Structure and Oscillation Behaviour of Photons of Static Maxwell Fields

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Abstract: From the trace of the energy momentum tensor and from covariant four dimensional commutators of communication relations four dimensional correlation structures of photons of static Maxwell fields are developed. Applying these correlation structures all properties of static Maxwell fields, especially the particle, the wave and the magnetic properties, can be simulated.

1 Introduction

Under the assumption that fields forming the Lagrange density and the commutators of communication relations of quantum mechanics, defined in the same space-time point, depend from each other, correlation structures of oscillators for photons of Maxwell fields are constructed on Fourier space, [1, 2]. The construction occurs under the Principle of Simultaneous Contrary Oscillation (PSCO). The PSCO demands that for each current flowing in one direction in the structure of an oscillator in a rest frame, there must exists another residual current with the same amount, the same current sign, flowing in opposite direction. The PSCO is the realization of the third law of Newton for oscillators in a rest frame. From products of the trace of the energy momentum tensor and from products of four dimensional commutators of communication relations of quantum mechanics, represented by the components of the vector potential, the obtained correlations are used in this way to construct structures of photons of Maxwell fields. Two different structures are obtained: such for photons of light and such for photons of static Maxwell fields. The Maxwell photons exists in two versions O and X, which are distinguished between each other by opposite correlation directions, and occur in two oscillation states. The structures can be interpreted as oscillators, therefore.

In the present paper only the structures of the static Maxwell field will be discussed, the structures and their properties of photons of light are discussed in [3]. The structures for static Maxwell fields exists in a combination of the two photons O and X. The three dimensional structures of the static O-X-photons formed from four dimensional components of the vector potential consists of two planes: in one plane - the creator plane - all creators are located and in the annihilator plane all annihilators. The planes are connected with each other by vertical correlations formed by sixteen cubes, obtained from the trace of the energy-momentum tensor. The oscillation of the correlation structure of photons can be explained by a current model. The currents in the correlation structure of oscillators are flowing always from creators of the creator plane to the annihilators of the annihilator plane. It will be shown that using the correlation structures of O-X-photons of static Maxwell fields, all properties of the Maxwell fields can be described, for example the particle properties, the wave properties and the magnetic properties and in addition the photons of Maxwell vacuum.

2 O-X-Photon of Static Maxwell Fields

Each photon O and X of O-X-photons of static Maxwell fields is formed from two parts (1/2) and (0/3), which together consists of ten sets of the components of the vector potential $\{A_\mu, \mu = 0, 1, 2, 3\}$, five positive and five negative. Overlapping the two parts (1/2) and (0/3) in the O-, or X- photons and superimposing the currents in the strings with the same current direction, the properties of the photons O or X are obtained. The photons O and X in the O-X-photon are related to each other by different correlation directions and are characterized by different spin (current) directions. The O and X-photons have common two sets of the vector potential $\{A_\mu, \mu = 0, 1, 2, 3\}$, one positive and one negative. They oscillate between two states Z1 and Z2; the two states are distinguished by different correlation directions and by different signs of the $\mu = 0$ components of the vector potential. The sign of the $\mu = 3$ oscillator is related to the sign of the charge: the positive sign of the $\mu = 3$ oscillator to the positive and the negative sign to the negative charge. Es an example state Z1 of an O-photon of a negative charge is shown in representation (1):

$$
\begin{array}{ccccccccccccc}
B_3 & \to & {}_+A_1 & \leftarrow & B_1 & & & & E_2 & \to & {}_+\mathbf{A}_0 & \leftarrow & E_3 \\
\uparrow & & & & \uparrow & & & & \uparrow & & & & \uparrow \\
{}_-\mathbf{A}_1 & & LO & & {}_-\mathbf{A}_1 & & & & {}_-A_0 & & RO & & {}_-A_0 \\
\downarrow & & & & \downarrow & & & & \Downarrow & & & & \downarrow \\
E_2 & \to & {}_+A_1 & \leftarrow & \partial A_2 & \Leftarrow & {}_-\mathbf{A}_2 & \to & \partial A_0 & \Rightarrow & {}_+\mathbf{A}_0 & \leftarrow & E_1 \\
 & & & & \Downarrow & & OZ1 & & \downarrow & & & & \\
 & & & & {}_+A_2 & & 1/2 & & {}_+A_1 & & & & \\
 & & & & \uparrow & & -0123 & & \Uparrow & & & & \\
B_1 & \to & {}_+A_3 & \Leftarrow & \partial A_3 & \leftarrow & {}_-\mathbf{A}_1 & \Rightarrow & \partial A_1 & \to & {}_+A_2 & \leftarrow & B_2 \\
\uparrow & & & & \Uparrow & & & & \uparrow & & & & \uparrow \\
{}_-\mathbf{A}_3 & & LU & & {}_-\mathbf{A}_3 & & & & {}_-\mathbf{A}_2 & & RU & & {}_-\mathbf{A}_2 \\
\downarrow & & & & \downarrow & & & & \downarrow & & & & \downarrow \\
E_3 & \to & {}_+A_3 & \leftarrow & B_2 & & & & E_1 & \to & {}_+A_2 & \leftarrow & B_3
\end{array}
\tag{1a}
$$

$$
\begin{array}{ccccccccccccc}
B_3 & \to & {}_+\mathbf{A}_2 & \leftarrow & B_1 & & & & E_2 & \to & {}_+\mathbf{A}_3 & \leftarrow & E_3 \\
\uparrow & & & & \uparrow & & & & \uparrow & & & & \uparrow \\
{}_-A_2 & & & & {}_-A_2 & & & & {}_-A_3 & & & & {}_-A_3 \\
\downarrow & & & & \Downarrow & & & & \downarrow & & & & \downarrow \\
E_2 & \to & {}_+\mathbf{A}_2 & \Leftarrow & \partial A_2 & \leftarrow & {}_-\mathbf{A}_0 & \Rightarrow & \partial A_0 & \to & {}_+\mathbf{A}_3 & \leftarrow & E_1 \\
 & & & & \downarrow & & OZ1 & & \Downarrow & & & & \\
 & & & & {}_+\mathbf{A}_3 & & 0/3 & & {}_+A_0 & & & & \\
 & & & & \Uparrow & & -0123 & & \uparrow & & & & \\
B_1 & \to & {}_+A_0 & \leftarrow & \partial A_3 & \Leftarrow & {}_-A_3 & \to & \partial A_1 & \Rightarrow & {}_+\mathbf{A}_1 & \leftarrow & B_2 \\
\uparrow & & & & \uparrow & & & & \Uparrow & & & & \uparrow \\
{}_-\mathbf{A}_0 & & & & {}_-\mathbf{A}_0 & & & & {}_-A_1 & & & & {}_-A_1 \\
\downarrow & & & & \downarrow & & & & \downarrow & & & & \downarrow \\
E_3 & \to & {}_+A_0 & \leftarrow & B_2 & & & & E_1 & \to & {}_+\mathbf{A}_1 & \leftarrow & B_3
\end{array}
\tag{1b}
$$

Arrows describe correlations; they are always directed from a creator to an annihilator. Double arrows describe the correlations received from the commutators of communication relations, the single arrows describe spin correlations. Positive components of the vector potential are marked by bold letters, the other components are negative.

The O-X-photon consists of sixteen cubes E_i, B_i and ∂A_μ describing the E-, B-fields and unity cubes. The cubes are obtained from transforming the trace of the energy-momentum tensor of Maxwell fields into the Fourier space; they are constructed from these correlations under conditions of the PSCO. Fig.1 shows, as an example, the cube B_i in the two oscillation states. The cubes are consisting of four strings, two of them are related to dynamic photons of light with subscripts ij-ji and ji-ij and two to photons of static Maxwell fields with the subscripts ij and ji.

The static Maxwell fields describe the photon cloud of charges. They are staying in a continuous interaction with the oscillators of the corr of elementary objects. In the present paper only the static Maxwell photons are described. Their interaction with oscillators of charges and of masses is discussed in [4, 5].

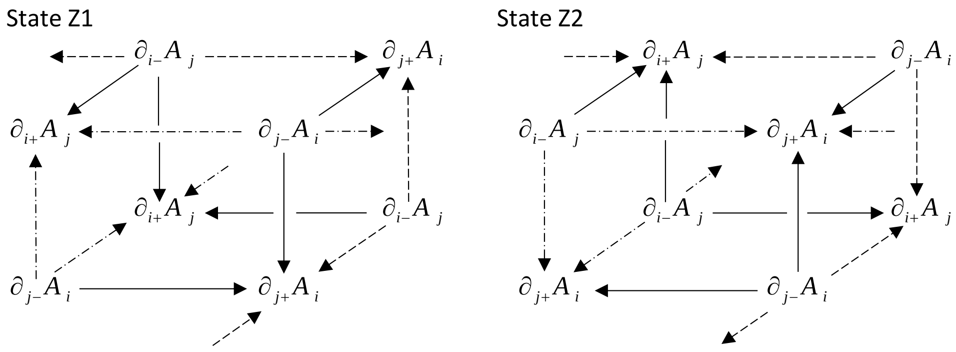

Figure 1: Correlation structure of the B_i cubes of vacuum, received from the trace of the energy- momentum tensor of Maxwell fields. Two string with the subscripts ij and ji for static photons are marked by continuous arrows and the ij-ji and ji-ij for photons of light are marked by discontinuous arrows and with chain-dotted arrows.

3 Representation of Action on Correlation Space

Each of the photons O and X contain one four dimensional commutator of communication relations, which can be positive (like $[A_\mu, \partial_\mu A_\mu]$) or negative (like $[\partial_\mu A_\mu, A_\mu]$). The correlations of the commutators, marked in (1) by double arrows are connected to the unity cubes $\partial A_\mu, \mu = 0, 1, 2, 3$. The unity cube ∂A_0 is shown in fig.2. The correlation strings between vector components, passing the unity cubes, are interpreted as currents. Action is formed by two currents: one positive current between a positive creator $+_- A_0$ of the vector potential components, flowing by a correlation into the unity cube ∂A_0, passing there three correlations and exiting into a correlation with a negative annihilator $-_+ A_0$ of the component of vector potential. A similar negative current is flowing from a negative creator $-_- A_0$ of the vector potential, passing the same cube ∂A_0 and is limiting into a positive annihilator of the vector potential component $+_+ A_0$. The currents flow in two different circulation directions of the path of the photon. A residual current is defined, relating both currents into the negative circulation direction (clockwise).

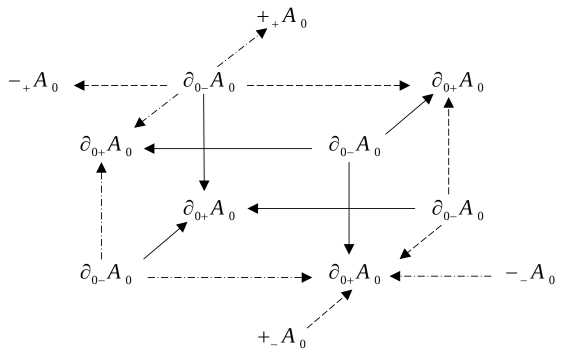

Figure 2: Formation of currents in the ∂A_0- oscillator of the correlation structure of a photon of static Maxwell fields in the oscillation state Z2 with negative action; arrows describe correlations. Chain-dotted and discontinuous arrows describe the two current lines, illustrating the current flow through the unity cubes, forming action. Currents are flowing always from the creator plane to the annihilator plane of the photon.

If this residual current is positive, the action of the oscillator is positive, if the residual current is negative, the action is negative. Reading the μ-correlations of the unity cubes into negative circulation direction, adding the correlation and transforming them back into space time, a commutator of communication relations is obtained; for a positive residual current the commutator results in positive action and for a negative residual current a commutator with negative action. The two currents in (1) are defining the action formed from the two parts (1/2) and (0/3) of the photon:

(1/2): $+_-A_0 \Rightarrow \partial A_0 \Rightarrow -_+A_0$ and (0/3): $+_+A_0 \Leftarrow \partial A_0 \Leftarrow -_-A_0$

The amount of action, generated in the $\mu = 0$ unity cube is determined by the amount of the two interacting components of the vector potential $+A_0$ and $-A_0$. They determine the number of oscillations in the ∂A_0 unity cube during the oscillation phase of the photon. From the O and X photons the following correlations describe the vertical correlations in the cub in fig.2:

$$\begin{array}{ll} \mathrm{O}(1/2){:}\ +\partial_-A_0 \rightarrow -\partial_+A_0, & \mathrm{X}{:}-\partial_+A_0 \leftarrow +\partial_-A_0 \\ \mathrm{O}(0/3){:}\ +\partial_+A_0 \leftarrow -\partial_-A_0, & \mathrm{X}{:}-\partial_-A_0 \rightarrow +\partial_+A_0 \end{array} \qquad (2)$$

They determine the products O: $+\partial A_0 \partial A_0$, or X: $-\partial A_0 \partial A_0$ on space time and are the products between the derivations of the fields in the equations of movement, while the similar horizontal correlations in the cubes contribute to the stability of the μ-unity directions.

There are two oscillation states of strings, forming commutators of communication relations (action), [4]. These two states follow from each other, by inverting the correlation directions; for the $\mu = 0$ oscillator in addition the sign of the currents, which is connected with the change of sign of action. The oscillation state Z1 is defined as positive action (positive residual currents), created by the commutator $[A_0, \partial_0 A_0]$, and the state Z2 as negative action (residual currents negative), formed by the commutator $[\partial_0 A_0, A_0]$. With the oscillation of the $\mu = 0$ oscillator, the whole Maxwell photon oscillate by changing correlation directions (current directions). In photons of static Maxwell fields all components of the vector potential A_0 change in addition their signs. The oscillation of the $\mu = 0$ oscillator can be interpreted as an interaction of the sign between two components of the vector potential $+A_0 \rightleftharpoons -A_0$. In photons of dynamic Maxwell fields (photons of light, [3]), all correlation directions and all components of the vector potential A_μ change their signs with the change of state, which is forced by the $\mu = 0$ oscillator.

4 Particle Properties

The photons of static Maxwell fields with particle properties are the photons of positive and negative charges. Photons of positive charge are active with real action in particle state Z2 with a positive $\mu = 3$ and a negative $\mu = 0$ oscillator; in state Z1 these photons are completely deleted by destructive interference with spin correlations. Photons of negative charges are active with real action in particle state Z1 with a negative $\mu = 3$ and a positive $\mu = 0$ oscillator; they are completely deleted by destructive interference with spin correlations in exchange state Z2.

The photons of static Maxwell fields of different objects interact in particle properties in the photon cloud by superposition and exchange of information. If two interacting O-X-photons with different action O-X and O+Δ-X+Δ overlap, under conditions of action minimization they separate under formation of two photons with the same action: O+Δ-X and O-X+Δ. This reaction describes the third law of Newton, because after interaction between two objects each of the interacting partners absorbs the same amount of action difference (the delta Δ of action, which is a four dimensional commutator).

The currents in vertical correlations in the cubes (2) are annihilating each other in a rest frame. If a delta of action is absorbed by the mass-oscillators, it is contained only in an O or X photon and changes the currents only in the vertical correlation (2) of one of the photons O or X. The change of action causes a change of the canonical momenta in oscillators of the object and the object changes its rest frame. During an interaction of the modified static electric photons with mass oscillators of particle and anti-particle, the oscillator pass four times with an absorbed delta of action the exchange state and the particle state of charge or mass oscillators, under a change of canonical momenta. Action, determining the rest frame of masses and charges, is virtually stored (stored in different memories with different signs) in the oscillators of mass-objects and in their photon cloud.

As an example of static photons with particle properties the correlation structure in state Z1 of a photon of positive charge is shown (for saving space only the central part of the photon structure is depicted)

$$\begin{array}{ccccccccc}
 & & {}_{-}A_1 & & & & {}_{-}A_0 & & \\
 & & \downarrow & & & & \Downarrow & & \\
{}_{+}\mathbf{A}_1 & \leftarrow & \partial A_2 & \Leftarrow & {}_{-}A_2 & \rightarrow & \partial A_0 & \Rightarrow & {}_{+}\mathbf{A}_0 \\
 & & \Downarrow & & OZ1 & & \downarrow & & \\
 & & {}_{+}\mathbf{A}_2 & & 1/2 & & {}_{+}\mathbf{A}_1 & & \\
 & & \uparrow & & + & & \Uparrow & & \\
{}_{+}\mathbf{A}_3 & \Leftarrow & \partial A_3 & \leftarrow & {}_{-}A_1 & \Rightarrow & \partial A_1 & \rightarrow & {}_{+}\mathbf{A}_2 \\
 & & \Uparrow & & & & \uparrow & & \\
 & & {}_{-}A_3 & & & & {}_{-}A_2 & &
\end{array}
\qquad
\begin{array}{ccccccccc}
 & & {}_{-}\mathbf{A}_2 & & & & {}_{-}\mathbf{A}_3 & & \\
 & & \Downarrow & & & & \downarrow & & \\
{}_{+}A_2 & \Leftarrow & \partial A_2 & \leftarrow & {}_{-}\mathbf{A}_0 & \Rightarrow & \partial A_0 & \rightarrow & {}_{+}A_3 \\
 & & \downarrow & & OZ1 & & \Downarrow & & \\
 & & {}_{+}A_3 & & 0/3 & & {}_{+}A_0 & & \\
 & & \Uparrow & & + & & \uparrow & & \\
{}_{+}A_0 & \leftarrow & \partial A_3 & \Leftarrow & {}_{-}\mathbf{A}_3 & \rightarrow & \partial A_1 & \Rightarrow & {}_{+}A_1 \\
 & & \uparrow & & & & \Uparrow & & \\
 & & {}_{-}\mathbf{A}_0 & & & & {}_{-}\mathbf{A}_1 & &
\end{array}$$

$$\begin{array}{ccccccccc}
 & & {}_{+}A_1 & & & & {}_{+}A_0 & & \\
 & & \uparrow & & & & \Uparrow & & \\
{}_{-}\mathbf{A}_1 & \rightarrow & \partial A_2 & \Rightarrow & {}_{+}A_2 & \leftarrow & \partial A_0 & \Leftarrow & {}_{-}\mathbf{A}_0 \\
 & & \Uparrow & & XZ1 & & \uparrow & & \\
 & & {}_{-}\mathbf{A}_2 & & 1/2 & & {}_{-}\mathbf{A}_1 & & \\
 & & \downarrow & & + & & \Downarrow & & \\
{}_{-}\mathbf{A}_3 & \Rightarrow & \partial A_3 & \rightarrow & {}_{+}A_1 & \Leftarrow & \partial A_1 & \leftarrow & {}_{-}\mathbf{A}_2 \\
 & & \Downarrow & & & & \downarrow & & \\
 & & {}_{+}A_3 & & & & {}_{+}A_2 & &
\end{array}
\qquad
\begin{array}{ccccccccc}
 & & {}_{+}\mathbf{A}_2 & & & & {}_{+}\mathbf{A}_3 & & \\
 & & \Uparrow & & & & \uparrow & & \\
{}_{-}A_2 & \Rightarrow & \partial A_2 & \rightarrow & {}_{+}\mathbf{A}_0 & \Leftarrow & \partial A_0 & \leftarrow & {}_{-}A_3 \\
 & & \uparrow & & XZ1 & & \Uparrow & & \\
 & & {}_{-}A_3 & & 0/3 & & {}_{-}A_0 & & \\
 & & \Downarrow & & + & & \downarrow & & \\
{}_{-}A_0 & \rightarrow & \partial A_3 & \Rightarrow & {}_{+}\mathbf{A}_3 & \leftarrow & \partial A_1 & \Leftarrow & {}_{-}A_1 \\
 & & \downarrow & & & & \Downarrow & & \\
 & & {}_{+}\mathbf{A}_0 & & & & {}_{+}\mathbf{A}_1 & &
\end{array}$$

In state Z1 of the O-X-photon of positive charge all overlapping currents annihilate each other between the parts (1/2) and (0/3) of the photon; the photon is carrying only virtual action. In this state the photon is interacting with the mass oscillators, submitting their (real) change of action after an interaction in the photon cloud. In state Z2 the O-X(+) photons are active with real action in longitudinal oscillators, generating the electric charge. (The interaction of a charge or a mass with a homogeneous electric or gravitational gradient is different to the interaction between two charges or between two masses; this is discussed in [5].)

The O-X-photon has particle properties, because only one of the two oscillation states is active, with real action different from zero, the other oscillation state is deactivated: overlapping both states simulating interference no change of action occurs. The interaction between two objects occurs under exchange of action contained in a four dimensional oscillator. The interaction takes place under validity of the three laws of Newton and the exchange of information between two objects is symmetric. The four dimensional oscillator, contained in the photons of static Maxwell fields we consider to be the physical information, being exchange during interaction. Because this four dimensional oscillator describes all properties of elementary objects and as a delta of action is exchanged during an interaction between the oscillators, the presented formalism we call the Physical Information Theory (PIT), [4].

5 Wave Properties

From photons of static electric Maxwell fields with particle properties photons of Maxwell fields with wave properties can be formed. These are the following photons:

$\mathrm{W1}_\alpha = \mathbf{OZ1}(+)\&\mathrm{XZ1}(-)$ $\mathrm{W2}_\alpha = \mathrm{OZ2}(+)\&\mathbf{XZ2}(-)$
$\mathrm{W1}_\beta = \mathrm{OZ1}(-)\&\mathbf{XZ1}(+)$ $\mathrm{W2}_\beta = \mathbf{OZ2}(-)\&\mathrm{XZ2}(+)$.

The photons with wave properties consists of O and X photons in the same oscillation state and with different sign of action in the $\mu = 3$ oscillator (described in brackets). The states W1 and W2 are characterized by virtual action, which in rest frame of the wave is formed from the real action of the photons O and X with electric properties of positive and negative action. In relation to a different rest frame, the states W1 are positive in the $\mu = 0$ and $\mu = 3$ oscillators and negative in states W2. Positive action in state W1 is formed in relation to another rest frame, because in this state the O or X photons with negative action are deleted by destructive interference and in state W2 the positive action of the O or X photons are in a same way annihilated. The active photons in relation to a different rest frame are marked by bold letters. Simultaneously with the oscillation of the static Maxwell photons with wave properties in photon cloud, the mass oscillators are oscillating in a wave modus in the two exchange states W1 and W2, which differ from the oscillation modus of mass oscillators in particle properties, [4]. The states W1 and W2 are occupied in wave properties by particles, anti-particles and neutral particles. This explains the wave properties of complex molecules.

In following two oscillation states of static photons with wave properties are shown:

$\mathrm{W1} = \mathrm{OZ1}(-)\&\mathrm{XZ1}(+)$, $\mathrm{W2} = \mathrm{OZ2}(-)\mathrm{XZ2}(+)$

oscillation state W1 (only XZ1(+) is shown):

$$
\begin{array}{cccccccccccccccccc}
 & & {}_+A_1 & & & & {}_+A_0 & & & & & {}_+\mathbf{A}_2 & & & & {}_+A_3 & & \\
 & & \uparrow & & & & \Uparrow & & & & & \Uparrow & & & & \uparrow & & \\
{}_-\mathbf{A}_1 & \rightarrow & \partial A_2 & \Leftarrow & {}_-\mathbf{A}_2 & \rightarrow & \partial A_0 & \Leftarrow & {}_-\mathbf{A}_0 & {}_-A_2 & \Rightarrow & \partial A_2 & \rightarrow & {}_+\mathbf{A}_0 & \Leftarrow & \partial A_0 & \leftarrow & {}_-\mathbf{A}_3 \\
 & & \Downarrow & & XZ1 & & \downarrow & & & & & \uparrow & & XZ1 & & \Uparrow & & \\
 & & {}_+A_2 & & 1/2 & & {}_+A_1 & & & & & {}_-A_3 & & 0/3 & & {}_-A_0 & & \\
 & & \uparrow & & +03 & & \Uparrow & & & & & \Downarrow & & +03 & & \downarrow & & \\
{}_-\mathbf{A}_3 & \Rightarrow & \partial A_3 & \leftarrow & {}_-\mathbf{A}_1 & \Rightarrow & \partial A_1 & \leftarrow & {}_-\mathbf{A}_2 & {}_+\mathbf{A}_0 & \leftarrow & \partial A_3 & \Rightarrow & {}_+\mathbf{A}_3 & \leftarrow & \partial A_1 & \Leftarrow & {}_-A_1 \\
 & & \Downarrow & & & & \downarrow & & & & & \uparrow & & & & \Downarrow & & \\
 & & {}_+A_3 & & & & {}_+A_2 & & & & & {}_-A_0 & & & & {}_+\mathbf{A}_1 & &
\end{array}
$$

oscillation state W2 (only OZ2(−) is shown):

$$
\begin{array}{cccccccccccccccccc}
 & & {}_+\mathbf{A}_1 & & & & {}_+\mathbf{A}_0 & & & & & {}_+A_2 & & & & {}_+\mathbf{A}_3 & & \\
 & & \uparrow & & & & \Uparrow & & & & & \Uparrow & & & & \uparrow & & \\
{}_-A_1 & \rightarrow & \partial A_2 & \Leftarrow & {}_-A_2 & \rightarrow & \partial A_0 & \Leftarrow & {}_-A_0 & {}_-\mathbf{A}_2 & \Rightarrow & \partial A_2 & \rightarrow & {}_+A_0 & \Leftarrow & \partial A_0 & \leftarrow & {}_-A_3 \\
 & & \Downarrow & & OZ2 & & \downarrow & & & & & \uparrow & & OZ2 & & \Uparrow & & \\
 & & {}_+\mathbf{A}_2 & & 1/2 & & {}_+\mathbf{A}_1 & & & & & {}_-\mathbf{A}_3 & & 0/3 & & {}_-\mathbf{A}_0 & & \\
 & & \uparrow & & -03 & & \Uparrow & & & & & \Downarrow & & -03 & & \downarrow & & \\
{}_-A_3 & \Rightarrow & \partial A_3 & \leftarrow & {}_-A_1 & \Rightarrow & \partial A_1 & \leftarrow & {}_-A_2 & {}_+A_0 & \leftarrow & \partial A_3 & \Rightarrow & {}_+A_3 & \leftarrow & \partial A_1 & \Leftarrow & {}_-\mathbf{A}_1 \\
 & & \Downarrow & & & & \downarrow & & & & & \uparrow & & & & \Downarrow & & \\
 & & {}_+\mathbf{A}_3 & & & & {}_+\mathbf{A}_2 & & & & & {}_-\mathbf{A}_0 & & & & {}_+A_1 & &
\end{array}
$$

Interference: The photons W1 and W2 show wave properties, because they have in relation to another rest frame in state W1 positive real action and in state W2 negative real action: Overlapping both states, all currents in the correlation structure cancel to zero.

The following two oscillation states form the atomic orbitals:

$$A1 = W1_\alpha + W2_\beta = OZ1(+)\&XZ1(-) + OZ2(-)\&XZ2(+)$$

$$A2 = W1_\beta + W2_\alpha = OZ1(-)\&XZ1(+) + OZ2(+)\&XZ2(-)$$

For the oscillation between two states A1 and A2 equal number of photons of positive and negative charge must take part. In an oscillation between A1 and A2 action is always virtual in a rest frame and there is no interaction with other photons, especially no emission of radiation. This explains the stability of atomic orbitals.

6 Magnetic Properties

From photons of static electric Maxwell fields with particle properties also the photons of magnetic fields can be obtained. They are formed by the photons:

magnetic field line:
M1 = OZ1(+)&XZ2(−)
M2 = OZ2(−)&XZ1(+)

electric field line:
E1 = OZ1(−)&XZ2(+)
E2 = OZ2(+)&XZ1(−)

The magnetic photons, generated from static currents in a conductor, contain in a rest frame also only virtual action, because they formed from photons of negative and positive charges. In each oscillation state of the photons M1 and E1 and so in E2 and M2 the photons O and X have the same correlation directions and different current signs. The photons E1 and E2 are activate in longitudinal direction and the photons M1 and M2 are activate in transversal direction. The photons are created by currents in a conductor. Because the currents in photons E1 and M1 and similar currents in photons E2 and M2 are parallel and have the same direction, a transfer of action between photons with longitudinal activation into photons with transversal activation occurs; the transversal activation in the M1/M2 photons is forming the magnetic properties, [4]. In contradiction to the electric-particle and wave properties, in which the oscillation states Z1 and Z2 and so W1 and W2 are oscillating in succession, in magnetic properties all four states of photons M1, M2, E1 and E2 are always present in the photon cloud, forming the magnetic field lines. Magnetic field lines are formed by transversal oscillators of the Maxwell photons, which is expressed by the Lorentz force and explains the Aharonov-Bohm effect. The activation of the M1/M2 photons by an oscillating current in a conductor, activates also the longitudinal currents under formation of electromagnetic waves, [4]. Electromagnetic waves have a different correlation structure in comparison to the dynamic photons of light and propagate in the transversal direction of the static photons, activating the fields E_3 and B_3, while the photons of light are active in the fields E_i and B_i, i = 1, 2 (compare structure (1)). In following as an example the magnetic M1 = OZ1(+)&XZ2(−)- photon is shown:

$$
\begin{array}{cccccccccccccccccc}
 & & -\mathbf{A}_1 & & & & -A_0 & & & & & -A_2 & & & & -\mathbf{A}_3 & & \\
 & & \downarrow & & & & \Downarrow & & & & & \Downarrow & & & & \downarrow & & \\
+A_1 & \leftarrow & \partial A_2 & \Leftarrow & -\mathbf{A}_2 & \rightarrow & \partial A_0 & \Rightarrow & +\mathbf{A}_0 & +\mathbf{A}_2 & \Leftarrow & \partial A_2 & \leftarrow & -\mathbf{A}_0 & \Rightarrow & \partial A_0 & \rightarrow & +A_3 \\
 & & \Downarrow & \bigcirc & OZ1 & & \downarrow & & & & & \downarrow & & OZ1 & \bigcirc & \Downarrow & & \\
 & & +A_2 & & 1/2 & & +A_1 & & & & & +A_3 & & 0/3 & & +A_0 & & \\
 & & \uparrow & & + & \bigcirc & \Uparrow & & & & & \Uparrow & \bigcirc & + & & \uparrow & & \\
+\mathbf{A}_3 & \Leftarrow & \partial A_3 & \leftarrow & -\mathbf{A}_1 & \Rightarrow & \partial A_1 & \rightarrow & +A_2 & +A_0 & \leftarrow & \partial A_3 & \Leftarrow & -\mathbf{A}_3 & \rightarrow & \partial A_1 & \Rightarrow & +\mathbf{A}_1 \\
 & & \Uparrow & & & & \uparrow & & & & & \uparrow & & & & \Uparrow & & \\
 & & -A_3 & & & & -\mathbf{A}_2 & & & & & -\mathbf{A}_0 & & & & -A_1 & & \\
 & & -A_1 & & & & -\mathbf{A}_0 & & & & & -\mathbf{A}_2 & & & & -A_3 & & \\
 & & \downarrow & & & & \Downarrow & & & & & \Downarrow & & & & \downarrow & & \\
+\mathbf{A}_1 & \leftarrow & \partial A_2 & \Leftarrow & -A_2 & \rightarrow & \partial A_0 & \Rightarrow & +A_0 & +A_2 & \Leftarrow & \partial A_2 & \leftarrow & -A_0 & \Rightarrow & \partial A_0 & \rightarrow & +\mathbf{A}_3 \\
 & & \Downarrow & \bigcirc & XZ2 & & \downarrow & & & & & \downarrow & & XZ2 & \bigcirc & \Downarrow & & \\
 & & +\mathbf{A}_2 & & 1/2 & & +\mathbf{A}_1 & & & & & +\mathbf{A}_3 & & 0/3 & & +\mathbf{A}_0 & & \\
 & & \uparrow & & - & \bigcirc & \Uparrow & & & & & \Uparrow & \bigcirc & - & & \uparrow & & \\
+A_3 & \Leftarrow & \partial A_3 & \leftarrow & -A_1 & \Rightarrow & \partial A_1 & \rightarrow & +\mathbf{A}_2 & +\mathbf{A}_0 & \leftarrow & \partial A_3 & \Leftarrow & -A_3 & \rightarrow & \partial A_1 & \Rightarrow & +A_1 \\
 & & \Uparrow & & & & \uparrow & & & & & \uparrow & & & & \Uparrow & & \\
 & & -\mathbf{A}_3 & & & & -A_2 & & & & & -A_0 & & & & -\mathbf{A}_1 & &
\end{array}
$$

In a rest frame all currents in the magnetic M1 = OZ1(+)&XZ2(−)- photon are cancelled by an overlap of parallel and equally directed correlations (currents) of different signs.

7 Maxwell Vacuum

In frame of our formalism the vacuum is formed from the Maxwell vacuum, [4]. The Maxwell vacuum is the carrier of all signals between objects, that is the photons of light, the photons of static Maxwell fields and of gravitons. It consists of photons with the same structure, as the active static and dynamic Maxwell photons. Correlation structures of vacuum can be formed with active and deactivated virtual action, but without real action. In photons of Maxwell vacuum with deactivated virtual action the currents with different current signs in unity cubes have the same circulation direction, the currents annihilate each other; the action is deactivated. Photons of vacuum with activated virtual action are obtained by an overlap of photons of positive and negative charges; as discussed in next section, such photons form gravitons. Active and deactivated vacuum photons, as well as photons with real and virtual action can be transferred between each other by fluctuations. The photons of Maxwell vacuum interact with photons of active static and dynamic Maxwell fields by superposition and induction. Photons of Maxwell vacuum are able to form transversal networks. Using the proposed concept of Maxwell vacuum, the deflection of light in gravity and the red shift in gravitation is explained, [4]. Es an example in following the static O-X- Photon of Maxwell vacuum V(−) with deactivated virtual action in oscillation state Z1 is shown:

$$
\begin{array}{ccccccccccccccccccc}
 & & +A_1 & & & & +\mathbf{A}_0 & & & & & & -A_2 & & & & -A_3 & & \\
 & & \uparrow & & & & \Uparrow & & & & & & \Downarrow & & & & \downarrow & & \\
-\mathbf{A}_1 & \rightarrow & \partial A_2 & \Rightarrow & +A_2 & \leftarrow & \partial A_0 & \Leftarrow & -A_0 & & +\mathbf{A}_2 & \Leftarrow & \partial A_2 & \leftarrow & -\mathbf{A}_0 & \Rightarrow & \partial A_0 & \rightarrow & +\mathbf{A}_3 \\
 & & \Uparrow & & OZ1 & & \uparrow & & & & & & \downarrow & & OZ1 & & \Downarrow & & \\
 & & -\mathbf{A}_2 & & 1/2 & & -\mathbf{A}_1 & & & & & & +\mathbf{A}_3 & & 0/3 & & +A_0 & & \\
 & & \downarrow & & -V & & \Downarrow & & & & & & \Uparrow & & -V & & \uparrow & & \\
-\mathbf{A}_3 & \Rightarrow & \partial A_3 & \rightarrow & +A_1 & \Leftarrow & \partial A_1 & \leftarrow & -\mathbf{A}_2 & & +A_0 & \leftarrow & \partial A_3 & \Leftarrow & -A_3 & \rightarrow & \partial A_1 & \Rightarrow & +\mathbf{A}_1 \\
 & & \Downarrow & & & & \downarrow & & & & & & \uparrow & & & & \Uparrow & & \\
 & & +A_3 & & & & +A_2 & & & & & & -\mathbf{A}_0 & & & & -A_1 & &
\end{array}
$$

$$
\begin{array}{ccccccccccccccccccc}
 & & -\mathbf{A}_1 & & & & -\mathbf{A}_0 & & & & & & +\mathbf{A}_2 & & & & +\mathbf{A}_3 & & \\
 & & \downarrow & & & & \Downarrow & & & & & & \Uparrow & & & & \uparrow & & \\
+A_1 & \leftarrow & \partial A_2 & \Leftarrow & -\mathbf{A}_2 & \rightarrow & \partial A_0 & \Rightarrow & +A_0 & & -A_2 & \Rightarrow & \partial A_2 & \rightarrow & +\mathbf{A}_0 & \Leftarrow & \partial A_0 & \leftarrow & -A_3 \\
 & & \Downarrow & & XZ1 & & \downarrow & & & & & & \uparrow & & XZ1 & & \Uparrow & & \\
 & & +A_2 & & 1/2 & & +A_1 & & & & & & -A_3 & & 0/3 & & -A_0 & & \\
 & & \uparrow & & -V & & \Uparrow & & & & & & \Downarrow & & -V & & \downarrow & & \\
+A_3 & \Leftarrow & \partial A_3 & \leftarrow & -\mathbf{A}_1 & \Rightarrow & \partial A_1 & \rightarrow & +A_2 & & -A_0 & \rightarrow & \partial A_3 & \Rightarrow & +\mathbf{A}_3 & \leftarrow & \partial A_1 & \Leftarrow & -A_1 \\
 & & \Uparrow & & & & \uparrow & & & & & & \downarrow & & & & \Downarrow & & \\
 & & -\mathbf{A}_3 & & & & -\mathbf{A}_2 & & & & & & +\mathbf{A}_0 & & & & +\mathbf{A}_1 & &
\end{array}
$$

For the photons of vacuum with deactivated virtual action is characteristic that all current strings forming action on μ-unity cubes have the same circulation direction and different current signs. Overlapping currents of photons of vacuum, also all fields, being generated in the E_i and B_i cubes are cancelled.

Table 1: Currents in longitudinal oscillators of static photons of particle and anti-particle

particle: O-X(+) anti-particle: O-X(−)

	μ=3	μ=0		μ=3	μ=0
OZ1(+):	(−+)/(+−)	(−+)/(+−)	OZ1(−):	(++)/(−−)	(−+)/(+−)
XZ1(+):	(+−)/(−+)	(+−)/(−+)	XZ1(−):	(−−)/(++)	(+−)/(−+)
OZ2(+):	(+−)/(−+)	(−−)/(++)	OZ2(−):	(−−)/(++)	(−−)/(++)
XZ2(+):	(−+)/(+−)	(++)/(−−)	XZ2(−):	(++)/(−−)	(++)/(−−)

8 Formation of Gravitons by Static Maxwell Fields

Already early in time the possibility was discussed that the Maxwell theory can be able to contribute to an understanding of gravity, [6, 7]. The presented model of interaction delivers a correlation structure, being part of the vacuum, which have the properties of gravitons.

The longitudinal oscillators of particle and anti-particle can be characterized by the currents in their unity cubes $\mu = 3$ and $\mu = 0$. This is shown in table 1. In this representation the currents in the μ- unity cubes are described by the sign of currents with first sign in the brackets and the circulation direction by the second sign in brackets. Overlapping the photons of particle and anti-particle a structures is obtained, which has the properties of gravitons. In general it can be expected that the photons O and X in O-X-photons have the same amount of action, because this property is forced by the conditions of minimization of action (Principle of Hamilton). The structure of gravitons is stable, because it is formed by a reduction of real into activated virtual action. The gravitons have the same current direction and the same current signs as the static photons of charges, but the currents are of much lower amount, as the current of photons created by an overlap of photons of charges with different signs and the gravitons are different to the photons of vacuum with deactivated action. This is shown in fig.3. In the upper part of fig.3 the O-X-photon of the vacuum with deactivated action at left is compared with the structure af a graviton, with activated virtual action, at right. The structures at the first glance are identical. At the lower part of fig.3 the formation of the structures of the vacuum and the structure of the the activated graviton is shown at the example of the X-photon of vacuum left and the X(+) photon of a graviton at right. In the X-photon of the graviton action is formed by two currents with different current signs and different circulation directions, while the two currents with different current signs and the same circulation direction in the X-photon of vacuum annihilate each other. Due to the same structure of

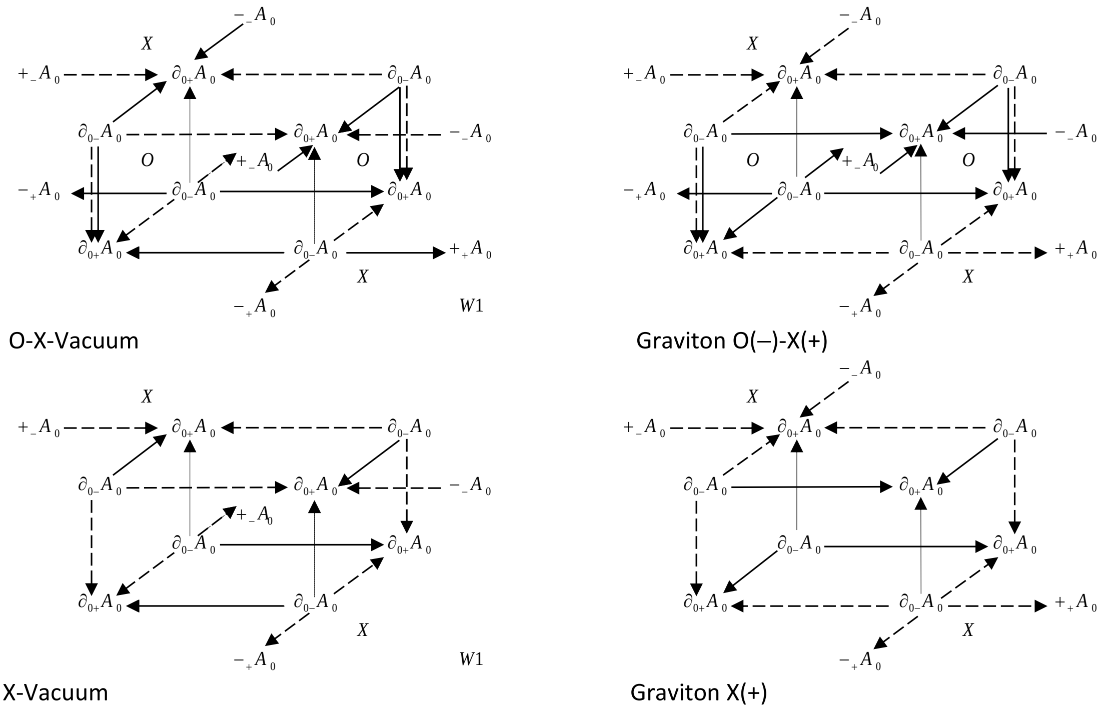

Figure 3: Formation of gravitons and relation to the deactivated vacuum. The strings of the X-photon is described by discontinuous, O-photon with continuous arrows. Arrows symbolize correlations

activated and deactivated vacuum the Maxwell vacuum is formed by an overlap of the two different photons: the photons of deactivated vacuum and the gravitons. It is to distinguished between the overlap of photons of charges with their high content of action, being fitted to the charges and the gravitons, having the same structure, with only a low content of action and being part of the Maxwell vacuum.

In an interaction with matter oscillators the gravitons are separated into O and X photons, which contain real action. The real action is transmitted to the oscillators of matter, where the absorbed real action is processes into a change of canonical momenta. Separating deactivated O-X-photons of vacuum into O and X-photons, they remain deactivated and cannot be absorbed by the matter oscillators. The photons of deactivated vacuum are only carrier of the events, [8], performed with O and X-photons with activated virtual action.

9 Summary and Conclusions

From trace of the energy-momentum tensor of Maxwell fields and from the four dimensional commutators of communication relations correlation structures on Fourier space are obtained for the photons of light and for the photons of static Maxwell fields. In the present paper it is shown that with the structure of photons of static Maxwell fields (in co-oscillation with mass oscillators, discussed in detains in [4, 5]) the properties and electromagnetic interactions can be described; especially the particle and wave properties of material waves, the interaction between particles and antiparticles, the magnetic properties and the Maxwell vacuum. In addition a structure can be proposed, which is characteristic for the gravitons. All described properties of O-X-photons of static Maxwell fields are derived from only one correlation structure, containing always ten sets of components of the vector potential $\{A_\mu, \mu = 0, 1, 2, 3\}$, five positive and five negative and of the 16 cubes, received from the trace of the energy momentum tensor of Maxwell fields in Lorentz gauge.

While on space time the characteristic quantum mechanical effects of quantum mechanical objects cannot be interpreted, the formulation of a correlation space with correlations obtained from the features describing an object on space time, as the Lagrange density and the communication relations, the explanation of theses effects is possible by locality and causality. The wave-particle dualism, for example, finds its interpretation on correlation space by a simple change of correlation structure. The explanation of the wave particle dualism for the photons of light is even simpler: only a change of signs of the transversal components of the vector potential describes on correlation space the transfer between the wave and particle properties, [4]. In a similar way formulation of the photons of magnetic Maxwell fields on correlation space allows the explanation of the Lorentz force, the description of the electromagnetic waves and the interpretation of the Aharonov-Bohm effect. All interactions on correlation space occur causally and locally by superposition (overlap), induction and entanglement.

The discussion of correlation structures of Maxwell fields leads not only to the formulation of the photons of light and of photons of positive and negative charges, applying the properties of the action, generated by the $\mu = 0$ oscillator in a four dimensional photon, also the analysis of properties of the Maxwell vacuum and of gravitons is possible. In an analysis of the interaction of the static photons of charges and the interaction of gravitons with oscillators the same interaction mechanism can be formulated, which is based on interaction between the photons of charges and between gravitons with matter oscillators and which leads to the same change of canonical momenta, [9]. The interaction of gravitons with matter can be applied to different phenomena of gravitation, as the line shift in gravitation, light deflection in gradient of gravitation and others, [4].

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