Scientific Research Publishing

Journal of High Energy Physics, Gravitation and Cosmology, 2026, 12(4), 2386-2420
https://www.scirp.org/journal/jhepgc
ISSN Online: 2380-4335
ISSN Print: 2380-4327

Fundamental Relations between Electromagnetism and Gravity

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How to cite this paper: Dudek, H.J. (2026) Fundamental Relations between Electromagnetism and Gravity. *Journal of High Energy Physics, Gravitation and Cosmology*, **12**, 2386-2420.
https://doi.org/10.4236/jhepgc.2026.124122

Received: September 9, 2026
Accepted: October 26, 2026
Published: October 29, 2026

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Abstract

On the correlation space photons of static Maxwell fields, the photons of light, the vacuum, the mass, and the charges are described by a common formalism in the form of three-dimensional structures, formed from a four-dimensional field and the action; the action is represented by the four-dimensional communication relations of quantum mechanics. The formation of structures and their interactions take place in gravity and electromagnetism by a uniform field and according to a common mechanism under the conditions of the Hamiltonian principle. The source of gravity and electromagnetism is a four-dimensional structure: the basic structure, which is built up of action and describes the mass and charges of elementary objects.

Keywords

Correlation Space, Hamiltonian Principle, Physical Information, Maxwell Vacuum, Photons of Static Maxwell Fields, Gravitons,
Basic Structure of Matter and Charge

1. Introduction

The fields of elementary objects, defined on space-time, are described by correlations on the correlation space (Wiener-Khintchine theorem, [1] [2]). On the correlation space, three-dimensional structures formed by four-dimensional fields are obtained by Fourier-transforming their Lagrangian density and their four-dimensional communication relations and forming their correlation structures under the conditions of the Hamiltonian principle. In this way, the correlation structures of the static photons of the charges, the photons of light, the vacuum, and the gravitons [3] can be formed. For the description of the mass and the charge, a structure consisting of action is proposed on the correlation space, which is formed

under the conditions of the Hamiltonian principle; we call this structure "basic structure" because, according to our ideas, it describes mass and charge [4].

As an example, the correlation structure of the longitudinal $\alpha(1/2)$ and $\beta(0/3)$ parts of the static photon in the state Ω1, obtained from the energy-momentum tensor of the Maxwell fields [4], is reproduced.

$$
\begin{array}{ccccccccccccc}
B_3 & \rightarrow & {}_+\mathbf{A}_1 & \leftarrow & B_1 & & & & E_2 & \rightarrow & {}_+\mathbf{A}_0 & \leftarrow & E_3 \\
\uparrow & & & & \uparrow & & & & \uparrow & & & & \uparrow \\
{}_-A_1 & & LO & & {}_-A_1 & & & & {}_-A_0 & & RO & & {}_-A_0 \\
\downarrow & & & & \downarrow & & & & \Downarrow & & & & \downarrow \\
E_2 & \rightarrow & {}_+\mathbf{A}_1 & \leftarrow & \partial A_2 & \Leftarrow & {}_-\mathbf{A}_2 & \rightarrow & \partial A_0 & \Rightarrow & {}_+\mathbf{A}_0 & \leftarrow & E_1 \\
 & & & & \Downarrow & & & & \downarrow & & & & \\
 & & & & {}_+A_2 & & 1/2 & & {}_+A_1 & & & & \\
 & & & & \uparrow & & & & \Uparrow & & & & \\
B_1 & \rightarrow & {}_+\mathbf{A}_3 & \Leftarrow & \partial A_3 & \leftarrow & {}_-\mathbf{A}_1 & \Rightarrow & \partial A_1 & \rightarrow & {}_+A_2 & \leftarrow & B_2 \\
\uparrow & & & & \Uparrow & & & & \uparrow & & & & \uparrow \\
{}_-A_3 & & LU & & {}_-A_3 & & & & {}_-\mathbf{A}_2 & & RU & & {}_-\mathbf{A}_2 \\
\downarrow & & & & \downarrow & & & & \downarrow & & & & \downarrow \\
E_3 & \rightarrow & {}_+\mathbf{A}_3 & \leftarrow & B_2 & & & & E_1 & \rightarrow & {}_+A_2 & \leftarrow & B_3
\end{array}
\tag{1.1a}
$$

$$
\begin{array}{ccccccccccccc}
B_3 & \rightarrow & {}_+\mathbf{A}_2 & \leftarrow & B_1 & & & & E_2 & \rightarrow & {}_+A_3 & \leftarrow & E_3 \\
\uparrow & & & & \uparrow & & & & \uparrow & & & & \uparrow \\
{}_-A_2 & & & & {}_-A_2 & & & & {}_-\mathbf{A}_3 & & & & {}_-\mathbf{A}_3 \\
\downarrow & & & & \Downarrow & & & & \downarrow & & & & \downarrow \\
E_2 & \rightarrow & {}_+\mathbf{A}_2 & \Leftarrow & \partial A_2 & \leftarrow & {}_-\mathbf{A}_0 & \Rightarrow & \partial A_0 & \rightarrow & {}_+A_3 & \leftarrow & E_1 \\
 & & & & \downarrow & & & & \Downarrow & & & & \\
 & & & & {}_+A_3 & & 0/3 & & {}_+A_0 & & & & \\
 & & & & \Uparrow & & & & \uparrow & & & & \\
B_1 & \rightarrow & {}_+A_0 & \leftarrow & \partial A_3 & \Leftarrow & {}_-\mathbf{A}_3 & \rightarrow & \partial A_1 & \Rightarrow & {}_+\mathbf{A}_1 & \leftarrow & B_2 \\
\uparrow & & & & \uparrow & & & & \Uparrow & & & & \uparrow \\
{}_-\mathbf{A}_0 & & & & {}_-\mathbf{A}_0 & & & & {}_-A_1 & & & & {}_-\mathbf{A}_1 \\
\downarrow & & & & \downarrow & & & & \downarrow & & & & \downarrow \\
E_3 & \rightarrow & {}_+A_0 & \leftarrow & B_2 & & & & E_1 & \rightarrow & {}_+A_1 & \leftarrow & B_3
\end{array}
\tag{1.1b}
$$

The correlation structures of the static photons with particle, wave, and magnetic properties, as well as the Maxwell vacuum, have a uniform three-dimensional structure, formed from the four-dimensional vector potential. The unit oscillators ∂A_μ of the longitudinal coordinates $\mu = 0$ and $\mu = 3$ form the peripheral four-blocks for electric fields, and the unit oscillators of the transverse coordinates $\mu = 1$ and $\mu = 2$ form the peripheral four-blocks for magnetic fields. Further details are described in [4].

The basic structure consists of two integrated four-blocks (**Figure 1**), which we refer to as active and non-active four-blocks due to their different functions, and which are each composed of an alpha four-block with positive currents and a beta four-block with negative currents. The active and non-active four-blocks oscillate against each other in two or four states [3]. The active four-blocks are connected to the static photons and gravitons via the surface of the basic structure; the correlations of the non-active four-blocks overlap with the active correlations in the basic structure. Static photons and gravitons are created by inductive interaction of the Maxwell vacuum with the surface of the basic structure, based on the Hamiltonian principle. The development of the correlation structures of the

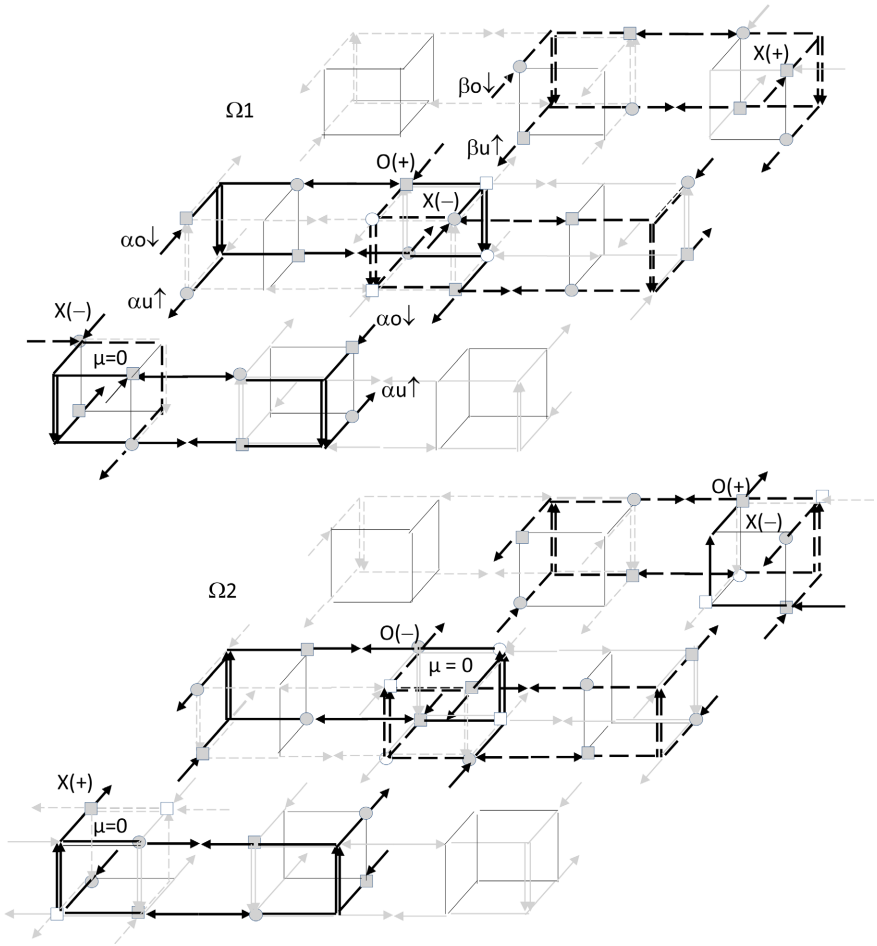

Figure 1. Basic oscillator of the basic structure in the two oscillation states Ω1 and Ω2, consisting of an active and a non-active four-block, each of which forms an alpha- and a beta-four-block. To simplify the presentation, only the currents generated by the action are reproduced. Continuous lines and arrows represent positive and discontinuous negative currents between the creators and annihilators. Strongly drawn lines and arrows describe active four-blocks; weakly hinted lines and arrows describe non-active four-blocks. Of the correlations in the cubes, only the vertical and action-forming correlations were highlighted by an arrow.

elementary objects leads to the statement that all elementary objects are uniformly constructed of four-dimensional structures: the four-blocks, and that their interaction can be described by exchanging such structures. We therefore call the four-blocks the physical information.

In the paper [3], the derivation of the structures of static photons and gravitons by an interaction of the Maxwell vacuum with the surface of the basic structure was proposed. In a first step, we assume that the correlation structures of the static photons, in the form obtained from the trace of the energy-momentum tensor of the Maxwell fields [5], arise in an interaction with the surface of the basic structure, and we also assume for the gravitons that they are formed in the same way by interaction of the surface of the basic structure with the Maxwell vacuum. The static photons contain partly real action, which is different for particles and anti-

particles, and for wave properties, the gravitons contain only virtual action (action with the same amount and different signs in O-X oscillators). The different sign of the action in the photons of the particles and anti-particles causes different currents in the electric E_i- and magnetic B_i-fields of the correlation structures of the static photons (and the photons of light [6]), which we consider as proof that the different signs of the E- and B- fields are to be assigned to different signs of the action (cf. (1.1)). In this report, due to the scope of the problem under consideration, we prefer to refer to the properties of a particle. The properties of the anti-particle are obtained from those of the particle by swapping the states, whereby positive action is formed into negative action, and negative action forms positive action (cf. (4.7)).

The aim of the present investigations is to provide a uniform description of the interaction between charges and between masses on the correlation space. In the paper on gravity [7], the interaction between masses is described by assuming the representation of mass by the basic structure and the transfer of information from the non-active four-blocks, which together with the active four-blocks represent the mass in the basic structure, to the active four-blocks and from there via the interface to the gravitons in the vacuum. The gravitons of two different masses overlap in vacuum in two different states, forming a difference in the action that is absorbed by the oscillators of the masses. The changes in the currents in the vertical correlations of the basic structure, caused by the absorption of the information, cause the masses to move towards each other.

Since there are two oscillating oscillator systems in the basic structure: the active and non-active four-blocks, it follows that the inertia of the mass during the absorption of the four-dimensional information is caused by opposite currents in the two oscillators of the basic structure. The analysis in [7] was performed using Einstein's field equations, without taking into account the presence of charges and therefore formally refers to dark matter.

In the present work, we want to deepen this principle of the formation of gravity by applying it to the interaction between masses and charges and showing that the fundamental properties of electromagnetism can also be described in this way. Taking into account the charges, one obtains a representation of the properties and interaction of matter, uniting the description of gravity and electromagnetism. The fundamental difference between gravity and electromagnetism results from the different sources of information and the different ways of forming photons and gravitons, while physical information, the methods of information formation, information transport, interaction in a vacuum, and information processing are for both kind of interactions the same in the basic structure.

The present work on the development of a common representation of electromagnetism and gravity using the methods of Physical Information Theory (PIT) is divided into four parts: (i) characterization of the basic structure as a source of charge and gravity, (ii) formation of static photons and gravitons on the surface

of the basic structure, (iii) interaction of the surface of the basic structure with the static photons with the formation of their particle-, wave- and magnetic- properties, as well as under the formation of gravitons, and (iv) interaction of the static photons and gravitons with each other under signal formation in vacuum and signal processing in the basic structure. As a starting point for this work, the static photons with particle, wave, and magnetic properties obtained from the energy-momentum tensor of the Maxwell fields are considered (example (1.1) [5]), and the structures of the gravitons derived from them on the one hand, and the proposed basic structure (**Figure 1**) as a model for matter and as a source of gravity and charge on the other hand.

2. Characterization of the Basic Structure

The characterization of the basic structure (i) is carried out by determining the currents in the two active and non-active alpha and beta four-blocks, preferably for the longitudinal oscillators and for the interaction between the active and non-active currents. For this purpose, a division of these currents into o- and u- currents, into α- and β- currents, and into currents between positive circulation $\uparrow$ and negative circulation $\downarrow$ is distinguished in **Figure 2**. Each current in a four-block in either of the two states can be characterized by these three properties. For the non-active correlations, an additional "n" is added; Example: $\alpha on\uparrow -\beta un\downarrow$. The three properties then clearly characterize each of the O and X oscillators; e.g., $\alpha o\uparrow -\beta u\downarrow$ denotes an oscillator with negative action (−) in O or X, regardless of its state Ω in the basic structure and in the photon type. Since the static photons are always two-dimensionally activated (see section (ii)), these currents of the same kind are common to the two longitudinal or the two transverse oscillators; they characterize a complete circulation in the four blocks in the same direction of circulation in four oscillation states in succession. The two pairs of currents $\alpha o-\beta u$ and $\alpha u-\beta o$ can also be used to describe all properties of gravity.

The currents $\alpha o-\beta u$ and $\alpha u-\beta o$ are defined in each cube between the creators in the creator plane and the annihilators in the annihilator plane of the basic structure. In the same state Ω, they are connected to the currents in the opposite direction of circulation, e.g., the current $\alpha o\uparrow -\beta u\downarrow$ is linked to the current $\alpha o\downarrow -\beta u\uparrow$ of the following unit cube. However, since longitudinal and transverse states are isolated from each other, the current $\alpha o\uparrow -\beta u\downarrow$ is continued in the following state in the cube that is now not activated. In this way, a circulating current is obtained in a four-part oscillation in all four states in the same direction in the four-block with the same designation. A current of the form $\alpha o\uparrow -\beta u\downarrow$ is thus assigned to the two longitudinal or the two transverse oscillators in all four states. Among other things, this means that both longitudinal (or both transverse) oscillators have the same action (but different signs between O and X) in a state of rest frame. As an example of the currents between creators and annihilators, the current for the $\mu = 3$ oscillator in the state Ω1 for the two oscillators O(+) and X(−) is reproduced in (2.1):

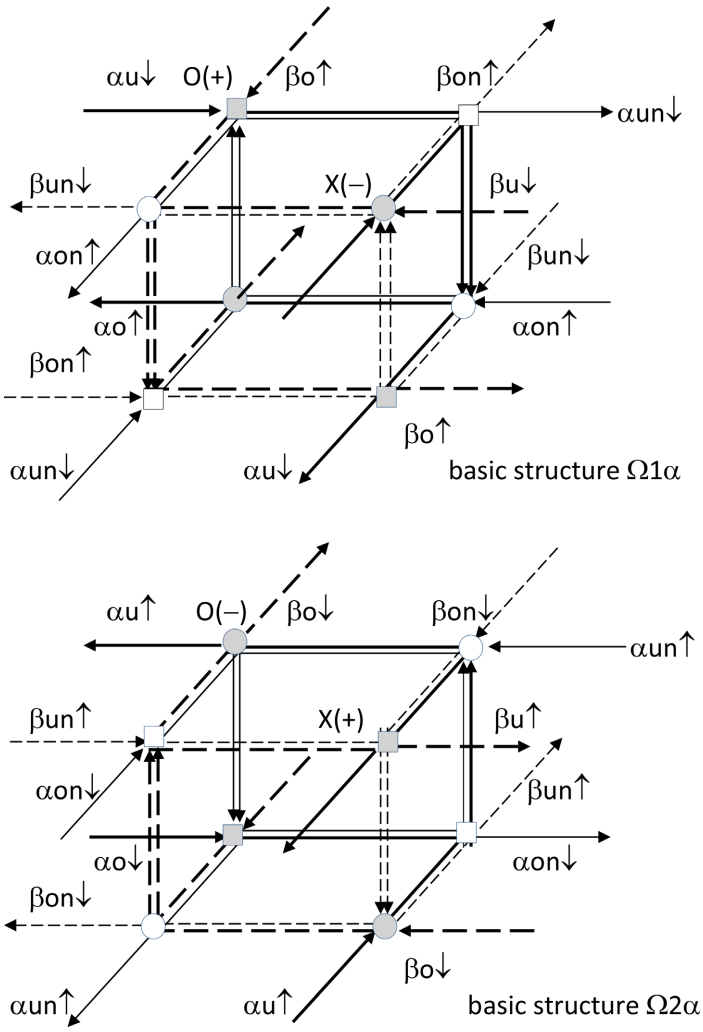

Figure 2. Unit cubes of the $\mu = 3$ oscillator in two oscillation states Ω1 and Ω2. Arrows describe correlations between creators and annihilators. Vector components and their derivatives are not specified. Strong lines and strong arrows are currents of active four-blocks; weak lines are currents of non-active four-blocks; continuous lines are positive currents; discontinuous lines are negative currents. Each arrow begins with a creator and ends in an annihilator (not shown). For descriptions, see text. Each cube is formed by two active sources of action (gray) and by two non-active sources (white); Squares sources of a positive action, circles sources of negative action.

$\mu = 3$ Ω1:O(+):$\alpha u\downarrow$- $\beta o\uparrow$:

$$
\begin{array}{lll}
O(+):\alpha u\downarrow\!:\ {}_{+}\mathrm{A}_0 \rightarrow \partial_0\ {}_{+}A_0 & & \\
\quad\downarrow & & \\
O(+):\alpha u\downarrow\!:\ +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 & O(+):\alpha u\downarrow\!:\partial_0\ {}_{-}\mathrm{A}_0 \Rightarrow \partial_0\ {}_{+}A_0 & O(+):\alpha u\downarrow\!:\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 \\
O(+):\alpha un\downarrow\!:\ +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 & X(-):\alpha o\uparrow\!:\partial_0\ {}_{-}\mathrm{A}_0 \Rightarrow \partial_0\ {}_{+}A_0 & X(-):\beta un\downarrow\!:\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 \\
 & & \quad\downarrow \\
 & & O(+):\alpha u\downarrow\!:\ +\partial_0{}_{-}A_0 \rightarrow -{}_{+}A_0
\end{array}
$$

$$
\begin{array}{lll}
O(+):\beta o\uparrow\!:\ -{}_{-}\mathrm{A}_0 \rightarrow \partial_0\ {}_{+}A_0 & & \\
\quad\downarrow & & \\
O(+):\alpha u\uparrow\!:\ +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 & O(+):\beta o\uparrow\!:\partial_0\ {}_{-}\mathrm{A}_0 \Rightarrow \partial_0\ {}_{+}A_0 & O(+):\beta o\uparrow\!:\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 \\
X(-):\alpha on\uparrow\!:\ +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 & X(-):\beta u\downarrow\!:\partial_0\ {}_{-}\mathrm{A}_0 \Rightarrow \partial_0\ {}_{+}A_0 & O(+):\beta on\uparrow\!:\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 \\
 & & \quad\downarrow \\
 & & O(+):\beta o\uparrow\!:\ +\partial_0{}_{-}A_0 \rightarrow +{}_{+}A_0
\end{array}
\tag{2.1}
$$

The currents of the active and non-active four-blocks overlap in the unit cubes (shown in (2.1) on top of each other, cf. Figure 2). Active and non-active overlap in the horizontal currents in both planes of the unit cube in the same orbital directions and therefore transfer their information to each other. There are four double vertical correlations (represented in (2.1) by a double arrow: $\Rightarrow$, only active arrows are shown) in each cube of the basic structure in each state, in each of which two positive or two negative currents of the active or non-active four-blocks with opposite direction of circulation (but the same vertical direction) are superimposed (Figure 2). Variable currents in the vertical correlations that are caused by interaction describe a change in the state of motion; constant currents describe the same relative velocity in a rest frame.

The properties of the active currents between creator and annihilator in the unit cubes of the basic structure are changed by the superposition in the creator and annihilator plane by overlapping with the non-active currents (compare (2.1)). Each oscillator O or X is formed by two currents with different circulations; e.g., $\mu = 3{:}\Omega 1{:}\mathrm{O}(+){:}\alpha u\downarrow$:-$\mathrm{O}(+){:}\beta o\uparrow$. Each of the two currents is superimposed with a current with the same direction of circulation in the creator and annihilator planes. E.g., the current represented in (2.1):

$$\mu = 3{:}\ \Omega 1{:}\mathrm{O}(+){:}\alpha \mathrm{u}\downarrow{:}\ \text{is superimposed by } \mathrm{O}(+){:}\alpha \mathrm{un}\downarrow{:}\ \text{in the creator plane and by } \mathrm{X}(-){:}\beta \mathrm{un}\downarrow{:}\ \text{in the annihilator plane and the current}$$
$$\mu = 3{:}\ \Omega 1{:}\mathrm{O}(+){:}\beta \mathrm{o}\uparrow{:}\ \text{is superimposed at the creator plane by } \mathrm{X}(-){:}\alpha on\uparrow \text{ and in the annihilator plane it is superimposed by } \mathrm{O}(+){:}\beta \mathrm{on}\uparrow. \qquad (2.2)$$

If the superposition in the creator plane occurs due to the non-active current of the same sign, then an addition of both currents occurs, and the current in the vertical correlations is represented by the current velocity of the object. If an addition is made with an opposite sign, then a difference between the two currents is formed, which describes a change in the motion around the difference. If the difference is zero, *i.e.*, the currents in the current oscillatory state (active current) are equal to the currents in the preceding oscillatory state (non-active current), then the motion does not change; if the difference is different from zero, then there is a change in the currents in the vertical correlations and a change in the velocity of the object. After the information has passed through the vertical correlations, the overlap caused in the creator plane is reversed in both cases by a superposition of the current with the same amount and with the opposite sign in relation to the annihilator plane.

The change in information brought about in the photon cloud reaches the vertical correlations after absorption, but not the annihilators of the basic structure; it is contained only in the vertical correlations, *i.e.*, it is effective in changing the motion. This applies to both active and non-active oscillators. In the case of an interaction in the photon cloud, the properties of the two four-blocks of the basic structure: the active and the non-active remain unchanged in their creators and annihilators. The non-active currents have the same properties as the active currents in the rest frame and contain the same information as the active currents. In the case of an interaction, the non-active ones contain the information of the pre-

ceding state and the active currents that of the current oscillatory state.

The basis for a constant charge (and mass, see below) is that the creators and annihilators of the basic structure remain unchanged; the interaction only changes the dynamic properties of the objects that are caused in the vertical correlations. The information obtained by the interaction is, as will be discussed later, contained in the memories of static photons, given by creators and annihilators. This is caused by the interaction between the surface of the basic structure and the static photons (part (iii)).

Active and non-active four-blocks have the same properties, differing from each other only in that the active ones interact with the static photons (and gravitons) via their surface. By superimposing the active and non-active currents in the basic structure, the information in both superimposed four-blocks is changed in the same way after each state. Each preceding state therefore causes that in the following state only the change compared to the preceding state occurs, especially in the vertical correlations; as discussed, this change is only contained in the currents of vertical correlations, but not in the creators and annihilators of the basic structure.

The vertical correlations of the active and non-active currents oscillate simultaneously but differ in the vertical direction. Since the vertical non-active correlations contain the information of the preceding oscillation phase, the basic structure describes two fundamental properties of matter: the change in motion and the inertia. The change in motion consists in the difference in the currents between two oscillation phases and thus the difference in the information stored in the photon cloud. The inertia is caused by the different direction of vertical correlations of active and non-active four-blocks.

In this paper, interaction between elementary objects is described by information exchange. Information is a three-dimensional structure (the four-block), formed by four-dimensional fields (the vector potential), carried by the static photons. Analysis of the basic structure, which describes the core of an elementary object, leads to the result that the mass, represented by two four-blocks oscillating against each other, remains unchanged during interactions. This also proves to be a condition for the charge to be unchanged during interaction. An explanation for the relativistic increase in mass is the time required for the supply, absorption, and processing of signals during an interaction: The time for transmission, the interaction in vacuum, and the process of absorption and processing of the information increase if the speed of the object approaches the speed of light. In extreme cases at the speed of light, the information emitted by the interaction partner no longer reaches the absorber. This is also shown by the steep increase in mass with an approximation of the speed of light.

As a result of the analysis of this section (i), it follows that the constancy of the charge in an interaction consists in the fact that the information received leaves the two four-blocks of the basic structure—the active and non-active—unchanged. As will be discussed below, the information formed during an interaction remains in the photon cloud (in quantum mechanics in the wave function)—there the

memories are changed in the form of creators and annihilators—and the change of motion takes place in the vertical correlations of the basic structure by changing the currents. The inertia of the mass is caused by the opposite vertical correlations of the active and non-active four-blocks.

3. Inductive Formation of Photons of Static Maxwell Fields

The formation of the photons of static Maxwell fields and the gravitons at the surface of the basic structure (ii) occurs by inductive interaction of the surface of the basic structure with the Maxwell vacuum [4] [8]. Induction takes place under the conditions of the Hamiltonian principle. As discussed elsewhere [3], each current in one part of an entangled correlation structure causes the *simultaneous* formation of a resultant current of equal magnitude, same sign but opposite direction in an adjacent part of the structure, thus *timelessly satisfying the Hamiltonian principle*. In this way, the currents at the surface of the basic structure induce currents in the Maxwell vacuum, forming the structures of the static photons and gravitons.

The formation of static photons (cf. (1.1)) is likely to take place in two steps: the formation of the central alpha and beta four-blocks of the photons in a first step and the formation of the four peripheral four-blocks in a second step. If the central alpha four-block is formed, then the beta peripheral four-blocks are formed by induction, due to the distribution of currents between alpha and beta, and vice versa: the alpha peripheral four-blocks are formed at the central beta four-block. In this way, two "output photons", alpha and beta, are formed with a central alpha four-block and four peripheral beta four-blocks and a central beta four-block with four peripheral alpha four-blocks. The gravitons formed in a similar manner are discussed in part (iv).

The transfer of information from the basic structure in the form of four-blocks into the vacuum of space-time is linked to a problem in electromagnetism: The basic structure contains only one dimension: the $\mu = 0$ oscillator, in all four unit cubes of the four-block, in space-time: four space-time dimensions must be formed from it in such a way that the Hamiltonian principle is fulfilled. Nature solves this problem by forming two alpha and two beta photons with shared tasks instead of one alpha and one beta photon, and by generating either longitudinal electric or transverse magnetic photons (cf. (1.1)).

We have already obtained four parts of a static photon of a state for all three types of static photons (wave, particle, magnetic properties) and for the gravitons [5]. There, we have labeled the two parts of Alpha and Beta respectively as (0/3) and (1/2). We therefore adopt this designation and obtain four photon parts $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$ for each state and for each longitudinal or transverse activation. We also transfer this four-part division of the static photons to the gravitons [5].

The division into alpha and beta photons is based on the fact that the surface of the basic structure has two types of active four-blocks: alpha and beta. The division of these into the parts (0/3) and (1/2) is done by the two parts, representing

the two different circulations of the currents: $\uparrow$ positive (counterclockwise) and negative: $\downarrow$ (clockwise). Since, with the change of states Ω, all correlations reverse their direction, the direction of circulation of the currents also changes with the state; Example: If in Ω1 the division is given by (0/3) $\uparrow$ and (1/2) $\downarrow$, then in the state Ω2 the division (0/3) $\downarrow$ and (1/2) $\uparrow$ is obtained. In this way, the classification of parts (0/3) and (1/2) for the circulating currents is as follows: Example for longitudinal photons

$$\textbf{Alpha } \Omega\textbf{1: } \textbf{(1/2): } \mu = \textbf{0: } \alpha o \uparrow\text{- Beta } \Omega 1\text{: } (0/3)\text{: } \mu = 3\text{: } \beta u \downarrow, (-)$$
$$\text{Alpha } \Omega 1\text{: } (0/3)\text{: } \mu = 3\text{: } \alpha u \downarrow\text{- } \textbf{Beta } \Omega\textbf{1: } \textbf{(1/2): } \mu = \textbf{0: } \beta o \uparrow, (+) \quad (3.1)$$

The (1/2)-photon forms the positive circulation in: $\uparrow$, the (0/3)-photon forms the negative circulation $\downarrow$ in Ω1. In addition to the alpha and beta division, there is also a circulation-direction division of the currents in the static photons (this division also continues with the dynamic photons of light [6]).

A formation of four space-time dimensions from the one-dimensional correlation space of the basic structure is based on the Hamiltonian principle: Only by forming space-time in four dimensions is it possible to form a structure that satisfies the Hamiltonian principle with the help of the "output photons" formed by the surface of the basic structure: all "output photons" in both states in a rest frame have only virtual, no real action.

It will be shown, in all three photon types and in gravitons, that the same information transfer always takes place from the surface of the basic structure: From the alpha-part of the surface, the circulating currents αo and αu, and from the beta-part of the surface, the currents βo and βu are transferred to the photons/gravitons. Each of the four circulating currents simultaneously supplies two O-X oscillators during an information transmission. Since each central four-block of the photons contains four unit cubes, each with an O-X oscillator, only two of the basic structure of its four O-X oscillators of the photon are supplied with information. This is the reason why, in space-time, static photons can always be activated by action either only in the longitudinal or only in the transverse direction from the basic structure. By activating only the longitudinal electric or only the transverse magnetic oscillators, only the two longitudinal or only the two transverse oscillators are independent of each other for geometrical reasons of the correlation structure of the photons.

Since the photon, together with the basic structure, passes through the currents o and u during the four oscillatory states, the transverse oscillators located between the longitudinal states, for example, remain inactive: the information of the preceding state is only transmitted in the same direction along the orbit. Although the orbits are interrupted in each state, the absorbed information circulates the orbit in the four-block during a four-part oscillation phase, and each orbit is characteristic of both longitudinal and transverse oscillators[1].

[1]In the double-slit experiment, only the transverse oscillators are temporarily superimposed, when interacting with the double-slit; the interaction is elastic because the transverse oscillators are not activated, and the wave properties are conserved [4].

The central alpha or beta four-block of photons contains four O-X oscillators; each O-X oscillator forms four currents; the two photons alpha and beta thus contain eight circulating currents that determine the action. However, each of the two alpha and beta photons contains only four currents: twice the currents o and u. The four currents of alpha and beta, αo-βu and αu-βo, supply either the two longitudinal or the two transverse oscillators with action from the basic structure. Each of the two "output photons" for electric or magnetic photons is two-dimensionally activated[2]. By dividing each of the two photons alpha and beta into the two parts (0/3) and (1/2), the number of circulating currents is doubled.

In addition to the four currents of the longitudinal coordinates, due to the formation of the two parts (0/3) and (1/2), four further currents are formed, which are assigned to the transverse coordinates[3]. However, the latter are not activated at transverse (or longitudinal) coordinates due to the only four active currents from the basic structure: they generate and absorb no action. If electrical properties in the longitudinal oscillators are activated by interaction, then the transverse circulating currents remain deactivated, and if the magnetic properties are activated in interaction, then the longitudinal properties remain deactivated (see correlation structure of the static photon (1.1)). Thus, the currents in the central four blocks of static photons (and gravitons) can be clearly assigned to the coordinates (**Figure 3**). In each of the four peripheral four-blocks, the (0/3) and (1/2) parts require two circuits in each of the central four-blocks. By dividing the fields into parts (0/3) and (1/2), each peripheral four-block in alpha and beta receives four circulations, which can be assigned to the four coordinates and can activate the fields E_i and B_i by one of the two O-X oscillators in the peripheral four-blocks.

As a result of this part (ii), in which the interaction of the surface of the basic structure with the Maxwell vacuum is analyzed under the conditions of the Hamiltonian principle, the formation of the two "output photons" alpha and beta is constructed in the two parts (0/3) and (1/2). The photons and gravitons in contact with the surface of the basic structure receive the information via the four circulating currents αo-βu and αu-βo, which activate two unit cubes (double, because O and X) on every two coordinates: the two longitudinal or the two transverse; two circulating currents each activate two longitudinal or two transverse O-X oscillators. A further division of the two photons takes place into the two parts (0/3) and (1/2), which make it possible to form currents for all four coordinates of an initial photon of a state, without generating further activation of the action. In this way, uniform static photons in space-time are formed from the one-dimensional correlation space of the basic structure, with four independent μ-coordinates, which can form the particle, wave, and magnetic properties depending on the activation.

[2]The three-dimensional spatial direction results from the radial propagation, the O-X oscillators that are not activated by action are still present, two dimensions are preserved in a rest frame, compare wave properties.

[3]The eight currents of the central four-blocks include another eight for the peripheral four-blocks.

4. Space-Time Properties of Static Photons

After the four-part output photon for electrical and magnetic properties could be determined in part (ii) and obtained by assigning the currents to the coordinates, it will first be shown that the output photons in a rest frame (without prior interaction) do not contain any real action. The formation of the actual electric and magnetic photons takes place during an interaction. In all cases considered, the four currents $\Omega 1:\alpha o\uparrow -\beta u\downarrow(-)$ and $\Omega 1:\alpha u\downarrow -\beta o\uparrow(+)$ per longitudinal or transverse coordinates (one O-X photon per coordinate) are always formed from the basic structure of the static photons with the corresponding action. The information transmitted is virtual. As explained in (ii), in order to satisfy the Hamiltonian principle, these currents in the photons must form all four space-time coordinates, whereby a division into the four parts $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$ must take place, with the consequence that the objects must move in space-time, because the Hamiltonian principle is only fulfilled when the next state is formed. If one adds up the currents activated in the longitudinal "output photon", they are identical in each state with the currents transferred from the basic structure to the photon. Using the example of the state Ω2 for electrical properties, it follows:

$$\begin{aligned}&\Omega 2:\ \mu=3:\ (0/3):\ (+)\alpha o\downarrow\text{-}\beta u\uparrow,\ \mu=3:\ (1/2):\ (-)\alpha u\downarrow\text{-}\beta o\uparrow,\\&\Omega 2:\ \mu=0:\ (0/3):\ (+)\alpha o\downarrow\text{-}\beta u\uparrow,\ \mu=0:\ (1/2):\ (-)\alpha u\downarrow\text{-}\beta o\uparrow.\end{aligned}\qquad(4.1)$$

This applies to both states and to the magnetic photons (corresponding to transverse coordinates), and these are common to the currents of the active four-blocks of the basic structure. The currents of a longitudinal or transverse "output photon", formed from the basic structure by induction, form the virtual action, transferred from the basic structure in the photon. With the formation of the output photons with virtual action, including a motion in space-time, the Hamiltonian condition is satisfied.

In order to obtain the particle, wave, and magnetic properties for the output photons, the corresponding interaction can be simulated. Since this is not yet sufficiently known, the properties of space-time will be determined at this point by comparing them with the corresponding results, obtained from the energy-momentum tensor of the Maxwell fields [5][4].

The common currents $\Omega 1:\alpha o\uparrow -\beta u\downarrow(-)$ and $\Omega 1:\alpha u\downarrow -\beta o\uparrow(+)$ of the basic structure and the static photons consist of a superposition of the constant currents of the basic structure, which form charge and mass[5], and of variable cur-

[4]In the present report, the properties of particles and anti-particles are modified compared to [4] in such a way that it is assumed that a change of state always occurs to reverse the sign of an oscillator with action. In [4], it was assumed that the sign of the $\mu=3$ oscillator characterizes the particle type in both states by the same sign.

[5]In the work [9] on gravity, a variable mass was assumed, which also leads to differences between the active and non-active four-blocks, whereby the two four-blocks become variable. This case can probably occur with elementary particles, such as neutrinos or dark matter. In the present investigations, we consider mass with charge, where the mass formed by active and non-active four-blocks must be constant in order for them to be able to describe a constant charge. This is ensured by the superposition of the active currents in the unit cubes by the non-active currents, which are added once and subtracted once with the same amount.

rents of motion, whose sources and sinks superimpose those in the photon cloud. While the currents of the basic structure determine the currents of charge in the photon cloud via the interface, the currents of motion, whose sources and sinks are only contained in the static photons, determine the currents in the vertical correlations and thus the motion of the object via the interface. If we assume that the output photon contains only the currents of charge (and mass), then the superimposed currents of motion cause the activation of the properties of the static photons and, via the interface, the vertical correlations of the basic structure: the absorbed information of the motion determines the magnitude and direction of the relative velocity.

The currents of motion, stored in the creators and annihilators of the photons, forming an action, are then also the information exchanged during an interaction, while the currents forming the charge, generated by the basic structure and transmitted to the photon cloud via the interface, change the state of motion due to a change in the vertical correlations, without changing the creators and annihilators of the basic structure. As already discussed elsewhere, the stored information of the motion is virtual, while the action of the photons of the charge generated in the basic structure is partly real in an interaction.

4.1. Wave Properties

The correlation structures of the photons with particle, wave, and magnetic properties derived from the energy-momentum tensor of the Maxwell fields (example (1.1), [4]) only reflect the real action of the charge and not the information of movement (no coupling to the matter tensor $M^{\mu\nu}$ [9]). The distribution of the virtual action of the movement on the static photons can be visualized by the distribution of the currents in the "output photons". The formation of the charges is recognizable in the structures obtained from the energy-momentum tensor. In order to extract the output photons obtained in this report from the photons obtained from the energy-momentum tensor, the method will be demonstrated using the example of wave properties. For example, the properties of photons with wave properties obtained from the energy-momentum tensor in [5] are considered:

$$
\begin{array}{ll}
(1){:}\alpha\Omega 1{:}\mu = 0{:}\mathrm{O}(+)\text{-}\mathrm{X}(0){:}\ \mu = 3{:}\mathrm{O}(+)\text{-}\mathrm{X}(0), & (3){:}\alpha\Omega 2{:}\mu = 0{:}\mathrm{O}(-)\text{-}\mathrm{X}(0){:}\mu = 3{:}\mathrm{O}(-)\text{-}\mathrm{X}(0),\\
(2){:}\alpha\Omega 1{:}\mu = 0{:}\mathrm{O}(0)\text{-}\mathrm{X}(-){:}\ \mu = 3{:}\mathrm{O}(0)\text{-}\mathrm{X}(-), & (4){:}\alpha\Omega 2{:}\mu = 0\ \mathrm{O}(0)\text{-}\mathrm{X}(+){:}\mu = 3{:}\mathrm{O}(0)\text{-}\mathrm{X}(+),\\
(1){:}\beta\Omega 1{:}\mu = 0{:}\mathrm{O}(0)\text{-}\mathrm{X}(+){:}\ \mu = 3{:}\mathrm{O}(0)\text{-}\mathrm{X}(+), & (4){:}\beta\Omega 2{:}\mu = 0{:}\mathrm{O}(0)\text{-}\mathrm{X}(-){:}\ \mu = 3{:}\ \mathrm{O}(0)\text{-}\mathrm{X}(-),\\
(2){:}\beta\Omega 1{:}\mu = 0{:}\mathrm{O}(-)\text{-}\mathrm{X}(0){:}\ \mu = 3{:}\mathrm{O}(-)\text{-}\mathrm{X}(0), & (3){:}\beta\Omega 2{:}\ \mu = 0{:}\mathrm{O}(+)\text{-}\mathrm{X}(0){:}\mu = 3{:}\ \mathrm{O}(+)\text{-}\mathrm{X}(0)
\end{array}
\tag{4.2}
$$

and an interpretation is sought for forming O-X photons on the basis of the "output photons" for longitudinal oscillators. For this purpose, the figures in **Figure 3** are considered, which reproduce the photons with wave properties for longitudinal activation. The properties (4.2) are characterized by the fact that in most O-X photons, one of these oscillators contains positive or negative action, while the other has no action (e.g., O(+)-X(0)). In the case of the oscillators of the charges in particle properties, this leads to the fact that the photon in the $\mu = 0$ oscillators has the same sign in both O-X oscillators and thus forms a real action (**Figure 3**

and (4.2))[6].

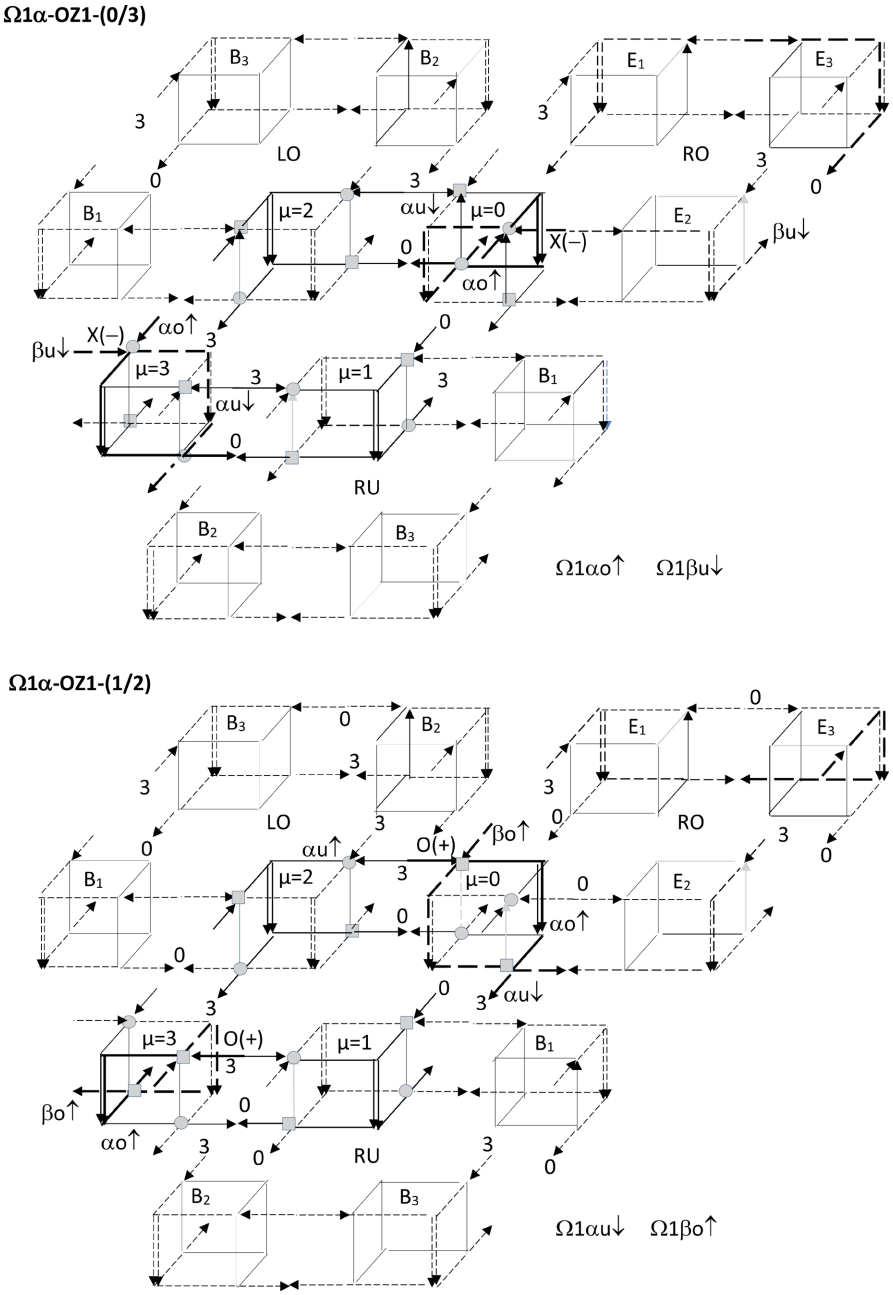

Figure 3. Correlation structure of static photons with wave properties: The two alpha parts $\alpha(1/2)$ and $\alpha(0/3)$ in the state Ω1 are shown. Activated are the strongly emphasized currents $\Omega 1:\alpha o\uparrow -\beta u\downarrow(-)$ in (0/3) and $\Omega 1:\alpha u\downarrow -\beta o\uparrow(+)$ in (1/2), which form the oscillators X(−): $\mu=0$ and O(+): $\mu=3$ in (0/3) and O(+): $\mu=0$ and X(−): $\mu=3$ and thus activate the fields E_3. For presentation reasons, the photon part LU was not reproduced.

[6]In order to save space, only the two photon parts Ω1α(0/3) and Ω1α(1/2) in **Figure 3** are depicted. For this reason, the reproduction of magnetic photons and photons with particle properties is also dispensed with. These have the same structure, but are activated differently in the O and X oscillators and thus in the currents.

For the formation of wave properties of static photons, the two photon parts $\Omega 1:\alpha o\uparrow\text{-}\beta u\downarrow$ in (0/3) and $\Omega 1:\alpha u\downarrow\text{-}\alpha o\uparrow$ in (1/2) are shown as an example in Figure 3. In each of the photon parts, two currents are formed: one current in the central block and one current in the corresponding peripheral four-block, each of which activates two of the four O and X oscillators. While the current in the central four-block activates the information between the basic structure and the photon through the connection in the interface with the basic structure, the current in the longitudinal peripheral four-blocks RO and LU causes the activation of the E_3 field. In the two alpha parts, the following two longitudinal currents are activated:

$$\begin{aligned}&\Omega 1\alpha\text{: } \alpha o\uparrow\text{-}\beta u\downarrow\text{:}(-) \text{ in } (0/3) \text{ and } \alpha u\downarrow\text{-}\beta o\uparrow\text{:}(+) \text{ in } (1/2)\\ &\Omega 2\alpha\text{: } \alpha o\downarrow\text{-}\beta u\uparrow\text{:}(+) \text{ in } (0/3) \text{ and } \alpha u\uparrow\text{-}\beta o\downarrow\text{:}(-) \text{ in } (1/2)\end{aligned} \tag{4.3}$$

The other of the two oscillators, O or X, remains deactivated and does not carry any charge information of its own; hence the partial absence of action in the O-X oscillators. The peripheral four-blocks are activated by the peripheral currents only in the two longitudinal oscillators, *i.e.*, in E_3. The assignment of the O or X oscillators with action takes place in such a way that the circulating currents activated in the photon receive the information from the basic structure and have an equal direction of circulation in the two states, because in this way they satisfy the Hamiltonian principle after four states in the motion in space-time (see (4.4)).

The constellation (4.2) and (4.4) is occupied by the static photons in a homogeneous potential gradient, in which the same change in action is exchanged in the longitudinal oscillators in successive interactions [10]. Each state Ω contains the currents o and u: Example Ω1: $\mu = 0$: $\alpha o\uparrow\text{-}\beta u\downarrow(-)$ and Ω1: $\mu = 3$: $\alpha u\downarrow\text{-}\beta o\uparrow(+)$, which are also transferred from the basic structure to the photons, and the currents that cause the wave properties come from the interaction with the homogeneous potential gradient. The consequence of the movement of a charge carrier in the homogeneous potential gradient is the wave properties. Since the currents of the basic structure (4.2) always determine the properties of the photon during four states of oscillation in the rest frame, the photons change without interaction from a state with particle properties to one with wave properties [3].

The advancing wave of matter is driven by the currents of the central four-blocks of the photons. The circulating current in the photons contains the information of the wave and determines its progress. Since there are two different directions of the circulating currents in the central four-block, there are also two different matter waves. In each of the two matter waves, both currents of the basic structure $\alpha o\uparrow\text{-}\beta u\downarrow$ and $\alpha u\downarrow\text{-}\beta o\uparrow$ are included (c: central circulation, p: peripheral circulation):

matter wave 1 c:α
Z1:$\Omega 1\alpha$: $(1/2)$: $\mu = 0$ c:$\alpha u \downarrow$-p:$\beta o \uparrow$ O$(+)$, $\mu = 3$ c:$\alpha u \downarrow$-p:$\beta o \uparrow$ O$(+)$
Z2:$\Omega 2\alpha$: $(0/3)$: $\mu = 0$ c:$\alpha o \downarrow$-p:$\beta u \uparrow$ X$(+)$, $\mu = 3$ c:$\alpha o \downarrow$-p:$\beta u \uparrow$ X$(+)$
Z3:$\Omega 1\beta$: $(1/2)$: $\mu = 0$ c:$\beta u \downarrow$-p:$\alpha o \uparrow$ O$(-)$, $\mu = 3$ c:$\beta u \downarrow$-p:$\alpha o \uparrow$ O$(-)$
Z4:$\Omega 2\beta$: $(0/3)$: $\mu = 0$ c:$\beta o \downarrow$-p:$\alpha u \uparrow$ X$(-)$, $\mu = 3$ c:$\beta o \downarrow$-p:$\alpha u \uparrow$ X$(-)$

matter wave 2 c:β
Z1:$\Omega 1\alpha$: $(0/3)$: $\mu = 0$ c:$\alpha o \uparrow$-p:$\beta u \downarrow$: X$(-)$, $\mu = 3$ c:$\alpha o \uparrow$-p:$\beta u \downarrow$ X$(-)$
Z2:$\Omega 2\alpha$: $(1/2)$: $\mu = 0$ c:$\alpha u \uparrow$-p:$\beta o \downarrow$: O$(-)$, $\mu = 3$ c:$\alpha u \uparrow$-p:$\beta o \downarrow$ O$(-)$
Z3:$\Omega 1\beta$: $(0/3)$: $\mu = 0$ c:$\beta o \uparrow$-p:$\alpha u \downarrow$: X$(+)$, $\mu = 3$ c:$\beta o \uparrow$-p:$\alpha u \downarrow$ X$(+)$
Z4:$\Omega 2\beta$: $(1/2)$: $\mu = 0$ c:$\beta u \uparrow$-p:$\alpha o \downarrow$: O$(+)$, $\mu = 3$ c:$\beta u \uparrow$-p:$\alpha o \downarrow$ O$(+)$ (4.4)

The matter wave 1cα is formed by the four photon parts in four orbital states. In this example, the state Z1 → Z2 → Z3 → Z4 is formed consecutively with positive circulation in the central four-block and with negative circulations in the longitudinal peripheral four-blocks, wherein the information carried is positive in the first two states and negative in the two third and fourth states. The reverse is true for matter wave 2cβ. The superposition of the first two with the third and fourth states leads to the cancellation of the currents, which proves the wave properties. For the second wave of matter with negative circulation into the central four-block, all directions and all signs of the action are reversed. To activate both circulating currents, both waves are formed at the same time and form a common circulating virtual wave in both directions of propagation.

The course of the wave is determined by the currents transmitted from the basic structure via the interface αo-βu and αu-βo, whereby at the interface the currents with the same direction of circulation overlap, but change the direction of circulation with the state. Both waves with opposite propagation direction form together the currents connected with the basic structure in the same state and can therefore overlap and cancel each other out (standing waves). The currents of the static photons with wave properties transfer their oscillation behavior to the basic structure via the interface; the currents of the basic structure oscillate with the currents of the photons. However, the amount of action determining the wave propagation is determined by the interaction (e.g., in the potential gradient): only the transmitted information excites the wave motion (part (iv) signal formation and signal processing).

4.2. Magnetic Properties

From the symmetry of the correlation structures of the static Maxwell fields and the different excitation of longitudinal and transverse oscillators, it follows that the magnetic properties in the transverse four-blocks correspond to the longitudinal ones (cf. (1.1)). For the magnetic properties, there are therefore also the four photons of a state: $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$, and the four currents αo$\uparrow$-βu$\downarrow$ and αu$\downarrow$-$\beta o\uparrow$ of the basic structure are assigned to the transverse coordinates of the photons. In this way, the structures of the magnetic photons are obtained for the rest frame, corresponding to those of the wave properties by activating the transverse oscillators. The magnetic photon, similar to the elec-

tric photon, is activated by the four currents αo$\uparrow$-βu$\downarrow$ and αu$\downarrow$-βo$\uparrow$ of the basic structure. These currents are assigned to the transverse oscillators. According to the electric photons with wave properties, we get two magnetic photons with different directions of circulation (c: central circulation, p: peripheral circulation):

magnetic field 1c:α
Z1:$\Omega 1\alpha$: $(1/2)$: $\mu = 2$ c:$\alpha u\downarrow$-p:$\beta o\uparrow$ O$(+)$, $\mu = 1$ c:$\alpha u\downarrow$-p:$\beta o\uparrow$ O$(+)$
Z2:$\Omega 2\alpha$: $(0/3)$: $\mu = 2$ c:$\alpha o\downarrow$-p:$\beta u\uparrow$ X$(+)$, $\mu = 1$ c:$\alpha o\downarrow$-p:$\beta u\uparrow$ X$(+)$
Z3:$\Omega 1\beta$: $(1/2)$: $\mu = 2$ c:$\beta u\downarrow$-p:$\alpha o\uparrow$ O$(-)$, $\mu = 1$ c:$\beta u\downarrow$-p:$\alpha o\uparrow$O$(-)$
Z4:$\Omega 2\beta$: $(0/3)$: $\mu = 2$ c:$\beta o\downarrow$-p:$\alpha u\uparrow$ X$(-)$, $\mu = 1$ c:$\beta o\downarrow$-p:$\alpha u\uparrow$ X$(-)$

magnetic field 2c:β
Z1:$\Omega 1\alpha$: $(0/3)$: $\mu = 2$ c:$\alpha o\uparrow$-p:$\beta u\downarrow$:X$(-)$, $\mu = 1$ c:$\alpha o\uparrow$-p:$\beta u\downarrow$ X$(-)$
Z2:$\Omega 2\alpha$: $(1/2)$: $\mu = 2$ c:$\alpha u\uparrow$-p:$\beta o\downarrow$:O$(-)$, $\mu = 1$ c:$\alpha u\uparrow$-p:$\beta o\downarrow$O$(-)$
Z3:$\Omega 1\beta$: $(0/3)$: $\mu = 2$ c:$\beta o\uparrow$-p:$\alpha u\downarrow$:X$(+)$, $\mu = 1$ c:$\beta o\uparrow$-p:$\alpha u\downarrow$X$(+)$
Z4:$\Omega 2\beta$: $(1/2)$: $\mu = 2$ c:$\beta u\uparrow$-p:$\alpha o\downarrow$:O$(+)$, $\mu = 1$ c:$\beta u\uparrow$-p:$\alpha o\downarrow$O$(+)$ (4.5)

which are now assigned to the transverse oscillators. As with wave properties, the central circuits are also responsible for both transverse oscillators in magnetic properties; virtual action is formed by the interaction of the two parts (0/3) and (1/2) of the central currents alpha and beta; Example (c: central four-blocks, p: peripheral four-blocks):

$\Omega 1\alpha$: $(0/3)$: $\mu = 2$ c:$\alpha o\downarrow$ and $\Omega 1\beta$: $(1/2)$: $\mu = 1$ c:$\beta u\uparrow$
$\Omega 1\beta$: $(0/3)$: $\mu = 2$ p:$\alpha u\uparrow$ and $\Omega 1\alpha$: $(1/2)$: $\mu = 1$ p:$\beta o\downarrow$ (4.6)

For one orbital direction, the two oscillators O(−)-X(+) and O(+)-X(−) are formed in the rest frame with virtual action. In the alpha phase of the oscillation with positive central circulation, the negative action is generated in Ω1 and Ω2 and the positive action in the beta phase. In the opposite negative central circulation direction, it is the other way around. The central circulation is determined by the direction of the current. When a magnetic field is formed by a current from a conductor passing through it, the current amounts depend on the number of charges and their speed in the conductor flowing through it. The information of the movement is localized in the creators and annihilators of magnetic photons, whose currents are transmitted via the interface to the vertical correlations of the moving charges, or the moving charges in the conductor generate the magnetic fields. The fourfold change in state is also visible in the elementary magnets.

The difference with the electric fields in space-time is a consequence of the differently excited oscillators: the electric fields are excited by a spatial and a temporal oscillator, which causes their radial propagation; the magnetic photons by two spatial ones, which causes their spatial connection to the sources. This is vividly illustrated by the circumferential magnetic field of a current in a conductor passing through it: one transverse direction is formed perpendicular to the direction of motion of the charges, the other transverse direction is perpendicular to the direction of the current and perpendicular to the first transverse direction, while the longitudinal directions are erased.

Similar to the wave properties, the magnetic properties in the rest system in (4.5) are also changed in their oscillation behavior by interaction. In particular, the interaction of electric and magnetic fields leads to the formation of electromagnetic waves, and the interaction of static photons leads to the formation of photons of light [4].

4.3. Particle Properties

Particle properties of the static photons are obtained from the wave properties (**Figure 3**) by providing all four central currents for each state. Then only one oscillator is active in each of the four photon parts $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$, and $\beta(1/2)$. In order for the Hamiltonian principle to be fulfilled according to two states during oscillation, the two longitudinal O or X oscillators must have different signs in one state, and reverse their signs in the next state. This can be done in two different ways, forming particles and anti-particles (c: central circulation, p: peripheral circulation, v1 - v4 shows the interacting currents, compare (5.2)):

particle	anti-particle
$\Omega 1\alpha$ $(1/2)$ c:$\alpha u\downarrow$-p:$\beta o\uparrow$ O$(+)$-X(0) v1	$\Omega 1\alpha$ $(0/3)$ c:$\alpha o\uparrow$-p:$\beta u\downarrow$ O(0)-X$(-)$ v2
$\Omega 1\beta$ $(0/3)$ c:$\beta o\uparrow$-p:$\alpha u\downarrow$ O(0)-X$(+)$ v2	$\Omega 1\beta$ $(1/2)$ c:$\beta u\downarrow$-p:$\alpha o\uparrow$ O$(-)$-X(0) v1
$\Omega 1\alpha$ $(0/3)$ c:$\alpha o\uparrow$-p:$\beta u\downarrow$ O$(-)$-X(0) v3	$\Omega 1\alpha$ $(1/2)$ c:$\alpha u\downarrow$-p:$\beta o\uparrow$ O(0)-X$(+)$ v4
$\Omega 1\beta$ $(1/2)$ c:$\beta u\downarrow$-p:$\alpha o\uparrow$ O(0)-X$(-)$ v4	$\Omega 1\beta$ $(0/3)$ c:$\beta o\uparrow$-p:$\alpha u\downarrow$ O$(+)$-X(0) v3
$\Omega 2\alpha$ $(1/2)$ c:$\alpha u\uparrow$-p:$\beta o\downarrow$ O$(-)$-X(0) v3	$\Omega 2\alpha$ $(0/3)$ c:$\alpha o\downarrow$-p:$\beta u\uparrow$ O(0)-X$(+)$ v4
$\Omega 2\beta$ $(0/3)$ c:$\beta o\downarrow$-p:$\alpha u\uparrow$ O(0)-X$(-)$ v4	$\Omega 2\beta$ $(1/2)$ c:$\beta u\uparrow$-p:$\alpha o\downarrow$ O$(+)$-X(0) v3
$\Omega 2\alpha$ $(0/3)$ c:$\alpha o\downarrow$-p:$\beta u\uparrow$ O$(+)$-X(0) v1	$\Omega 2\alpha$ $(1/2)$ c:$\alpha u\uparrow$-p:$\beta o\downarrow$ O(0)-X$(-)$ v2
$\Omega 2\beta$ $(1/2)$ c:$\beta u\uparrow$-p:$\alpha o\downarrow$ O(0)-X$(+)$ v2	$\Omega 2\beta$ $(0/3)$ c:$\beta o\downarrow$-p:$\alpha u\uparrow$ O$(-)$-X(0) v1

(4.7)

In the interface between basic structure and photon are overlapping alpha with alpha oscillators and beta with beta oscillators for static photons, and alpha with beta oscillators for gravitons. Since the $\mu = 0$ oscillator in space-time determines the time, we assume that the sign of the action in the $\mu = 3$ oscillator in the photon cloud determines the type of particle: positive for the particle, negative for the anti-particle. When alpha is superimposed with alpha and beta with beta, the same circulation direction with the same signs of the current between the basic structure and photons takes place (in the case of gravitons, different signs). Emission of information into the photons occurs in both types of photons in the state Ω1. In the particle, the positive action is transferred to the photons in $\mu = 3$; in the case of the anti-particle, negative action. We therefore define the formalism as a particle, which forms an oscillator in the state Ω1 with positive action in the $\mu = 3$ oscillator.

Only central circuits for the particle properties are activated: in each state, the currents transferred from the basic structure become effective. The central currents convey the information directly from the photons to the basic structure.

Each of the four photon parts $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$ has a complete current for each of the two longitudinal coordinates. The currents for each of the two parts, $\alpha,\beta(1/2)$ αu-βo, $\alpha,\beta(0/3)$ αo-βu, are different, but in one state they capture all the information transferred from the basic structure to the photons. Each

state consisting of $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$ parts contains a complete current that is linked to the basic structure. All four parts therefore react with the interaction partner, whereby currents of the interaction partners in the interaction region of the vacuum are always parallel and rectified. This is given under the same conditions: opposite direction of propagation and different states. For geometrical reasons, the two different longitudinal oscillators are then superimposed with different o and u currents.

In the case of particle properties, a central orbit and a corresponding peripheral orbit, and thus either an O or an X, are always activated in each of the four parts of the oscillators. The activation of an oscillator O or X is always associated with the activation of a peripheral orbit. The latter causes an activation of the current in the peripheral circulation and thus an activation of the E-fields in this circulation. The E-fields are what become visible as a field in space-time. The central orbit, on the other hand, is what connects the basic structure with the static photon with particle properties and is thus the place that causes the exchange of information during the interaction.

The $\mu = 0$ oscillator is activated in the case of the particle in $\Omega 1 \alpha\beta$ by the currents $\alpha o \uparrow - \beta u \downarrow$:(−), and for $\mu = 3$ by the currents $\alpha u \downarrow - \beta o \uparrow$ (+), and in the $\Omega 2 \alpha\beta$ correspondingly for $\mu = 0$ by $\alpha o \downarrow - \beta o \uparrow$ (+) and for $\mu = 3$ by $\alpha u \uparrow - \alpha o \downarrow$ (−). Although the photons have the excitation of

particle, particle properties:

$\alpha\Omega 1$: $\mu = 0$ O(0)-X(−), $\mu = 3$: O(0)-X(+) $\quad$ $\alpha\Omega 2$: $\mu = 0$ O(0)-X(+), $\mu = 3$: O(−)-X(0)

$\beta\Omega 1$: $\mu = 0$ O(−)-X(0); $\mu = 3$: O(+)-X(0) $\quad$ $\beta\Omega 2$: $\mu = 0$ O(+)-X(0); $\mu = 3$: O(0)-X−)

from [4] in particle properties, it is again the current of the basic structure that causes the exchange of information between the photon cloud and the basic structure in both states. For the absorption of information in the interaction between charges, the photon structure for particle properties of [4] is required. In order for the information to be forwarded to the basic structure, the four currents $\alpha u \downarrow - \beta o \uparrow$ (+) and $\alpha u \uparrow - \beta o \downarrow$ (−) are always required in the interface; they are needed for the formation of the four-block, that is, the structure of the information. In an interaction that leads to particle properties, the wave properties are changed in such a way that the flow of information between the photon cloud and the basic structure in both states can occur via the currents for $\mu = 0$ $\alpha o \downarrow - \beta u \uparrow$:(+) and for $\mu = 3$ by $\alpha u \uparrow - \beta o \downarrow$ (−), *i.e.*, the currents in the interface, while in wave properties the oscillators in the basic structure oscillate back and forth with opposite directions of circulation together in the photons and in the basic structure.

5. Signal Formation and Signal Processing

Signal formation takes place by superimposing the photons and gravitons of the interaction partners in vacuum; signal processing occurs by absorbing the changed information through the basic structure and converting it into a change in motion. The photons/gravitons in a vacuum contain the information of the currents of charge and mass, transmitted by the basic structure, and the information of the mo-

tion superimposed on the photons/gravitons. These three pieces of information are always represented by the four currents.

$$\Omega 1:\ (-):\alpha o\uparrow\text{-}\beta u\downarrow \text{ and } (+):\alpha u\downarrow\text{-}\beta o\uparrow \text{ and } \Omega 2:\ (+):\alpha u\uparrow\text{-}\beta o\downarrow \text{ and } (-):\alpha o\downarrow\text{-}\beta u\uparrow \tag{5.1}$$

exchanged via the interface; In electromagnetism, they activate only either the longitudinal or the transverse O-X oscillators and interact at the interface between the surface of the basic structure and the photons/gravitons, and within the basic structure between active and non-active currents. The three types of oscillating currents are always in equilibrium between the currents in the photon cloud, or the graviton network, and the basic structure in a rest frame.

In the case of an interaction, we assume that the photons/gravitons overlap in vacuum, form in an oscillation a common piece of information under conditions of the Hamiltonian principle, and, after the separation process, the changed information is formed again at the interface with new currents in a rest frame, in such a way that after the end of the interaction, an equilibrium is restored. In [3], we have simplified the information exchanged with delta, which is absorbed by the interaction partners as a positive and negative value under the conditions of the Hamiltonian principle in the form of a change in current, converted into a change in motion and causing a change in the creators and annihilators as storage. Stores of mass and charge are the active and non-active four-blocks of the basic structure; the stores of motion are formed by the creators and annihilators in the photons/gravitons. The conversion of the information into movement takes place in the vertical correlations of the basic structure. When analyzing the interaction, it is important to distinguish between the three different pieces of information: motion, charge, and gravity. The three signals all have the form of a four-block, generated by the currents (5.1), that is the physical information.

The change in motion after an interaction can be analyzed at the interface, if it is assumed that the state of the photon/graviton represents the result of the interaction in a vacuum. To do this, we consider a state of a graviton (photon), resting directly on the state of the basic structure (example **Figure 4**)[7]. Both states are different; at the interface in gravity, there are superimposed currents of different signs in the same direction (in the case of photons, currents of the same sign). In the state Ω2 of the graviton/photon, Ω1 is the state of the basic structure. In this case, the active vertical correlations of the graviton are directed towards the basic structure and the active vertical correlations of the basic structure are directed towards the graviton/photon. During formation of this state, both preceding states change simultaneously, resulting in a flow of information from the basic structure towards the interface and an opposite flow of information from the photon towards the interface. In equilibrium, both interaction partners have the annihilator (or creator) in common. In the following state, the vertical correlations are reversed, and so is the flow of information. In the rest frame, the currents are the same in

[7]In the rest frame, the signals of the basic structure at the interface are also deleted; activation only occurs when the amounts of Information are different, e.g., there is an interaction. But there are probably no rest frames of the masses.

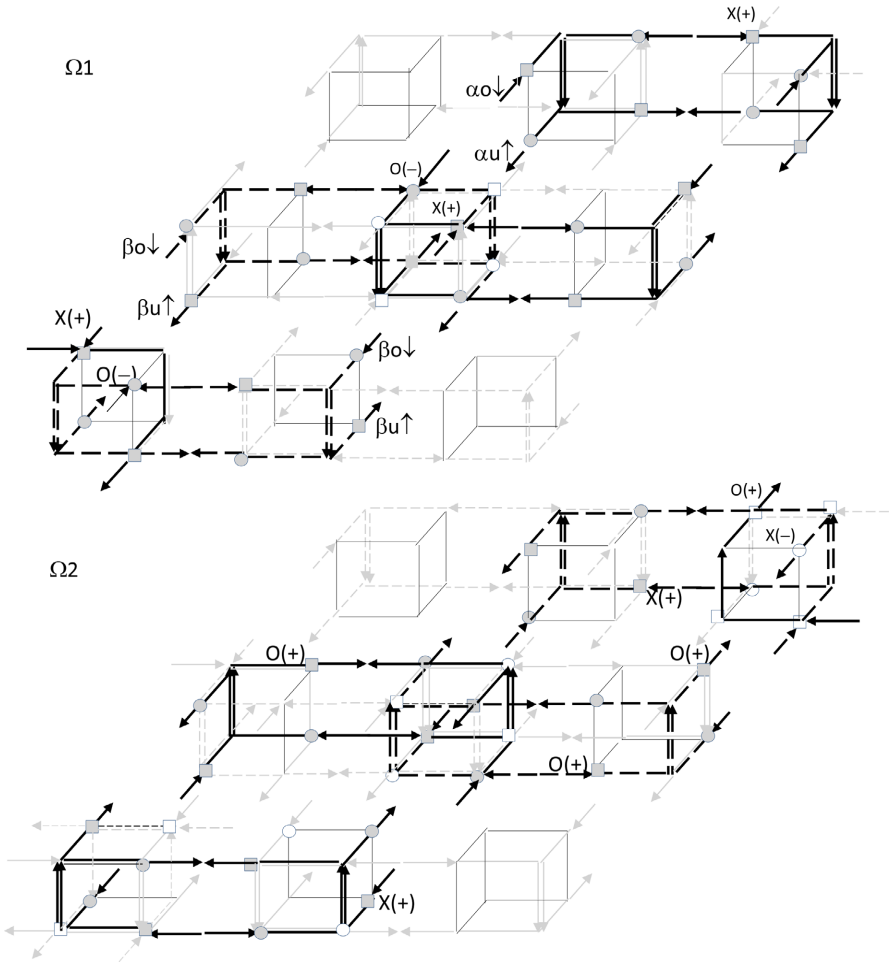

Figure 4. Simulation of the formation of gravitons by superimposing the alpha part of the graviton on beta and beta of graviton on alpha parts of the basic structure. Solid lines are positive currents; discontinuous lines are negative currents; currents activated by the basic structure are amplified.

both parts; they meet in the common annihilator/creator at the interface, comparable to the situation in the volume of the basic structure.

In terms of interaction, the difference between electromagnetism and gravity is that the photons essentially interact via the central four-block, because the peripheral four-blocks do not contain any sources of information. The information is thus transmitted between the interaction partners via the central field lines forming four-blocks. In contrast, gravitons consist of a network of four-blocks in which all four peripheral sources have action. As explained in the paper [7], it can be shown that the peripheral four-blocks in the gravitons transfer their information into central four-blocks and thus gravitons also exchange information with the sources of the masses via field lines.

This is especially true in the case of a superposition of gravity and electromagnetic interaction. We therefore want to use the method described in [7] in this work for the interaction of gravitons, although it is a simplification with regard to gravity. However, the formation of gravitons does not take place in a transfer of

information via individual central four-blocks, as in the case of photons, but the network of the basic structure forms the network of gravitons in a vacuum. Based on the considerations for the formation of four-dimensional static photons, the networks of gravitons are formed on the correlation space and only take effect when they interact in space-time. However, as the following explanations show, the information of the ("light") mass is mainly transferred to the static photons.

5.1. Formation of Graviton Networks

The static photons do not form networks corresponding to the gravitons with units of action in the peripheral four-blocks, but contain their information only in the central four-block. The cause of the formation of networks of gravitons, consisting of four-blocks, should be the basic structure, the surface of which forms networks and thus induces network formation in a vacuum. The gravitons thus represent a continuation of the active four-blocks of the basic structure on the correlation space of the vacuum. They therefore do not contain E and B fields, but only the information of the mass transmitted from the surface of the basic structure. The network consists of a superposition of alpha and beta photons, which have no action as a result of the superposition, but have the information of the basic structure, *i.e.*, the mass (see below). The static photons do not form networks, because the surfaces of the basic structure are not neutralized by superimposing the alpha and beta components, but alpha and beta photons are emitted and only superimpose themselves in a vacuum under the conditions of space-time.

If the mass is considered without charge (e.g., dark matter), gravitons can form spatial networks by superimposing four-blocks according to the pattern of **Figure 4**. Instead of forming individual alpha and beta photons from the surface of the basic structure, the surface generates a three-dimensional network, consisting of alpha and beta parts under the conditions of the Hamiltonian principle (deactivation of the surface of the basic structure): the alpha parts of the gravitons superimpose beta units of the basic structure in a vacuum, and the beta parts of the gravitons superimpose alpha parts of the surface of the basic structure. The networks created in this way (ideally) do not contain any action formed by the basic structure in the O-X oscillators, because all positive currents neutralize negative currents and negative currents neutralize positive currents at the interface. The currents within the structures of the graviton network cancel each other; they do not form a virtual action; virtual action is formed by the formation of O-X photons with different signs in O and X and the same amount of action. In this way, an image of the active network of the basic structure is formed in a vacuum (and superimposed on the Maxwell vacuum [4]). The graviton network consists only of the $\mu = 0$ dimension and exists only on the correlation space.

Gravity appears in space-time as a four-dimensional space in the interaction and only here takes on the four space-time dimensions. At the transition to space-time during the interaction of "bright matter", four gravitons $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$ must be formed for each state. This does not result in peripheral four-

blocks with E and B fields, as in the case of photons, but contains four space-time dimensions activated by information from the mass. In contrast to static photons, the four space-time dimensions can be formed in any four-block, because the action is erased from the charge-related sources of the basic structure and the signals caused by mass can form a four-dimensional network: by superimposing currents of different signs in the same direction in the interface. The information of the mass, discussed in parts 5.3 and 5.4, on the other hand, is superimposed on the structures formed in vacuum. As will be shown, it is again given in the currents (5.1).

5.2. Interaction of Static Photons

In the case of interaction between two particles or between particles and anti-particles with particle properties, this leads according to (4.5) to an overlap of the currents, marked by the same v-number. Examples are (Ω2 with opposite propagation direction):

particle	anti-particle
$\Omega 1\beta$ (0/3) c:$\beta o\uparrow$-p:$\alpha u\downarrow$ O(0)-X(+) v2	$\Omega 1\beta$ (1/2) c:$\beta u\downarrow$-p:$\alpha o\uparrow$ O(−)-X(0) v1
$\Omega 2\alpha$ (0/3) c:$\alpha o\downarrow$-p:$\beta u\uparrow$ O(+)-X(0) v1	$\Omega 2\alpha$ (1/2) c:$\alpha u\uparrow$-p:$\beta o\downarrow$ O(0)-X(−) v2

(5.2a)

The central part $\Omega 1\beta(0/3)$ c: $\beta o\uparrow$ of the particle overlaps with the central part $\Omega 2\alpha(1/2)$ c: $\alpha u\uparrow$ of the anti-particle, and the central part $\Omega 1\beta(1/2)$ c: $\beta u\downarrow$ of the anti-particle overlaps with $\Omega 2\alpha(0/3)$ c: $\alpha o\downarrow$ of the particle under formation of the virtual action O(+)-X(−) and O(−)-X(+). The interaction between two particles follows:

Interaction by superposition: particle 1 in Ω1 with particle 2 in Ω2

$\Omega 1\alpha$ (1/2) c:$\alpha u\downarrow$-p:$\beta o\uparrow$ O(+)-X(0) v1	$\Omega 1\beta$ (0/3) c:$\beta o\uparrow$-p:$\alpha u\downarrow$ O(0)-X(+) v2
$\Omega 2\alpha$ (0/3) c:$\alpha o\downarrow$-p:$\beta u\uparrow$ O(+)-X(0) v1	$\Omega 2\beta$ (1/2) c:$\beta u\uparrow$-p:$\alpha o\downarrow$ O(0)-X(+) v2
$\Omega 1\alpha$ (0/3) c:$\alpha o\uparrow$-p:$\beta u\downarrow$ O(−)-X(0) v3	$\Omega 1\beta$ (1/2) c:$\beta u\downarrow$-p:$\alpha o\uparrow$ O(0)-X(−) v4
$\Omega 2\alpha$ (1/2) c:$\alpha u\uparrow$-p:$\beta o\downarrow$ O(−)-X(0) v3	$\Omega 2\beta$ (0/3) c:$\beta o\downarrow$-p:$\alpha u\uparrow$ O(0)-X(−) v4

(5.2b)

The interaction must always occur by rectified currents between o and u and between Ω1 and Ω2. There is no alternative superposition of the currents: The signs of the oscillators of the photons of particles and anti-particles are different in each state in the O-X oscillators of $\mu = 0$ and $\mu = 3$, and they are also different between the states. In an interaction, two different states are superimposed, whereby the sign changes once, but due to the geometry, photons are also superimposed between two longitudinal oscillators, whereby the original sign is restored. Therefore, in the interaction between photons of a charge of the same sign, O-X photons with the same sign are always superimposed, causing them to repel each other, and in the interaction of photons of charges with different signs, O-X photons of different signs are superimposed, causing them to attract each other.

In contrast to wave properties, in particle properties each state in the central four-blocks contains all four currents, two o and two u. Each state of particles and anti-particles thus generates two virtual O-X oscillators: O(+)-X(−) and O(−)-X(+) for both longitudinal oscillators. All four currents of a state interact with the

basic structure. Thus, in one state, the information from all four currents is transferred from the photon cloud to the basic structure at the same time, and in the other state, all four currents are transferred from the basic structure to the photons. This is an exchange of an alpha- and a beta-four-block, that is, the physical information, as defined.

When photons of the same charge are superimposed, currents of the same sign are superimposed; the action is increased in a vacuum, and the charges repel each other (the information of the motion was stored in the photon cloud and arose when the two charge carriers approached). When the photons of different charges are superimposed, rectified currents of different signs are superimposed, and the real action in a vacuum between two different charges decreases with the formation of virtual action; Charges of different signs attract, while the formed virtual action generates the information of the movement.

With a complete superposition of currents of particles and anti-particles in vacuum, all real currents cancel each other. In (4.7), other currents, such as those caused by gravity, but also those of motion, are not taken into account. Zero action in O and X oscillators means, in this case, that, e.g., in a simulation of the interaction due to the relative motion of two objects, the information of the motion must first be inserted. The information of the movement is also described by the four currents of the basic structure (5.1). It is obtained, for example, in the analysis of information transmission in gravity (cf. (5.5)).

It is the change of action in a gradient that is effective for the direction of motion. If the information passes through the basic structure in an oscillation phase and is emitted into the photons, then this emission only occurs under the conditions of the Hamiltonian principle if the information in the photons is lower. So, if the information decreases in the gradient, as in wave formation in a homogeneous potential gradient, then the information is emitted into the photons and stored there. If this is not the case, no wave properties are obtained. If the information increases in a gradient in the photons, then the information also remains in the basic structure (in vertical correlations), and if there is, in a purely longitudinal view, a movement in the opposite direction, *i.e.,* repulsion takes place. In both cases, it is a motion relative to the density of the information in the photon cloud, where the memories of the motion are located. In order to achieve a state of a rest frame, a balance of information must be established between the basic structure and the photons. Then wave properties form again.

In an interaction, the wave properties (4.4) convert into particle properties (4.7), because particle properties require different currents for $\mu = 0$ and $\mu = 3$ formation of virtual action; This is in O-X oscillators the reason why during an interaction particle- and anti-particle properties are formed. Only as virtual action can the signal be converted into motion. This applies to electromagnetic interaction and to gravity (next sections).

A comparison between the representation of the wave properties in (4.4) and the particle properties in (4.7) and (5.2) explains the wave-particle duality of mat-

ter waves. In wave and particle properties, the same four static photon parts are active in a different arrangement in each state, which in both cases must finally satisfy the Hamiltonian conditions. In wave properties, two processes have to be considered: the propagation of the wave in the rest frame and the formation of the wave properties in a homogeneous potential gradient. In the rest frame, nothing changes in the interface during the four-part oscillation (4.4): the creators and annihilators in the interface are common to the photons and to the basic structure; the oscillation takes place in four oscillation phases. In each phase, two states are formed, each of which determines a central orbit and a peripheral orbit and thus contains all four currents of the basic structure. For example, the current $\alpha u\downarrow$ and $\alpha o\downarrow$ in the photon cloud form the positive action and thus the wave 1cα, while the currents $\alpha u\uparrow$ and $\alpha o\uparrow$ form the negative (together with the peripheral currents) action in 2cβ.

In the case of propagation of charges in the homogeneous potential gradient, the information required to advance the object to the potential is transported in equal amounts towards the photons and thereby converted into motion (local equilibrium, [10]). In the case of particle properties, O-X oscillators with real action are formed, which satisfy the Hamiltonian principle in each state, because they contain real action with different signs in the two longitudinal oscillators in each state. This constellation makes it possible to activate all four currents of the basic structure in each state and thus to exchange virtual information about the motion in each state. This oscillation occurs only in two phases, in which both longitudinal oscillators exchange information simultaneously in each phase. The formation of the real action of the charge is a consequence of the interaction (Details will be discussed elsewhere).

5.3. Signal Formation in Gravitons

From the analysis of the interaction between the same and different charges, it follows that the movement triggered by the interaction always takes place in the direction of a lower density of the information in vacuum. If the information density in the photon/graviton cloud increases in the type of interaction under consideration (charge, mass, motion) as a result of the superposition of the photons/gravitons, then the interaction partners repel each other and move away from each other: an example is two charges of the same sign. If the information density decreases, for example, two charges with different signs of real action attract each other and move towards each other. This corresponds to the Hamiltonian principle of minimizing the action. This interaction mechanism of the charges can be observed in a motion in a homogeneous potential gradient: Electrons are accelerated in a decreasing homogeneous potential gradient and take on wave properties.

The same behavior can therefore be expected for the interaction of the gravitons. In the case of gravitons, however, this initially leads to a contradiction: the masses move towards each other; they attract each other, although the information density

must increase when the gravitational fields of two objects are superimposed.

To solve this contradiction, we first look at the formation of mass signals in the network of gravitons. They are formed by the interaction of the correlations between the active and non-active four-blocks in the unit cubes. In order to meet the condition of inertia and the constancy of the charges, both four-blocks of the basic structure must have the same action in a rest frame. The signals that are decisive for the transmission from the basic structure to the graviton networks are generated at the interface in the *annihilator plane*. In the annihilator plane, alpha-to-alpha correlations superimpose to form positive signals of mass, beta-to-beta correlations to form negative signals, and alpha-to-beta correlations to form null signals. You get positive, negative, and zero signals of the basic structure in the interface, which are transmitted to the gravitons in the network and vary with the change of state in the sign, or remain zero at zero.

To illustrate this, the interaction of the active and non-active currents in the basic structure for the oscillator Ω1:O(+)-X(−) from (2.1) is considered as an example:

$$
\begin{array}{lll}
O(+):\alpha u\downarrow\colon +_{-}\mathrm{A}_0 \rightarrow \partial_0\ {}_{+}A_0 & & \\
\quad\downarrow & & \\
O(+):\alpha u\downarrow\colon +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 & O(+):\alpha u\downarrow\colon\partial_0\ {}_{-}\mathrm{A}_0 \Rightarrow \partial_0\ {}_{+}A_0 & O(+):\alpha u\downarrow\colon\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 \\
O(+):\alpha un\downarrow\colon +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 & X(-):\alpha o\uparrow\colon\partial_0\ {}_{-}\mathrm{A}_0 \Rightarrow \partial_0\ {}_{+}A_0 & X(-):\beta un\downarrow\colon\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0 \\
 & & \quad\downarrow \\
 & & O(+):\alpha u\downarrow\colon +_{-}\mathrm{A}_0 \leftarrow \partial_0\ {}_{+}A_0
\end{array}
$$

Active and inactive parts

$$
\begin{aligned}
&\mathrm{O}(+):\alpha u\downarrow\colon +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0{}_{-}A_0\\
&\mathrm{O}(+):\alpha un\downarrow\colon +\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0
\end{aligned}
\qquad (5.3)
$$

are identical with the same direction and the same sign. They can only add up when superimposed. They add up to a positive amount if both currents are the alpha currents and to a negative amount if both are beta currents, and they cancel each other out when alpha and a beta current are superimposed: the currents

$$
\begin{aligned}
&\mathrm{O}(+)\colon \alpha u\downarrow\colon\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0\\
&\mathrm{X}(-)\colon \beta un\downarrow\colon\partial_0\ {}_{+}\mathrm{A}_0 \leftarrow \partial_0\ {}_{-}A_0
\end{aligned}
\qquad (5.3a)
$$

are identical in the amount at rest frame, but differ in the sign of the current; they are subtracted from each other when superimposed and cancel each other out[8]. Therefore, the following two states of the annihilators in the longitudinal oscillators of the basic structure are considered:

$$
\begin{array}{ll}
\mu=3\colon\ \Omega1\colon\ \mathrm{O}(+):\alpha u\downarrow 0\text{:-}\Downarrow\ \mathrm{O}(+):\beta o\uparrow -\ \colon\Downarrow & \mu=3\text{:}\Omega2\text{:}\mathrm{O}(-):\alpha u\uparrow +\colon\Uparrow\text{-}\ \mathrm{O}(-):\beta o\downarrow 0\colon\Uparrow \\
\mu=3\colon\ \Omega1\colon\ \mathrm{X}(-):\alpha o\uparrow +\colon\Downarrow\text{-}\ \mathrm{X}(-):\beta u\downarrow 0\colon\Downarrow & \mu=3\text{:}\Omega2\colon\ \mathrm{X}(+):\alpha o\downarrow 0\colon\Uparrow\text{-}\ \mathrm{X}(+):\alpha u\uparrow -\ \Uparrow \\
\mu=0\colon\ \Omega1\colon\ \mathrm{O}(-):\alpha o\uparrow +\colon\Downarrow\text{-}\ \mathrm{O}(-):\beta u\downarrow 0\colon\Downarrow & \mu=0\colon\ \Omega2\colon\ \mathrm{O}(+):\alpha o\downarrow 0\colon\Uparrow\text{-}\ \mathrm{O}(+):\beta u\uparrow -\colon\Uparrow \\
\mu=0\colon\ \Omega1\colon\ \mathrm{X}(+):\alpha u\downarrow 0\text{:-}\Downarrow\text{-}\ \mathrm{X}(+):\beta o\uparrow -\colon\Downarrow & \mu=0\text{:}\Omega2\colon\ \mathrm{X}(-):\alpha u\uparrow +\colon\Uparrow\text{-}\ \mathrm{X}(-):\beta\ \mathrm{o}\downarrow 0\ \colon\Uparrow
\end{array}
\qquad (5.4)
$$

The double arrows describe the direction of the vertical correlations: in the state Ω1, all vertical correlations point towards the surface of the basic structure (if this direction is defined in this way), then all annihilators are also on the surface of the

[8]An interpretation of the mass-signal formation is used here, that differs from the assumptions of oscillation made in [9].

basic structure, and the delta can be emitted into the gravitons, provided that there is an action on the surface that is smaller than that in the basic structure. The same applies to the state Ω2, in which, in this case, the vertical correlations point inwards to the basic structure and in the gravitons towards the vacuum. The signs plus, minus, and zero indicate in (5.4) the content of the information in the common annihilator in the interface between graviton and basic structure.

The compilation (5.4) again contains the currents αu-βo and αo-βu on the surface of the basic structure for both states, which also show the exchange of information between the basic structure and photons/gravitons in the static photons. The number of currents in gravitons is the same as in static photons, but only half of the currents have either a positive or a negative signal; the other half contains zero, *i.e.*, no signal, because the signals are canceled within the cubes of the basic structure.

5.4. Information Exchange in Gravity

In order to determine the consequences of the interaction between gravitons, the signal formation of which was described in the previous section, for the exchange of information, we consider the interaction of two opposing sources Q1 and Q2 of the masses m1 and m2, which emitted the gravitons G1 and G2 and which, in a vacuum, according to the superposition geometry described, overlap. From the construction of the interaction (**Figure 5**), which is not fully reproduced here for reasons of limited space, the figures **Figure 6(A)** and **Figure 6(B)** emerge, which represent the longitudinal unit cubes of $\mu = 3$ and $\mu = 0$ with an overlap of the two gravitons, G1 (top) and G2 (bottom) in a vacuum.

For the sake of clarity, the overlapping gravitons in **Figure 6** are shown separately. According to the explanations in the preceding section, the part of the information formed by addition on the surface of the basic structure is always transferred to the gravitons (or photons) by the masses. This is highlighted by reinforcement in Figures **Figure 5** and **Figure 6**. In contrast to the basic structure, the information transferred to the gravitons affects the entire current from the creator to the annihilator, because the gravitons do not contain any non-active currents that could delete the information in between. In the superposition of the information on the gravitons G1 and G2, as a result of the interaction, the following information is formed according to **Figure 6**:

$$\alpha u \downarrow\text{-}\beta o \uparrow (+)\ \alpha u \uparrow\text{-}\beta o \downarrow (-) \qquad \alpha o \downarrow\text{-}\beta u \uparrow (+)\ \alpha o \uparrow\text{-}\beta u \downarrow (-) \quad (5.5)$$

By superimposing the signals of the gravitons G1 and G2 from two different sources Q1 and Q2 of two masses m1 and m2, all currents of the basic structure are formed in each of the longitudinal (the same applies to transverse) unit oscillators. In the superposition of the two gravitons, virtual information is created in the O-X oscillators for each of the two sources Q1 and Q2. This information is the same for both of the sources, due to the Hamiltonian principle. The same information is transferred to both interaction partners in the form of a virtual action O(+)-X(−) and O(−)-X(+). Example of the interaction under consideration

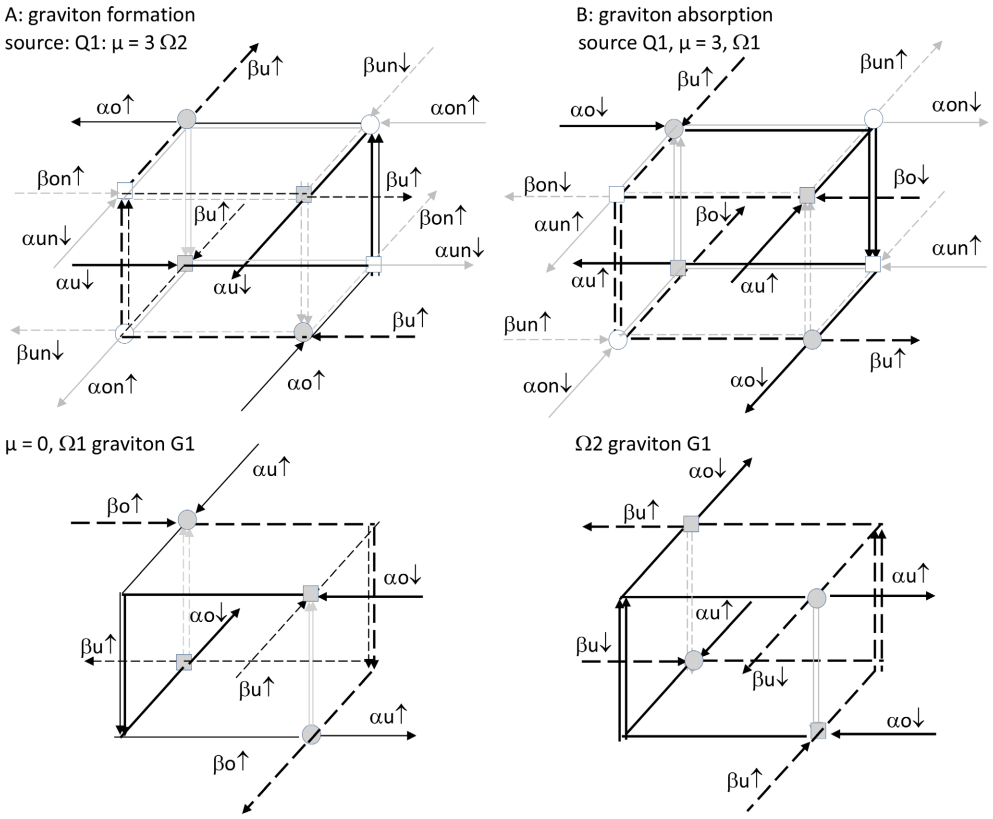

Figure 5. Signal formation (left) and signal absorption (right) in gravity using the example of the superposition of the unit cube $\mu = 3$ at the interface. In the upper area, the sources (left) and sinks (right) of the cube of the basic structure with its active and non-active currents are shown below the corresponding cube in graviton, on the left by emission, on the right by absorption. The basic structure and graviton are shown separately for clarity; in the interface, rectified correlations with different signs are superimposed.

$$
\begin{aligned}
&\mathrm{Q1{:}\Omega2{:}G1{:}\Omega1} \leftarrow\rightarrow \mathrm{Q2{:}\Omega1{:}G2{:}Q2{:}\Omega2}\\
&\mu = 3 \Rightarrow \mu = 0\\
&\mu = 3{:}\ \mathrm{O}(+)\ \alpha u - \beta o \quad \mathrm{X}(-)\ \alpha o - \beta u\\
&\mu = 0{:}\ \mathrm{O}(-)\ \alpha o - \beta u \quad \mathrm{X}(-)\ \alpha u - \beta o\\
&\\
&\mu = 0 \Rightarrow \mu = 3\\
&\mu = 3{:}\ \mathrm{X}(+)\ \alpha u - \beta o \quad \mathrm{O}(-)\ \alpha o - \beta u\\
&\mu = 0{:}\ \mathrm{X}(-)\ \alpha o - \beta u \quad \mathrm{O}(+)\ \alpha u - \beta o
\end{aligned}
\tag{5.6}
$$

In a simple calculation, assuming that all currents in both gravitons are the same, the result is: When the gravitons G1 and G2 are superimposed in a vacuum, contributions from both sources Q1 and Q2 form together all four active currents with information and thus activate both O and X oscillators of the cube in both gravitons. The Hamiltonian principle ensures that in both gravitons G1 and G2, which contained only single currents before the interaction, the same virtual action is formed after the interaction.

Figure 5 shows the emission (left) and absorption (right) for the source Q1 of mass m1 for the $\mu = 3$ cube. We look directly at the interface between the surface of the basic structure and the gravitons formed downwards. On the left, the grav-

iton is emitted under the discussed conditions and carries the information (amplified) of the mass and thus excites the two oscillators O(−) with the current $\beta o\downarrow$ and X(+) with $\alpha o\downarrow$. As shown in Figure 6, the graviton G1 also experiences the excitation of the currents O(−) $\alpha u\uparrow$ and X(+) $\beta u\downarrow$. Thus, in the overlapping gravitons G1 and G2, both O-X oscillators, the currents αo-βu and αu-βo, *i.e.*, the currents emitted from the basic structure of both sources Q1 and Q2 to the vacuum, are formed.

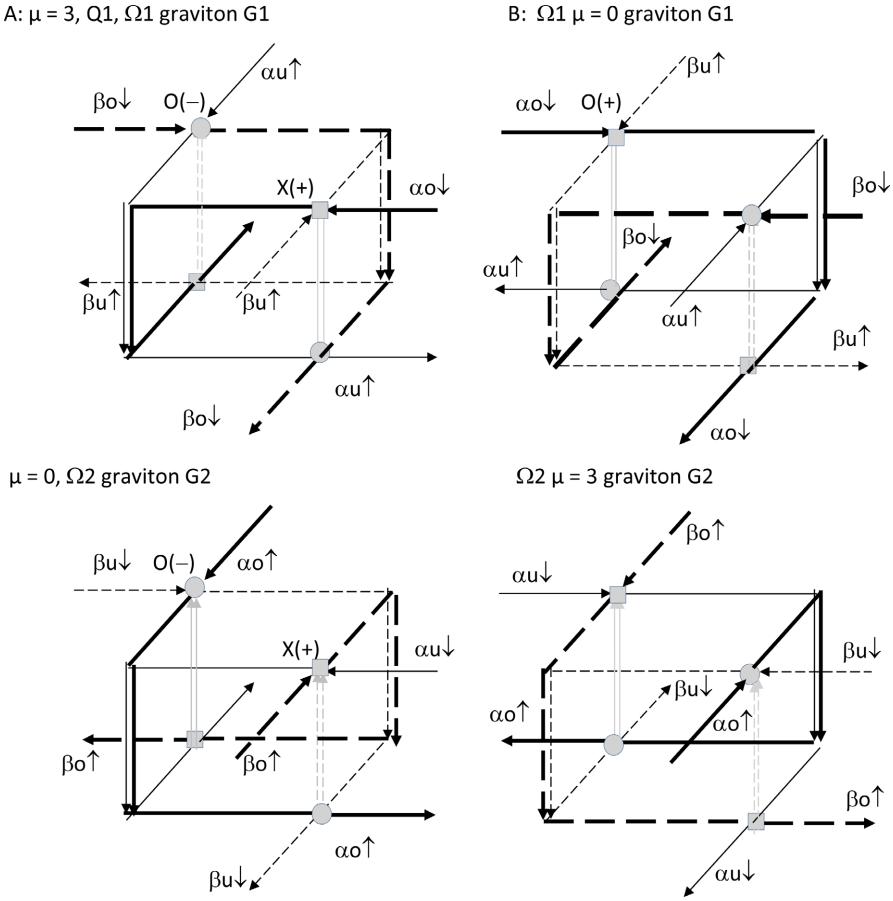

Figure 6. Superposition of gravitons in vacuum using the example of the two longitudinal O-X oscillators. On the left, superposition of $\mu = 3$ cube (top) on $\mu = 0$ cube (bottom); on the right, superposition of the $\mu = 0$ cube (top) on $\mu = 3$ cube (bottom). Reinforced lines show the currents transferred from the basic structure to the gravitons; continuous lines and arrows show positive currents, and discontinuous lines and arrows show negative currents. For interaction geometry and description of the currents, see text. The signals of the mass are converted due to the superposition of G1 and G2 into signals of movement by superimposition.

Due to the Hamiltonian principle, both gravitons G1 and G2 transfer half of the formed information and are absorbed by the sources Q1 and Q2 of the basic structure. Figure 5(B) simulates the absorption of the information after the interaction by the source Q1. As with emission, currents of different signs are superimposed at the interface during absorption. Four currents, αo-βu and αu-βo, are transferred

to the basic structure. After the interaction, the basic structure absorbs the virtual action of motion in the form O(+)-X(−), which leads to a change in motion when processed in vertical correlations.

In Figure 6, it is the information that is transported from the $\mu = 3$ oscillator to the $\mu = 0$ oscillator and back (A) during an oscillation process and the information that is transported from the $\mu = 0$ oscillator to the $\mu = 3$ oscillator and back (B). The information of all oscillators O and X of the two longitudinal (and correspondingly the transverse) oscillators of the four-block of graviton connected to the four-block of the basic structure is transferred to both interaction partners Q1:Ω1:G1:Ω2 and Q2:Ω2:G2:Ω1 in the following state under inversion of the sign. In the interaction region, the information is superimposed in such a way that positive on positive and negative on negative currents are superimposed (Figure 6), where positively activated is transferred to positively non-activated (*i.e.*, the currents carrying the signal zero) and negatively activated to negatively non-activated.

During the return transport in the following state, the information is superimposed with the opposite sign, reversing the sign on the annihilators of the basic structure. Since the superposition of the information of both interacting gravitons leads to the formation of virtual action, and thus the information of the mass is reduced by interaction in the basic structure, forming the information of the motion, the interaction in gravity results in an attraction of the masses.

In contrast to emission, after the interaction in the gravitons, the information is present in both currents o and u; both currents are absorbed and go through the oscillation process as virtual information of the movement of the basic structure, change the movement in the vertical correlations, are emitted as such, superimpose the already existing currents in the gravitons, and are stored by the creators and annihilators of the gravitons. The information stored in the gravitons is realized as energy when the masses hit.

The gravitational interaction therefore causes a movement towards the interaction partner, triggered by the currents in the vertical correlations of the basic structure, forming the virtual action of the motion. The increase in the density of information due to the approximation of the masses therefore has the opposite effect for gravitational attraction compared to charges. However, it has the same effect of reducing the information of the masses, transforming it into information of motion and emission of information from the basic structure into the gravitational network.

For the preservation of the information in the interaction between the masses: The effect of the interaction between the currents during the formation of gravity between masses corresponds to the interaction of the photons between two different charges: in both cases, the virtual action of the motion is formed. In order to restore the state before the interaction, the virtual action must be restored to real action on the photons, and the individual currents of the masses on gravitons must be restored.

5.5. Comparison between Electromagnetism and Gravity

Due to the interaction geometry, the signal carriers of gravity and electromagnetism superimpose alpha and beta according to the same superposition pattern: different propagation directions and different states. This superposition is determined by the Hamiltonian principle and has the consequence that different longitudinal oscillators and different o- and u- currents are superimposed. The superimposed currents are different: in photons of the same charge, currents of the O and X oscillators of the same direction and sign are superimposed; in photons of different charges, currents of the same direction and different signs are superimposed. In the first case, there is an increase in information in the interaction area and, after passing through the vertical correlations, repulsion; in the second case, a decrease in information, and after passing through the vertical correlations, attraction occurs. In the case of gravity, currents of the same direction and sign generated by the superposition of the active and not-active correlations are superimposed in vacuum with currents of the same direction and sign, but without information (zero signal of mass). In all three cases, virtual information of the movement is formed from the considered information: charge, mass, which leads to a change of currents in the vertical correlations and a change in the movement. The change in the direction of movement always takes place in the direction of reducing the information being discussed: attraction, when the information in the interaction area decreases, and repulsion, when the information under consideration is increased. The information resulting from the interaction forms, in the case of electromagnetism and in gravity, a four-block, consisting of the four currents $\alpha u \downarrow$ - $\beta o \uparrow$ (+) and $\alpha u \uparrow$ - $\beta o \downarrow$ (−); the information which is transmitted from the basis structure and is virtual information of movement.

6. Summary

The fundamentals of electromagnetism and gravity are investigated in a common representation by the vector potential on the correlation space. For this purpose, the static photons obtained from the trace of the energy-momentum tensor of the Maxwell fields are used. A model is proposed for mass as a source of gravitation and charge: the basic structure. The basic structure consists of four blocks that are formed by action.

Part (i) analyzes the currents within a basic oscillator of the basic structure. This analysis showed that the four blocks of the basic structure remain unchanged during an interaction, because the changes in the currents, flowing from the creators to the annihilators, are canceled out before the annihilators in the basic structure. The immutability of the sources and sinks of the basic structure in the case of an interaction guarantees the constancy of charge and mass, while the (relativistic) change of velocity is caused by the currents in the vertical correlations; the stores of the information of the motion are located in the photon cloud. This guarantees constancy of charge and mass; the change in motion is caused by currents in the vertical correlations of the basic structure during the absorption of information;

inertia is caused by the differences in the directions of the vertical correlations of active and non-active four-blocks.

In part (ii), "output photons" for electrical and magnetic properties are constructed by creating four parts of the photons, which form the four-dimensional space-time from the one-dimensional space of the basic structure under the conditions of the Hamiltonian principle by induction. The Hamiltonian principle is only fulfilled in the formation of static photons if there is movement in space and time. Electric longitudinal and magnetic transverse "output photons" are therefore two-dimensional with regard to a source of action and each form a virtual action, generated by the currents of the basic structure via the interface to the longitudinal, electric or transverse, magnetic photons. One can assign the μ-coordinates of space-time to them.

In part (iii), the particle and wave properties are assigned to the longitudinal electric output photons and the transverse properties to the magnetic output photons, by showing which currents in the output photons lead to the properties that they also have from the derivation from the energy-momentum tensor of the Maxwell fields. All three properties are formed by the same currents o and u; they are the currents of the alpha and beta four-blocks of the basic structure, which also determine the "output photons".

In part (iv), the signal formation is obtained by superimposing the photons in vacuum; Information during the interaction is created by superimposing different directions of propagation, different states, and four-blocks with different signs of the currents. In an interaction, a distinction must be made between three different parts of the information: the information of the motion, the information of the charge, and the information of the mass. In the formation of the information of the motion, whose sources and sinks are located in the photons themselves, the superposition of the photons leads to the formation of deltas of information in the form of four-blocks. Due to the Hamiltonian principle, these form currents, circulating between the basic structure and photons, to the vertical correlations and to the peripheral four-blocks for E and B fields.

Signal formation in gravity differs from information formation in electromagnetism. Instead of forming four-part photons per state, as in electromagnetism in space-time, three-dimensional networks are formed from the surface of the basic structure in the Maxwell vacuum, which correspond to the network formation in the basic structure, but only contain the information of the mass. In contrast to photons, each four-block contains sources of the action, which becomes four-dimensionally effective when it transitions into space-time. The signals of the mass in the gravitational networks also differ from those in the photons: in the graviton network, the mass only forms components of the information, which only come together in the information of the motion when they interact. In electromagnetism, the currents αo-βu and αu-βo formed by the O-X oscillators of the basic structure are transferred to the photons in all states, where they form the properties for particle, wave, and magnetism in spacetime. The signals in the gravitons,

which originate from mass, are incomplete; in contrast to the photons, they form either o or u currents, which only form the currents αo-βu and αu-βo for the information of the motion when there is an interaction on the correlation space.

This results in a changed interaction mechanism for gravitons compared to photons, in which the peripheral four-blocks contain four-dimensional information and already form information of the motion on the correlation space. In a simplified model, it can be assumed that the graviton network also forms field lines by transferring the information from the peripheral four-blocks to the vertical correlations of the central four-block [7]. For this purpose, the gravitational network is transferred locally from the correlation space into the common space-time of charges and thus into the formation of four graviton parts $\alpha(0/3)$, $\alpha(1/2)$, $\beta(0/3)$ and $\beta(1/2)$, all of which have sources of action in the peripheral four-blocks, but no E and B fields.

Both types of interaction overlap in a vacuum with opposite directions of propagation, between two different states and between the photon/graviton types alpha and beta. The inductive information transfer between the surface of the basic structure and photons/gravitons always takes place for all properties: electric particle, wave, magnetic properties, and gravity through the two currents αo-βu and αu-βo. The signal formation for electromagnetism and gravity is fundamentally different, but the information is always represented by a four-block, and the mechanism of the interaction is very similar. Under the conditions of the Hamiltonian principle, the emission of information, the interaction in the case of superposition in vacuum, the absorption of the information, and the formation of the change in the motion of the objects take place. As a result of the interaction, there is, for all kinds of interactions, a fundamental movement-change direction: The currents in the basic structure of the objects triggered by interaction always move in the direction of the lower information density taken into account. This becomes simple and obvious in the case of the electrical interaction between charges, but it is not trivial in the case of gravity, because the information density increases with the decrease in the distance with attraction. However, the interaction mechanism of gravitons confirms the rule that minimizing the density of information in a vacuum causes the objects to move in relation to each other. If one wants to simulate repulsion in gravity, then the interaction mechanism between the masses must be changed in such a way that the information density increases with the approach of the masses. This is achieved in a simple way by bringing additional information into the interaction area from external sources.

7. Conclusions

The analysis of electromagnetism and gravity on the correlation space allows, based on the Lagrange density of the Maxwell fields and the associated four-dimensional communication relations of quantum mechanics, a uniform representation of both types of interaction with the help of a four-dimensional field (vector potential), the communication relations that represent sources of action and the requirements

of the Hamiltonian principle for minimizing the action. For this purpose, we derived the static photons as three-dimensional structures, consisting of four-dimensional fields from the trace of the energy-momentum tensor of the Maxwell fields.

The structures of static photons in their wave, particle, and magnetic properties turn out to be uniform, consisting of four blocks: the four μ-dimensions of space-time form four unit cubes in the four-block in the static photons, and the peripheral structures of the photons, which form the electric and magnetic fields, also consist of four blocks. From this observation, we derive the assumption that matter is basically made up of four-blocks and that their interaction consists of the exchange of four-blocks. Based on this assumption, we propose to form a so-called basic structure for the mass that forms charge and gravity, which consists solely of nested four-blocks, *i.e.*, of action. The gravitons emitted by the mass then also have structures consisting of four-blocks.

In this report, these assumptions are investigated by analyzing the currents in the basic structure, the interaction of the surface of the basic structure with the Maxwell vacuum with the formation of gravitons and static photons, and the interaction of the static photons and the gravitons in the vacuum under signal formation and signal processing. The basic structure that represents mass consists of action, formed by the communication relations of quantum mechanics. In interaction with the static photons and gravitons, it describes both gravity by detecting inertia and the attractive effect of the interaction, as well as the electric, particle, wave, and magnetic properties.

Mass, like photons, gravitons, and vacuum, has a correlation structure that is formed by action; this structure describes the three properties in gravity and electromagnetism: electromagnetic interactions, gravity, and motion. Changing the movement of objects is done by exchanging information; information is the building block of nature, consisting of a three-dimensional structure formed by four-dimensional fields, on the correlation space caused by the interaction of field components that generate action in oscillations [3].

In the present investigations, the fundamental relationships between electromagnetism and gravity consist in the common basic structure as a model for mass and charge, which, like gravitons and static photons, is built up of four blocks. Under the conditions of the Hamiltonian principle basic structure, photons and gravitons together form interacting, elementary objects.

The joint analysis of gravity and electromagnetism on correlation space also shows the relationship between what happens on correlation space and on space-time. The interpretation of physical reality in space-time requires that both interconnected spaces must be taken into account in their interaction: in the formation and interaction of matter, vacuum and radiation. The analysis of electromagnetism and gravity carried out under this assumption in this report should lead to a modified interpretation in the physics of elementary objects and in cosmology.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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