characteristic length of a material body is its Schwarschild radius, namely when its gravitational energy equals its total energy mc^2, i.e., $r_S = Gm/c^2$. This means for the mass of the clock $m < r_S\, c^2/G$, because the body must not be a black hole from which signals cannot escape. Inserting the value l for r_S, $m < \delta t\; c^3/G$. Inserting the value of m in the above relation for δt, one obtains the final relation $\delta t^2 > \hbar G / c^5$. Thus the quantization aspect of the *GODQ* principle directly delivers a fundamental lowest limit for a time interval, termed the Planck time. In a similar way the smallest units for length and mass can be found. As shown above, Planck units are constructed from the three fundamental constants in *Nature*, namely $\hbar$, c, and G. The values for the Planck units are: *Planck mass* $m_p = (\hbar c/G)^{1/2} = 2.176 \times 10^{-8}$ kg, *Planck length* $l_p = (G\hbar c^{-3})^{1/2} = 1.615 \times 10^{-35}$ m, and *Planck time* $t_p = (G\hbar/c^5)^{1/2} = 5.389 \times 10^{-44}$ s. This means that the *classical picture of points in a continuous spacetime does not make physical sense*. Physics below the Planck units is not possible, since one cannot distinguish between vaccum and matter. No measurements are possible. The nature of spacetime is discrete in the same way as energy is discrete, expressed by $E = h\nu$. Since spacetime therefore is a quantum field, it should have corresponding quantum states, described by a quantum field theory. Since spacetime is equivalent to gravity, gravity itself needs to be described by a quantum field theory. In both classical physics and quantum mechanics point particles are used, and the inverse force law leads to infinities of type 1/0 at the location of the particle. As was shown above, any particle must have a geometric structure, since it is finite in size. The minimal surface must be proportional to the Planck length squared. From scattering experiments, however, it is known that many particles have a much larger radius, for instance, the proton radius is some 10^{-15} m, and thus its surface would be covered by about 10^{40} elemental Planck surfaces. Hence, an elementary particle would be a highly complex geometrical structure. Heim has analyzed in detail the structure of elementary particles and introduced the concept of a smallest surface termed *metron*. According to Heim, the current area of a *metron*, τ, is $3Gh/8c^3$ where G is the gravitational constant, h denotes the Planck constant, and c is the speed of light in vacuum. The *metron* size is a phenomenologically derived quantity and is not postulated. It is therefore mandatory that point particles are banished. However, because of the discrete nature of spacetime there seems to be no need for string theory, which replaces point particles by strings, but requires hitherto unobserved additional spatial dimensions.

Energy Coordinates

Furthermore, a most important element has to be added to the structure of H^8 that is missing in *GR*. The metric tensor, as used in *GR*, has *purely geometrical means* that is of immaterial character only, and does not represent any physics. Consequently, the *Einsteinian Geometrization Principle* (EGP) is equating the Einstein curvature tensor, constructed from the metric tensor, with the stress tensor, representing energy distribution. Stated in simple terms: matter curves spacetime. In this way, the metric tensor field has become a physical object whose behavior is governed by an action principle, like that of other physical entities. According to the quantization principle, the minimal length in the space part of H^8 is the Planck length. Applying the geometrization rule of the *GODQ* principle, Planck mass and Planck time are converted into length units leading to two additional lengths constants $l_{pm} = \hbar/m_{\mathrm{p}}c$ and $l_{\mathrm{pt}} = ct_p$ that have the same numerical value as l_{p} but define two additional different length scales, relating lengths with time units as well as length with mass units. The introduction of basic physical units is in contradiction to classical physics that allows infinite divisibility. As a consequence, measurements in classical physics are impossible, since units cannot be defined. Consequently, *Nature* could not provide any elemental building blocks to construct higher organized structures, which is inconsistent with observation. Thus the quantization principle is fundamental for the existence of physical objects. Therefore the three Planck length units as defined above must occur in the structure of both M^4 and H^8. In M^4 length unit l_{p} is the basic unit for the spatial coordinates and l_{pt} measures the time coordinate. In order to connect geometry with physical entities, in the internal symmetry space coordinates ξ^i are measured in units of l_{pm}. Hence all lengths in H^8 are represented by multiples of $1/m_{\mathrm{p}}$, and therefore internal coordinates ξ^i are denoted as *energy coordinates*. In other words, the concept of energy coordinate ensures that an inverse length is representing a physical mass. Since length values are quantized, the *same holds for physical mass*. In this regard the connection of geometry with physical objects has been established, but, in order to achieve this goal, the quantization principle had to be introduced *ab initio*.

The Physics of Hermetry Forms

The following four tables contain the complete set of hermetry forms (individual metric tensors) and their physical meaning. The word hermetry is a combination of hermeneutics and geometry that is, a hermetry form stands for the physical meaning of geometry. It is most important to note that gravitation comprises three interactions that are mediated by three messenger particles, termed *graviton* (attractive), *gravitophoton* (attractive and repulsive), and *quintessence* (repulsive) particle. The gravitophoton interacts with virtual matter, while the quintessence particle interacts with the vacuum.

Table 1: *The three gravitational interactions are related to different types of matter as indicated in the first column. The gravitational hermetry forms are explained in Tables 2 and 3.*

Generated by	Messenger particles	Force	Coupling constant	Hermetry form
real particle	*graviton*	*attractive*	G_g	$H_1(S^2)$
virtual particles	*gravitophoton*	*repulsive and attractive*	$G^+_{gp}, G^-_{gp} = 1/67^2 G_g$	$H_5(S^2 \times I^2)$
Planck mass vacuum	*quintessence or vacuum particle*	*repulsive*	$G_q = 4.3565 \times 10^{-18}\ G_g$	$H_9(I^2)$

Table 2: Table of hermetry forms describing interaction particles: classification scheme for physical interactions and particles (hermetry forms not shown, see Table 3) obtained from polymetry in Heim space H^8. Superscripts for subspaces indicate dimension. Subspaces S^2 and I^2 stand for organization and information, respectively. A hermetry form characterizes either a physical interaction or a particle, and is associated with an admissible subspace. Either S^2 or I^2 need to be present in such a subspace in order to realize a physical event in our spacetime. Spaces R^3, T^1, S^2 and I^2 form the basis of Heim space H^8. The additional four dimensions of H^{12} are not needed for describing physical interactions, but seem to steer probability amplitudes. It should be noted that a white field in a table entry of the messenger particle column implies that the corresponding hermetry form does not describe an interaction particle and is listed separately in Table 3.

Subspace	*Hermetry form* *Lagrange density*	*Messenger particle*	*Symmetry group*	*Physical interaction*
S^2	$H_1(S^2), L_G$	*graviton*	*U(1)*	gravitation +
$S^2 \times \mathbb{R}^3$	$H_2(S^2 \times \mathbb{R}^3)$			
$S^2 \times T^1$	$H_3(S^2 \times T^1)$			
$\underbrace{S^2 \times \mathbb{R}^3 \times T^1}_{\text{particle aspect}}$	$H_4(S^2 \times \mathbb{R}^3 \times T^1)$			
$S^2 \times I^2$	$H_5(S^2 \times I^2), L_{gp}$	$\underbrace{-\ \text{neutral} +}_{\text{three types of gravitophotons}}$	*U(1)× U(1)*	gravitation ± *+ attractive* *– repulsive*
$S^2 \times I^2 \times \mathbb{R}^3$	$H_6(S^2 \times I^2 \times \mathbb{R}^3), L_{ew}$	Z^0 *boson*	*SU*(2)	electroweak
$S^2 \times I^2 \times T^1$	$H_7(S^2 \times I^2 \times T^1), L_{em}$	*photon*	*U(1)*	electromagnetic
$S^2 \times I^2 \times \mathbb{R}^3 \times T^1$	$H_8(S^2 \times I^2 \times \mathbb{R}^3 \times T^1)$	$W^{\pm}$ *bosons*	*SU*(2)	electroweak
wave aspect: I^2	$H_9(I^2), L_q$	*quintessence*	*U(1)*	gravitation – vacuum
wave aspect: $I^2 \times \mathbb{R}^3$	$H_{10}(I^2 \times \mathbb{R}^3), L_s$	*gluons*	*SU*(3)	strong
wave aspect: $I^2 \times T^1$	$H_{11}(I^2 \times T^1)$			
wave aspect: $I^2 \times \mathbb{R}^3 \times T^1$	$H_{12}(I^2 \times \mathbb{R}^3 \times T^1)$			

Table 3: Table of real particles and their interactions. The lepton weak charge is responsible for the following interactions: lepton weak charge for interactions of: *e* and ν_e, μ and ν_μ , τ and ν_τ *as well as* interactions between neutrinos caused by Z^0 and $W^\pm$ bosons.

Subspace	***Hermetry form***	***Particle class***
$S^2 \times T^1$	$H_3(S^2 \times T^1)$	weak charge for leptons
$S^2 \times \mathbb{R}^3 \times T^1$	$H_4(S^2 \times \mathbb{R}^3 \times T^1)$	electrically charged particles
$S^2 \times \mathbb{R}^3$	$H_2(S^2 \times \mathbb{R}^3)$	neutral particles with rest mass
$I^2 \times T^1$	$H_{11}(I^2 \times T^1)$	weak charge for quarks
$I^2 \times \mathbb{R}^3 \times T^1$	$H_{12}(I^2 \times \mathbb{R}^3 \times T^1)$	quarks

Table 4: **Table of the three degenerated hermetry forms**: A * indicates that the metric tensor is from the associated space, but some of the fundamental metric components of that space are 0, which is denoted as degeneration.In the first row there the probability amplitude for the conversion of photons into gravitophotons. The third row shows the conversion amplitude from gravitophpotons into the quintessence particle.

Subspace	***Associated space***	***Physical quantity***	***Metric tensor***
$\mathbb{R}^3$	$H_{13}*(T^1 \times S^2 \times I^2)$	w_{ph_gp}	g = (44,55,56,57,58 66,67,68 77,78,88)
T^1	$H_{14}*(\mathbb{R}^3 \times S^2)$	neutrinos	
$\mathbb{R}^3 \times T^1$	$H_{15}*(I^2)$	w_{gp_q}	g = (77,88)