ECE theory in higher dimensions - the link to Heim theory

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Abstract

The realms of matter and spirit and their connection are the subject of many debates in natural philosophy. In this article we take the standpoint that both realms exist. The most developed theories for this subject are the ECE theory of Myron Evans for the four-dimensional material world, and the field theory of Burkhard Heim for the non-material aspects. Heim defined a unified world of matter and spirit, involving twelve dimensions. ECE theory, which is based on Cartan geometry, can be extended to more than four dimensions. The transition from mind to matter can be described by a mechanism based on a six-dimensional space, with two dimensions overlapping matter-like processes and the world of Heim. This overlap is the area that is explored in this paper. We use the field equations and the wave equation of ECE theory to describe this quantitatively, thereby tending to close a gap between conventional physics and metaphysics.

Keywords: ECE theory, field equations, Burkhard Heim, unified field theory, higher dimensions.

1 Introduction

The development of ECE (Einstein-Cartan-Evans) theory aimed at explaining all sub-areas of physics on a common basis, which is geometry [1–3]. This goal was reached after nearly twenty years of intensive development. The basis is Cartan's geometry, which is a mathematical-algebraic description of curved and twisted spacetime. Einstein was the first to describe physics (more precisely, gravitation) by the geometry of space, directly. Since Cartan's geometry was not yet developed when Einstein published his theory of general relativity in 1916, he used Riemann's geometry of curved spacetime, which missed torsion. This omission was not corrected until the advent of the ECE theory of Myron

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Evans in 2003. Certain problems of Einstein's theory, for example, no conservation of energy in space and the inability to explain the structures of galaxies, were resolved by ECE theory. As it developed, ECE theory allowed all fields of physics to be explained on a common geometrical basis. It has facilitated significant insights into physics and natural philosophy, for example, that the laws of gravitation could be formulated equivalently to those of electrodynamics (Maxwell's equations). Newton's law is one of them, but there are three further laws of gravitation which were not known before, although they had been found experimentally and explained ad-hoc, for example, the gravito-magnetic field.

Until now, ECE theory had been developed only in four dimensions (time and three space dimensions), as was the case for Einstein's theory. The reason is that, in standard physics and natural philosophy, there is no need to go beyond this limit. Natural sciences are based on the principle of objectivity, that all insight and knowledge must be provable by experiments in repeatable and replicable form. In hard science, there is no room for spiritual, or even philosophical components stemming from the human mind. Nevertheless, one can consider interfaces connecting, for example, physiological processes in the human brain and psychology, which has a completely non-material basis. In such border areas of science, it is reasonable to ask: "Is the human spirit bound to processes in the brain or not?" This motivates us to investigate how ECE theory, as a basis for describing all kinds of material processes, can be coupled to pure mental and even spiritual processes. The formal method for such investigation is to extend the theory beyond four dimensions.

Fortunately, there was a German physicist, Burkhard Heim (1925-2001), who dedicated his whole life to developing a theory of higher dimensions [4, 5]. Continuing the work of Einstein, he extended spacetime by at least 8 dimensions, which are of nonmaterial character, and which he visualized as spiritual dimensions, in which thinking takes place and the will of human beings is formed.

In this article, we approach the universe of Heim from below. Since Cartan geometry is not restricted to any specific number of dimensions, we will show how taking the fifth and sixth dimensions into account could lead to a paradigm in which the human will (in dimensions 5 and 6) could interact with matter (in dimensions 1 to 4) and influence structure. We know of no other theory that could describe this transition on a mathematical and quantitative basis. This is the first approach to do so, and may lead to a completely new area of research.

In the next section, we describe some aspects of the foundations of Heim's theory. We then develop the connection between ECE and Heim by applying ECE to higher dimensions, first in a classical approach, then in terms of Cartan geometry. Finally, we show how the ECE wave equation is suited to describing the coupling of the mental-spiritual world with matter.

2 Heim theory

Burkhard Heim [4, 5], who was a student of Werner Heisenberg, extended the ideas of Einstein to the highest levels of knowledge, through his extraordinary mind, in spite of living a difficult life and being severely disabled in accidents. To accomplish this, he had to shift his focus beyond the world of material-bound physics, and develop ideas requiring the highest insights.

Heim extended the four spacetime dimensions of Einstein to 12 dimensions.

The first four dimensions (d1-d4) are the well-known relativistic spacetime. d5 and d6 comprise an energetic control field for processes in d1-d4. The higher dimensions d7-d12 represent a space of consciousness, containing a global information field (d7-d8) and the realm of mind (d9-d12). Dimensions d5-d6 obey the conservation of energy, in higher dimensions the notion of energy does no more exist. All dimensions d5-d12 are time-like, concerning the metric of space. Formally, it is a 12-dimensional manifold, but dimensions greater than 4 are immaterial. Material processes are controlled by higher dimensions, that means there must be a coupling between higher and lower dimensions. In more detail, the structural correlation is [6]:

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- d1-d4: spacetime of general relativity
- d5: individual regulation fields, morphogenetic fields, realization of will
- d6: collective regulation fields, thoughts, unconditioned love
- d7: individual information patterns and blueprints (templates), thoughts, personal identification, human ego
- d8: collective information patterns and blueprints (templates), archetypes, ancestors
- d9: intent, purposeful mind, pure Logos
- d10: godhood, higher self, being in tune with oneself
- d11: divine will, attention and observation
- d12: cosmic consciousness, transition to god, the all-one

Above the fourth dimension, higher dimensions are not directly affected by lower dimensions. There is a strict hierarchy of dependencies, which means that fields defined in any dimension have dependencies only to fields of higher dimension.

Heim unified gravitation and electromagnetism by adding the energy-momentum tensors of both fields, which is an ad hoc approach, while in ECE theory both fields are derived axiomatically from the same underlying geometry[1]. In cases where both fields exist, both related force fields can be added, which effectively leads to the same result as that of Heim. He used a divergence equation,

[1]It has to be respected that Heim's notion of geometry seems to be different from that of ECE theory. Heim obviously has basic geometrical structures in mind, while ECE theory uses the mathematically defined Cartan geometry, which is a much more general use of the notion of geometry.

which is part of the ECE field equations. Heim also mentioned torsion, but based the development of his concepts primarily on Einstein's theory, without using Einstein's field equation (to the best knowledge of the author). So far the structural considerations predominate, while ECE theory is able to describe the dynamics of generally covariant systems in full detail via the ECE field equations. Connecting the benefits of both theories should lad to many new insights.

Heim developed a quantization scheme based on structural considerations of the first six dimensions. A very surprising result was the ability of this scheme to predict the masses and lifetimes of all known elementary particles to high precision [7]. The deviations of particle masses from measured values are less than 0.2%. For particle life times, the deviation is 20% in some cases, but mostly less than 2%. In ECE theory, the wave equation (in quantized or non-quantized form) has to be used to make such predictions. This incorporates curvature and therefore goes far beyond standard quantum mechanics. This is not yet fully developed in ECE theory, so we cannot say how successful ECE will be in predicting the structure of elementary particles.

3 Higher dimensions in ECE theory

3.1 ECE field equations in 4 dimensions

Before studying the effects of higher dimensions, we recapitulate important details of ECE field theory in four dimensions. This will make it easier to extend consideration to higher dimensions later. The unified field tensor F of ECE theory is defined by the second ECE axiom

$$F^a := A^{(0)} T^a \tag{1}$$

where T is the torsion tensor of Cartan geometry, a is the polarization index und $A^{(0)}$ a constant with physical dimensions. F and T are 2-forms (antisymmetric differential forms). The equation can be written in explicit form:

$$F^a{}_{\mu\nu} = A^{(0)} \begin{bmatrix} T^a{}_{00} & T^a{}_{01} & T^a{}_{02} & T^a{}_{03} \\ T^a{}_{10} & T^a{}_{11} & T^a{}_{12} & T^a{}_{13} \\ T^a{}_{20} & T^a{}_{21} & T^a{}_{22} & T^a{}_{23} \\ T^a{}_{30} & T^a{}_{31} & T^a{}_{32} & T^a{}_{33} \end{bmatrix}. \tag{2}$$

In the electromagnetic case, the elements of the field tensor are the components of the electric and magnetic field. Written in covariant form, the tensor contains the coordinates of these fields:

$$F^{a\mu\nu} = A^{(0)} \begin{bmatrix} 0 & -E^{a1}/c & -E^{a2}/c & -E^{a3}/c \\ E^{a1}/c & 0 & -B^{a3} & B^{a2} \\ E^{a2}/c & B^{a3} & 0 & -B^{a1} \\ E^{a3}/c & -B^{a2} & B^{a1} & 0 \end{bmatrix}. \tag{3}$$

The field equations are identical to the Cartan-Bianchi identity of the field F and its Hodge dual $\widetilde{F}$ (called the Cartan-Evans identity):

$$d \wedge F^a = \mu_0 \, j^a, \tag{4}$$

$$d \wedge \widetilde{F}^a = \mu_0 \, J^a, \tag{5}$$

where j^a is the homogeneous current and J^a the inhomogeneous current. The former is the (hypothetical) magnetic charge and current density, the latter is the usual electrical charge and current density. Both are geometrical quantities. Eq. (4) is the Gauss and Faraday law, while Eq. (5) represents the Coulomb and Ampère-Maxwell law. In vector form, these are the Maxwell-like field equations in a spacetime with torsion and curvature:

$$\boldsymbol{\nabla} \cdot \mathbf{B}^a = -\mu_0 j^{a0}, \tag{6}$$

$$\frac{\partial \mathbf{B}^a}{\partial t} + \boldsymbol{\nabla} \times \mathbf{E}^a = c\,\mu_0\,\mathbf{j}^a, \tag{7}$$

$$\boldsymbol{\nabla} \cdot \mathbf{E}^a = \frac{\rho^a}{\epsilon_0}, \tag{8}$$

$$-\frac{1}{c^2}\frac{\partial \mathbf{E}^a}{\partial t} + \boldsymbol{\nabla} \times \mathbf{B}^a = \mu_0\,\mathbf{J}^a. \tag{9}$$

The same field equations (4, 5) hold for the gravitational field. This consists of the Newtonian field $\mathbf{g}^a$ and the gravito-magnetic field $\boldsymbol{\Omega}^a$. The field tensor of ECE gravitation is

$$G^{a\mu\nu} = G^{(0)} \begin{bmatrix} 0 & -g^{a1}/c & -g^{a2}/c & -g^{a3}/c \\ g^{a1}/c & 0 & -\Omega^{a3} & \Omega^{a2} \\ g^{a2}/c & \Omega^{a3} & 0 & -\Omega^{a1} \\ g^{a3}/c & -\Omega^{a2} & \Omega^{a1} & 0 \end{bmatrix}. \tag{10}$$

Then the tensorial field equations

$$d \wedge G^a = \mu_0\; j^a_m, \tag{11}$$

$$d \wedge \widetilde{G}^a = \mu_0\; J^a_m \tag{12}$$

in vector form are:

$$\boldsymbol{\nabla} \cdot \boldsymbol{\Omega}^a = -\frac{4\pi G}{c}\rho^a{}_{mh}, \tag{13}$$

$$\frac{\partial \boldsymbol{\Omega}^a}{\partial t} + \boldsymbol{\nabla} \times \mathbf{g}^a = \frac{4\pi G}{c}\mathbf{j}^a{}_{mh}, \tag{14}$$

$$\boldsymbol{\nabla} \cdot \mathbf{g}^a = 4\pi G\,\rho^a{}_m, \tag{15}$$

$$-\frac{1}{c^2}\frac{\partial \mathbf{g}^a}{\partial t} + \boldsymbol{\nabla} \times \boldsymbol{\Omega}^a = \frac{4\pi G}{c^2}\,\mathbf{J}^a{}_m, \tag{16}$$

where $\rho^a{}_m$ is the mass density and $\mathbf{J}^a{}_m$ is the mass current density. The homogeneous mass and current densities $\rho^a{}_{mh}$ and $\mathbf{j}^a{}_{mh}$ are zero for all practical purposes. G is Newton's gravitational constant.

3.2 Classical fields in 6 dimensions

Now, we extend the field tensors F and G to 6 dimensions, using the electromagnetic case for convenience. We omit the polarization index a, and extend the $\mathbf{E}$ and $\mathbf{B}$ fields by dimensions numbered 4 and 5 according to the ECE convention, beginning with index 0. We call these extended components ϵ_4, ϵ_5 or $\beta_4 \ldots \beta_{10}$, respectively. Then the field tensor of Eq. (3) becomes a 6x6 tensor and takes the form

$$F^{\mu\nu} = \left[\begin{array}{cccc|cc} 0 & -E^1/c & -E^2/c & -E^3/c & -\epsilon^4 & -\epsilon^5 \\ E^1/c & 0 & -B^3 & B^2 & -\beta^4 & \beta^5 \\ E^2/c & B^3 & 0 & -B^1 & \beta^6 & -\beta^7 \\ E^3/c & -B^2 & B^1 & 0 & -\beta^8 & \beta^9 \\ \hline \epsilon_4 & \beta^4 & -\beta^6 & \beta^8 & 0 & -\beta^{10} \\ \epsilon_5 & -\beta^5 & \beta^7 & -\beta^9 & \beta^{10} & 0 \end{array}\right]. \tag{17}$$

The upper left quadrant is the standard 4x4 field tensor. The signs of the β field elements have been defined in analogy to the **B** components. The **B** field is a rotational field, while **E** is a translational field. The covariant form of F is computed with aid of the Minkowski metric:

$$F_{\mu\nu} = \eta_{\mu\rho}\eta_{\nu\sigma}F^{\rho\sigma}. \tag{18}$$

According to Heim theory, the higher dimensions are time-like. Therefore, the extended Minkowski metric has the diagonal elements $+1$ for dimensions 4 and 5:

$$\eta_{\mu\nu} = \eta^{\mu\nu} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 \end{bmatrix}. \tag{19}$$

Then the covariant form of F is

$$F_{\mu\nu} = \left[\begin{array}{cccc|cc} 0 & E_1/c & E_2/c & E_3/c & -\epsilon_4 & -\epsilon_5 \\ -E_1/c & 0 & -B_3 & B_2 & \beta_4 & -\beta_5 \\ -E_2/c & B_3 & 0 & -B_1 & -\beta_6 & \beta_7 \\ -E_3/c & -B_2 & B_1 & 0 & \beta_8 & -\beta_9 \\ \hline \epsilon_4 & -\beta_4 & \beta_6 & -\beta_8 & 0 & -\beta_{10} \\ \epsilon_5 & \beta_5 & -\beta_7 & \beta_9 & \beta_{10} & 0 \end{array}\right]. \tag{20}$$

The field equations in the classical case can be formulated for the free field (no current densities) in the form

$$d \wedge F = 0, \tag{21}$$

$$d \wedge \widetilde{F} = 0 \tag{22}$$

(see Examples 2.11 and 2.12 in [3]). We evaluate Eq. (21) to find the field equations in six dimensions, for the free field, as in the classical example. We can utilize the antisymmetry property of F so that, for example:

$$(d \wedge F)_{014} = 2(\partial_0 F_{14} + \partial_1 F_{40} + \partial_4 F_{01}). \tag{23}$$

For all elements of $(d \wedge F)_{\mu\nu\rho}$ we obtain non-trivial equations only for the case $\mu < \nu < \rho$, which leads to 20 equations in 6 dimensions. These have been listed in Table 1. It is seen that equations 1, 2, 5, and 11 contain E and B components exclusively, i.e. they define the vector form of the field equations (6, 7), or (13, 14) in the gravitational case. The other equations define couplings between E_μ, B_μ and the higher dimensional components ϵ_μ, β_μ. In total, there are 15 variables and 20 equations. Seemingly, the equation system of Table 1 is over-determined. We know, however, that not all equations are independent from each other in the four-dimensional case. This will also be the case here.

No.	Indices	Equations
1	0 1 2	$\frac{1}{c}\partial_1 E_2 - \frac{1}{c}\partial_2 E_1 + \partial_0 B_3 = 0$
2	0 1 3	$\frac{1}{c}\partial_1 E_3 - \frac{1}{c}\partial_3 E_1 - \partial_0 B_2 = 0$
3	0 1 4	$-\frac{1}{c}\partial_4 E_1 - \partial_1 \epsilon_4 - \partial_0 \beta_4 = 0$
4	0 1 5	$-\frac{1}{c}\partial_5 E_1 - \partial_1 \epsilon_5 + \partial_0 \beta_5 = 0$
5	0 2 3	$\frac{1}{c}\partial_2 E_3 - \frac{1}{c}\partial_3 E_2 + \partial_0 B_1 = 0$
6	0 2 4	$-\frac{1}{c}\partial_4 E_2 + \partial_0 \beta_6 - \partial_2 \epsilon_4 = 0$
7	0 2 5	$-\frac{1}{c}\partial_5 E_2 - \partial_0 \beta_7 - \partial_2 \epsilon_5 = 0$
8	0 3 4	$-\frac{1}{c}\partial_4 E_3 - \partial_0 \beta_8 - \partial_3 \epsilon_4 = 0$
9	0 3 5	$-\frac{1}{c}\partial_5 E_3 + \partial_0 \beta_9 - \partial_3 \epsilon_5 = 0$
10	0 4 5	$\partial_0 \beta_{10} - \partial_4 \epsilon_5 + \partial_5 \epsilon_4 = 0$
11	1 2 3	$\partial_3 B_3 + \partial_2 B_2 + \partial_1 B_1 = 0$
12	1 2 4	$\partial_1 \beta_6 + \partial_2 \beta_4 + \partial_4 B_3 = 0$
13	1 2 5	$-\partial_1 \beta_7 - \partial_2 \beta_5 + \partial_5 B_3 = 0$
14	1 3 4	$-\partial_1 \beta_8 + \partial_3 \beta_4 - \partial_4 B_2 = 0$
15	1 3 5	$\partial_1 \beta_9 - \partial_3 \beta_5 - \partial_5 B_2 = 0$
16	1 4 5	$\partial_1 \beta_{10} - \partial_4 \beta_5 - \partial_5 \beta_4 = 0$
17	2 3 4	$-\partial_2 \beta_8 - \partial_3 \beta_6 + \partial_4 B_1 = 0$
18	2 3 5	$\partial_2 \beta_9 + \partial_3 \beta_7 + \partial_5 B_1 = 0$
19	2 4 5	$\partial_2 \beta_{10} + \partial_4 \beta_7 + \partial_5 \beta_6 = 0$
20	3 4 5	$\partial_3 \beta_{10} - \partial_4 \beta_9 - \partial_5 \beta_8 = 0$

Table 1: Field equations in 6 dimensions.

The character of the equation set becomes clearer if we omit the rotational variables β_μ. We set them to zero, which is the same as assuming that there are no rotations in higher dimensions, which gives us a simplified equation set. Rearranging the order of these equations gives us the set in Table 2. This set has only 17 equations, with the following properties:

No.	Indices	Equations
1	0 1 2	$\frac{1}{c}\partial_1 E_2 - \frac{1}{c}\partial_2 E_1 + \partial_0 B_3 = 0$
2	0 1 3	$\frac{1}{c}\partial_1 E_3 - \frac{1}{c}\partial_3 E_1 - \partial_0 B_2 = 0$
3	0 2 3	$\frac{1}{c}\partial_2 E_3 - \frac{1}{c}\partial_3 E_2 + \partial_0 B_1 = 0$
4	1 2 3	$\partial_3 B_3 + \partial_2 B_2 + \partial_1 B_1 = 0$
5	0 1 4	$-\frac{1}{c}\partial_4 E_1 - \partial_1 \epsilon_4 = 0$
6	0 1 5	$-\frac{1}{c}\partial_5 E_1 - \partial_1 \epsilon_5 = 0$
7	0 2 4	$-\frac{1}{c}\partial_4 E_2 - \partial_2 \epsilon_4 = 0$
8	0 2 5	$-\frac{1}{c}\partial_5 E_2 - \partial_2 \epsilon_5 = 0$
9	0 3 4	$-\frac{1}{c}\partial_4 E_3 - \partial_3 \epsilon_4 = 0$
10	0 3 5	$-\frac{1}{c}\partial_5 E_3 - \partial_3 \epsilon_5 = 0$
11	0 4 5	$-\partial_4 \epsilon_5 + \partial_5 \epsilon_4 = 0$
12	2 3 4	$\partial_4 B_1 = 0$
13	2 3 5	$\partial_5 B_1 = 0$
14	1 3 4	$-\partial_4 B_2 = 0$
15	1 3 5	$-\partial_5 B_2 = 0$
16	1 2 4	$\partial_4 B_3 = 0$
17	1 2 5	$\partial_5 B_3 = 0$

Table 2: Field equations in 6 dimensions without β terms.

- There are 17 equations for 8 variables, defining a highly over-determined equation system on the level of field elements.
- The first four equations give the well-known 4D result.
- Eqs. 5-10 describe a coupling between the electric standard components and higher-dimensional components.
- The E field components have dependencies on higher coordinate dimensions.
- The ϵ components have dependencies on lower dimensions in order to describe their positioning in 4D space.
- The coupling between higher and lower dimensions is described by an antisymmetry law.
- Eqs. 12-17 state that the magnetic components do not depend on higher dimensions.

To obtain the full set of Maxwell-like equations (6-9), or (13-16), respectively, we have to use the Hodge dual equation (5), which gives the Coulomb and Ampère-Maxwell law. The Hodge dual is defined, in general, by

$$\widetilde{F}_{\mu_1 \dots \mu_{n-p}} = \frac{1}{p!} |g|^{-1/2} \, \epsilon_{\nu_1 \dots \nu_n} \, F^{\nu_1 \dots \nu_p}, \tag{24}$$

or

$$\widetilde{F}^{\mu_1 \dots \mu_{n-p}} = \frac{1}{p!} |g|^{1/2} \, \epsilon^{\nu_1 \dots \nu_n} \, F_{\nu_1 \dots \nu_p}, \tag{25}$$

where $|g|$ is the absolute value of the determinant of the metric (unity in our case) and ϵ is the n-dimensional Levi-Civita symbol. n is the number of dimensions and p is the number of indices of F. In 4 dimensions, we have $n = 4$, $p = 2$ and $n - p = 2$, so the Hodge dual of $F_{\mu\nu}$ has the same number of indices as the original field. This peculiarity only holds in four dimensions. Therefore the Coulomb and Ampère-Maxwell law cannot be generalized to higher dimensions directly. For $n = 6$, the Hodge dual has 4 indices:

$$\widetilde{F}^{\mu\nu\rho\sigma} = \frac{1}{4!} |g|^{1/2} \, \epsilon^{\mu\nu\rho\sigma\lambda\tau} \, F_{\lambda\tau}. \tag{26}$$

This result shows that geometry in more than 4 dimensions leads to quite complicated tensor structures, which are not straightforward to interpret by physical quantities. For the simplified field without β terms in (20), there are 192 non-vanishing elements of the Hodge dual (26).

3.3 ECE approach

Now we consider the field equations based on the Cartan-Bianchi identity, in a spacetime with curvature and torsion. This identity is

$$D \wedge T^a = R^a{}_b \wedge q^b \tag{27}$$

and is independent of the dimension. $R^a{}_b$ is the curvature form and q^b the tetrad form. Instead of the partial exterior derivative $d\wedge$ we use the covariant exterior derivative $D\wedge$, which is defined in tensor form by

$$(D \wedge F^a)_{\mu\nu\rho} = (d \wedge F^a)_{\mu\nu\rho} + (\omega^a{}_b \wedge F^b)_{\mu\nu\rho}, \tag{28}$$

or, written as a cyclic sum:

$$D_{[\mu} F^a{}_{\nu\rho]} = \partial_{[\mu} F^a{}_{\nu\rho]} + \omega^a{}_{[\mu b} F^b{}_{\nu\rho]} \tag{29}$$

with spin connection $\omega^a{}_{\mu b}$. The polarization index a is present as usual in ECE theory (for details see [3]). Inserting this equation into Eq. (27) leads to the following form of the field equation:

$$d \wedge F^a = j^a \tag{30}$$

with the homogeneous current defined as

$$j^a := R^a{}_b \wedge A^b - \omega^a{}_b \wedge F^b. \tag{31}$$

In classical theory, and when there is no coupling between gravitation and electromagnetism, this current disappears. Then, we have

$$d \wedge F^a = 0, \tag{32}$$

which is exactly the field equation (21), with an additional polarization index. Therefore, the results and inferences of the preceding section also hold for a spacetime with curvature and torsion. Physical processes are underdetermined and have additional degrees of freedom.

The homogeneous current is a 3-form, which follows from its tensor representation:

$$j^a{}_{\mu\nu\rho} = R^a{}_{b\mu\nu} \wedge A^b{}_\rho - \omega^a{}_{\mu b} \wedge F^b{}_{\nu\rho}. \tag{33}$$

As already pointed out, it is difficult to interpret such a term as a physical current, because a current is usually a vector with only one coordinate index. For a complete determination of the homogeneous current tensor, knowledge of the entire geometry (curvature, torsion, tetrad) is necessary. The field equation in the form of Eqs. (30) and (31) is an implicit and non-linear equation, because the field F appears on both sides of the equation. Therefore, it is not possible to solve it with a non-vanishing current j^a in one step. In higher dimensions, this becomes even more difficult due to increasing complexity.

The number of indices of the homogeneous current can be reduced to one by contracting two indices, after one of them has been raised:

$$j^a{}_\mu := j^a{}_\mu{}^\nu{}_\nu. \tag{34}$$

However, this procedure cannot be used for solving the field equation. An alternative is to use the ECE wave equation, which reads

$$\Box\, A^a{}_\nu + R\, A^a{}_\nu = 0 \tag{35}$$

and is valid for any number of dimensions. The d'Alembert operator $\Box$, in cartesian coordinates, is:

$$\Box = \frac{1}{c^2}\frac{\partial^2}{\partial t^2} - \frac{\partial^2}{\partial X^2} - \frac{\partial^2}{\partial Y^2} - \frac{\partial^2}{\partial Z^2}, \tag{36}$$

and R is a scalar curvature defined by

$$R = q^\nu{}_a \left(\partial^\mu(\omega^a{}_{\mu b} q^b{}_\nu) - \partial^\mu(\Gamma^\lambda{}_{\mu\nu} q^a{}_\lambda)\right). \tag{37}$$

For a constant curvature (for example a particle with rest mass m_0), R is constant:

$$R_0 = \left(\frac{m_0 c}{\hbar}\right)^2. \tag{38}$$

In the same way as for the homogeneous current, the curvature (37) requires knowledge of the full Cartan geometry. Because the vector potential is the tetrad (within constant factors), we have an implicit equation similar to (30). However, the wave equation is based on the potentials, not the force fields, so we can define an iterative procedure for solving the wave equation. This suggests a mechanism that could enable a special “concentration of will” in the fifth and sixth dimension to affect the material 4D world.

Assume that we have an undistorted, flat space at the beginning. Then we have

$$q^a{}_\mu = \delta^a{}_\mu, \tag{39}$$

where $\delta^a{}_\mu$ is the Kronecker function. According to the first ECE axiom, this means that

$$A^a{}_\mu = A^{(0)}\delta^a{}_\mu = \text{const.} \tag{40}$$

for all $\mu = 0 \dots 5$.[2] From Eq. (35) it follows $R = 0$ in this case. Now imagine that a certain curvature structure is built up in the fifth and sixth dimensions by a higher “will”. Then we have

$$q^a{}_4 \neq \delta^a{}_4, \quad q^a{}_5 \neq \delta^a{}_5. \tag{41}$$

We have left the polarization indices undetermined. Both tetrad elements are functions of the coordinates in general. From these elements, the curvature R is constructed in the following way.

The metric is determined by

$$g_{\mu\nu} = n\ q^a{}_\mu q^b{}_\nu\, \eta_{ab}, \tag{42}$$

the Γ conections are the solution of the equation set

$$D_\sigma g_{\mu\nu} = \partial_\sigma g_{\mu\nu} - \Gamma^\lambda{}_{\sigma\mu} g_{\lambda\nu} - \Gamma^\lambda{}_{\sigma\nu} g_{\mu\lambda} = 0 \tag{43}$$

and the spin connection follows from

$$\omega^a{}_{\mu b} = q^a{}_\nu q^\lambda{}_b \Gamma^\nu{}_{\mu\lambda} - q^\lambda{}_b \partial_\mu q^a{}_\lambda \tag{44}$$

(see [8] for details). In particular, we will have

$$\begin{aligned} q^a{}_4 &\neq 0, \quad q^a{}_5 \neq 0, \\ q^4{}_a &\neq 0, \quad q^5{}_a \neq 0, \\ \omega^a{}_{4b} &\neq 0, \quad \omega^a{}_{5b} \neq 0, \\ \Gamma^4{}_{45} &\neq 0, \quad \Gamma^5{}_{45} \neq 0. \end{aligned} \tag{45}$$

Further elements with indices <4 may also be non-vanishing. From Eqs. (45) it follows that R is now different from zero. This is enforced by the curvature terms appearing in higher dimensions. Consequently, this has an impact on the vector potential of the lower dimensions $\mu = 0 \dots 3$. Since R has changed, we have to change $A^a{}_\mu$ as well, in order to satisfy the wave equation (35). Because of the first ECE axiom, when $A^a{}_\mu$ is changed the tetrad is changed, so that R changes again, which describes a cyclic process that should converge and terminate (see Fig. 1 for clarification). This description, which is in the form of a computational algorithm, shows how a modification of space geometry in

[2] Please notice that we cannot have an empty space in ECE theory, because this would mean $q^a{}_\mu = 0$ for all indices. A zero tetrad is not possible because the rank of the tetrad matrix must always be equal to the dimension of spacetime.

higher dimensions could be transported to lower dimensions. In nature, all of these changes happen simultaneously.

Since the time coordinate of spacetime is directly affected, an evolution in 4D time is initiated. We must keep in mind, however, that the higher dimensions are time-like, too. We do not know how a being living in these dimensions will experience its local time (if this exists at all), but on that level the perception or experience will be different from the one in 4D time. Perhaps it is comparable to what is said to happen in general relativity, when an object approaches a space region of extremely high gravitation.[3] For the outer observer, the time development of the object will nearly stand still. Local to the object, however, time elapses as usual.

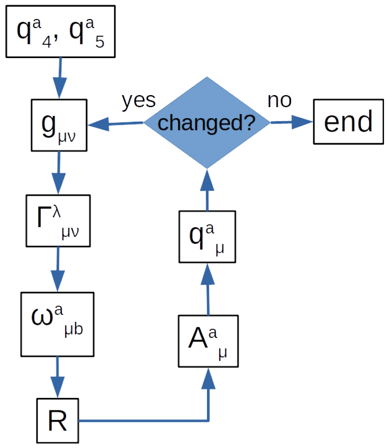

Figure 1: Iterative solution scheme for wave equation.

4 Conclusions

The field theory of Burkhard Heim was the inspiration for this investigation of a path of interaction between matter (dimensions 1 to 4) and mind (dimensions 5 to 12). In natural philosophy, there is an enduring concept that the human mind or spirit can influence material processes. However, there has always been a piece missing between this idea and low-level physics details: the mechanism by which this interaction could work was unknown. Through this paper we have shown that the ECE wave equation can provide a connection between the material world and the higher dimensions envisioned by Burkhard Heim.

The extension of classical fields to six (or more) dimensions leads to a disproportionate increase of the ECE field equations. This is consistent with the idea that higher dimensions belong in the realm of thought and spirit, in that a thought cannot be constrained by physical properties, and particularly not by the properties of four spacetime dimensions.

Cartan geometry is applicable to any dimension, and this allows physical fields and processes to be described in higher dimensions (to a certain extent),

[3]We avoid the notion of "black hole", because such objects are mathematically singular and do not exist according to ECE theory.

through the ECE axioms. According to Heim, the coupling to matter is mediated by the fifth and sixth dimensions, where energy conservation is still valid. This coupling evokes changes in the scalar curvature, and since the scalar curvature interacts with all dimensions, this allows the lower dimensions to be influenced.

There are two possible ECE mechanisms for describing such an interaction: one is the field equation, via a homogeneous current; the other is the wave equation. Because the wave equation mechanism is easier to understand, the effects of higher dimensions have been described using an iterative solution process for this equation.

In natural philosophy, it was known for long that human mind or spirit impact material processes. However, there was a gap between this principal knowledge and the "low-level details" of basic physics. The mechanism, how the transition practically works, was unknown. This gap has been closed to a certain extent by this paper. The mechanism can be understood by means of the wave equation.

By using the wave equation of classical field theory, instead of a quantum process, we have shown that the interface from spiritual space to matter does not necessarily require quantum effects. Nevertheless, quantum processes could be explored by using the quantized form of the wave equation, which is the fermion equation of ECE theory.

Physicists have a tendency to make quantum effects responsible for things they do not understand properly. However, we made clear that the transition from spiritual space to matter does not necessarily require such considerations. By combining the classical field theories of Burkhard Heim and Myron Evans, we have provided an inclusive solution, and since this solution is quantitative, it may be possible to develop models and numerical examples, in the future.

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