Action as Foundation in Cosmology

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Abstract: Using action as a part of Maxwell fields, the elementary objects are represented as oscillators formed by correlation structures. Properties and interaction of matter, charges, radiation and vacuum are described under conditions of the principle of Hamilton. In the present paper this method is applied on the formation, the properties and the development of the universe.

1 Introduction

Properties of elementary objects are characterized by physical information, the interaction between the objects by exchange of physical information and the change of properties of the objects after an interaction are described by the exchanged physical information, [1]. As physical information action generated in Maxwell fields is used. Properties and interaction between objects is characterized under conditions of the principle of Hamilton.

The physical information is obtained by transforming the products of fields of the trace of the energy-momentum tensor of Maxwell fields and the fields of the covariant four dimensional commutators of communication relations, [2], both described by the components of the vector potential, into the Fourier space. On Fourier space the products of the fields are form correlations, [3, 4]. It is assumed that all correlations together from the trace and from the commutator are describing the properties of the Maxwell fields. To realize this idea, the obtained correlations are used to construct a correlation structure. For the formation of correlation structures, the correlations are connected between each other under conditions of the third law of Newton. This especially means that in a closed structure formed from correlations for each current generated in one direction, there must be at the same time another residual current with the same sign and the same amount, but of

opposite direction. This condition is called the principle of simultaneous contrary oscillation (abbreviated by PSCO).

The correlation structures are quantized by the introduction of the commutators of communication relations. In this way a general representation of photons of the Maxwell fields are obtained by correlation structures, especially for the photons of light and for the photons of static Maxwell fields. The static Maxwell fields represent the photons of positive and negative charges, as well as the photons of the Maxwell vacuum. The Maxwell vacuum exists in two modifications: as vacuum photons with deactivated virtual action and as photons of activated virtual action. The photons with activated virtual action fulfil the properties of gravitons, [5, 6].

The correlation structures of the photons can be interpreted by currents, [7], flowing between the creator components to the annihilator components of the vector potential. The currents are generated by the $\mu = 0$ unity oscillator in the correlation structure, which oscillate between two states and is the source of positive and negative action in the correlation structure of Maxwell photons. Details will be discussed below.

With the same method as for the construction of Maxwell photons, the correlation structures of mass objects are obtained, using the scalar fields of the Lagrange density and of the covariant four dimensional commutators of scalar communication relations. The scalar correlation structures of the mass objects fulfil also the conditions of the third law of Newton; they are formed by two scalar oscillators O1 and O2, each of them consists of four closed structures with opposite circulation direction and opposite current signs. The scalar oscillators oscillate by the same oscillators, as the photons of Maxwell fields. To each scalar oscillator O1 and O2 one O-X-photon in the photon cloud is related.

The interaction between elementary objects is described in the following steps: The photons of the photon cloud formed by static Maxwell fields of two objects are interacting by an overlap (superposition) under conditions of the third law of Newton by an exchange of information: the information in form of a delta of four dimensional commutators of communication relations is absorbed in mass oscillators under a change of canonical momenta and a storage of information as virtual action.

In this paper the interaction of masses characterized by gravitons will be discussed in their application to questions of cosmology. First further details of the physical information theory (in following abbreviated by PIT) related to gravita-

tion are described and after that the results are applied to different questions of cosmology.

2 Photons of static Maxwell fields

The photons of static Maxwell fields have the structure shown in the relations (1):

$$
\begin{array}{ccccccccccccccc}
B_3 & \leftarrow & {}_-A_1 & \rightarrow & B_1 & & & & E_2 & \leftarrow & {}_-\mathbf{A}_0 & \rightarrow & E_3 & & \\
\downarrow & & & & \downarrow & & & & \downarrow & & & & \downarrow & & \\
{}_+\mathbf{A}_1 & & LO & & {}_+\mathbf{A}_1 & & & & {}_+A_0 & & RO & & {}_+A_0 & & \\
\uparrow & & & & \uparrow & & & & \Uparrow & & & & \uparrow & & \\
E_2 & \leftarrow & {}_-A_1 & \rightarrow & \partial A_2 & \Leftarrow & {}_-A_2 & \rightarrow & \partial A_0 & \Leftarrow & {}_-\mathbf{A}_0 & \rightarrow & E_1 & & \\
 & & & & \Downarrow & & XZ1 & & \downarrow & & & & & & \\
 & & & & {}_+\mathbf{A}_2 & & 1/2 & & {}_+\mathbf{A}_1 & & & & & & (1a) \\
 & & & & \uparrow & & +V & & \Uparrow & & & & & & \\
B_1 & \leftarrow & {}_-\mathbf{A}_3 & \Rightarrow & \partial A_3 & \leftarrow & {}_-A_1 & \Rightarrow & \partial A_1 & \leftarrow & {}_-A_2 & \rightarrow & B_2 & & \\
\downarrow & & & & \Downarrow & & & & \downarrow & & & & \downarrow & & \\
{}_+A_3 & & LU & & {}_+A_3 & & & & {}_+\mathbf{A}_2 & & RU & & {}_+\mathbf{A}_2 & & \\
\uparrow & & & & \uparrow & & & & \uparrow & & & & \uparrow & & \\
E_3 & \leftarrow & {}_-\mathbf{A}_3 & \rightarrow & B_2 & & & & E_1 & \leftarrow & {}_-A_2 & \rightarrow & B_3 & &
\end{array}
$$

$$
\begin{array}{ccccccccccccccc}
B_3 & \leftarrow & {}_-\mathbf{A}_2 & \rightarrow & B_1 & & & & E_2 & \leftarrow & {}_-A_3 & \rightarrow & E_3 & & \\
\downarrow & & & & \downarrow & & & & \downarrow & & & & \downarrow & & \\
{}_+A_2 & & & & {}_+A_2 & & & & {}_+\mathbf{A}_3 & & & & {}_+\mathbf{A}_3 & & \\
\uparrow & & & & \Uparrow & & & & \uparrow & & & & \uparrow & & \\
E_2 & \leftarrow & {}_-\mathbf{A}_2 & \Rightarrow & \partial A_2 & \leftarrow & {}_-A_0 & \Rightarrow & \partial A_0 & \leftarrow & {}_-A_3 & \rightarrow & E_1 & & \\
 & & & & \downarrow & & XZ1 & & \Downarrow & & & & & & \\
 & & & & {}_+\mathbf{A}_3 & & 0/3 & & {}_+\mathbf{A}_0 & & & & & & (1b) \\
 & & & & \Uparrow & & -V & & \uparrow & & & & & & \\
B_1 & \leftarrow & {}_-A_0 & \rightarrow & \partial A_3 & \Leftarrow & {}_-A_3 & \rightarrow & \partial A_1 & \Leftarrow & {}_-\mathbf{A}_1 & \rightarrow & B_2 & & \\
\downarrow & & & & \downarrow & & & & \Downarrow & & & & \downarrow & & \\
{}_+\mathbf{A}_0 & & & & {}_+\mathbf{A}_0 & & & & {}_+A_1 & & & & {}_+A_1 & & \\
\uparrow & & & & \uparrow & & & & \uparrow & & & & \uparrow & & \\
E_3 & \leftarrow & {}_-A_0 & \rightarrow & B_2 & & & & E_1 & \leftarrow & {}_-\mathbf{A}_1 & \rightarrow & B_3 & &
\end{array}
$$

This structure is characteristic for all photons of static Maxwell fields, that is for photons of positive and negative charges and for photons forming the vacuum with activated and deactivated vacuum. The arrows in this structure describe correlations, the double arrows correlations of the fields obtained from the commutators of communication relations. The letters E_i and B_i describe the electric

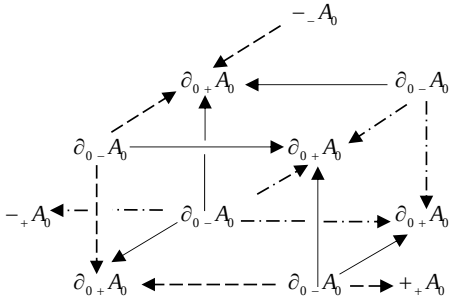
fields E_i and magnetic fields B_i and ∂A_μ the four unities of the Maxwell fields. The E_i and B_i and ∂A_μ fields form in the correlation structure three dimensional cubes on the correlation space; the sixteen cubes E_i and B_i and ∂A_μ are obtained from the trace of the energy momentum tensor of Maxwell fields in Lorentz gauge, [8]. The bold letters in the relations (1) describe positive and the other letters negative components of the vector potential.

The photons of static Maxwell fields are consisting of O-X-structures. Relations (1) represent the X-photon of deactivated virtual vacuum. From the X-photon (1) the O-photon is obtained by inverting all correlation directions. Each O and each X part of the static O-X-photons are formed by the two parts (1/2) and (0/3), which always overlap; in (1) they are shown separately. The photons O and X represent two spin directions. The O-X-photons consists, beside of the sixteen cubes E_i and B_i and ∂A_μ, of ten sets of components of the vector potential $\{A_\mu \mu = 0, 1, 2, 3\}$, five positive and five negative; two of them one positive and one negative are common to both photons O and X. The O-X-photons oscillate between two oscillation states: in state Z1 of photons of charges the $\mu = 0$ components of the vector potential are positive and in state Z2 negative. The $\mu =$ i components represent the charge: for positive charge the components $\mu =$ i are positive and for negative charge negative. The $\mu = 0$ oscillator can be also interpreted as an interaction between a positive $+A_0$ and a negative $-A_0$ component, resulting in an oscillation between two signs of action: state Z1: $+A_0 \rightleftharpoons -A_0$ and state Z2: $-A_0 \rightleftharpoons +A_0$, [9].

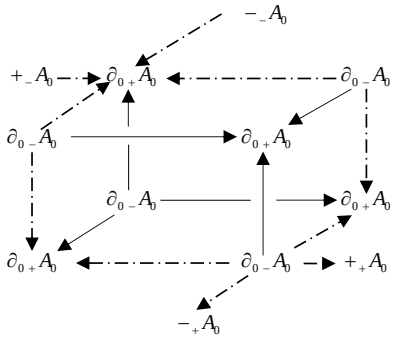
3 Source of Action, the $\mu = 0$ Oscillator

In fig.1(a)-(d) the structure of different unity cubes ∂A_0 and in (e) and (f) two oscillation states of the cubes E_i and B_i are shown. Each cube consists of twelve correlations; the sixteen cubes form together the trace of the energy momentum tensor, which contains 192 products between the partial derivations of the components of the vector potential. The E_i cubes are formed by i0 and 0i correlations, the B_i cubes by the ij and ji correlations and the unity cubes ∂A_μ by the $\mu\mu$ correlations.

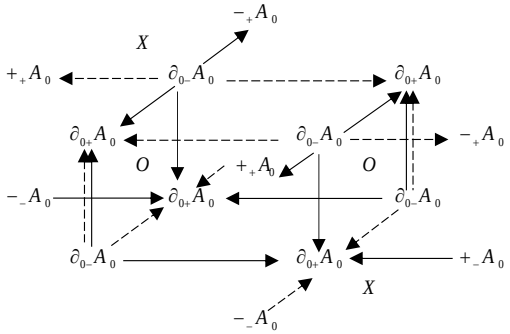
The cubes in the correlation structure of Maxwell photons are connected to the components of the vector potential. The unity cubes ∂A_μ are connected to the components A_μ and form the correlations of the commutators of communication relations. It is assumed that the $\mu = 0$ commutator is the source of action. The commutators are formed from two correlation strings between a positive or negative creator of components of the vector potential $\pm\_A_\mu$ and of a negative or



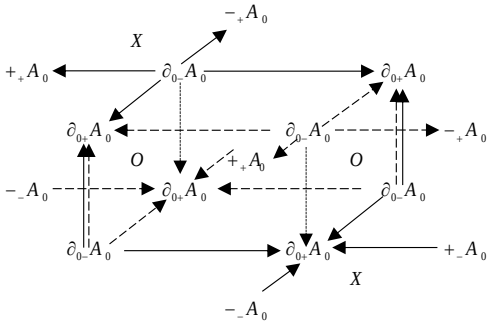
(a) ∂A_0- vacuum



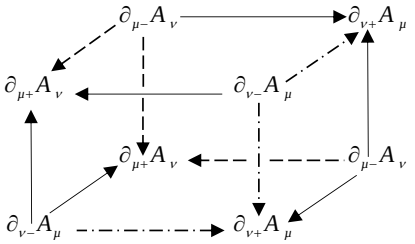
(b) μ = 0 communication relation



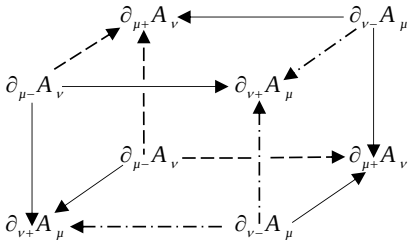
(c) O-X- vacuum



(d) O(–)-X(+)-graviton



(e) State Z1



(f) State Z2

Figure 1: (a) to (d) $\mu = 0$ unity cubes, (e) and (f) cubes for the fields E_i and B_i. (a) $\mu = 0$ cube of a photon of deactivated vacuum, (b) $\mu = 0$ commutator of a X(+)-photon, (c) O-X-photon of activated vacuum, (d) $\mu = 0$ oscillator of an O(−)-X(+) graviton.

positive annihilator of the component of the vector potential $\mp_+ A_\mu$, respectively. The strings between creator and annihilator are interpreted as currents flowing during a change of state from creator to the annihilator: a positive creator defines a positive current and a negative creator a negative current. The signs and the circulation direction of the currents determine the properties of action generated in the $\mu = 0$ oscillator. The two currents at unity cubes are always of different current sign. A residual current is defined relating both currents to the negative circulation direction (clockwise).

If the two currents have a different circulation direction in the path of the correlation structure, the residual currents form positive or negative (real) action. If the two currents have the same circulation direction, they cancel each other; the action is virtual deactivated. The positive residual current form in the $\mu = 0$ oscillator positive action and the negative residual current form negative action. This can be shown by transforming the correlations of the commutators of communication relations back to space time. The vertical correlations in the cubes describe the products between the derivations of functions in the dynamic equations and in the Lagrange density.

In each O and X-photons a four dimensional commutator is present. If the $\mu = 0$ oscillator have in the O-X-photons in both photons O and X different signs of the residual current, and the amount of action in both photons is the same, the currents annihilate each other, the residual currents form in these O-X- photons activated virtual action. The same amount of action in O- and X-photons is always formed under conditions of action minimization (Principle of Hamilton). It will be shown that O-X-photons with activated virtual action have the properties of gravitons.

In fig.1 the different properties of the $\mu = 0$ oscillator are depicted. In fig.1a the $\mu = 0$ oscillator with deactivated virtual action is shown. The two currents with different current signs have in the path of the photon the same circulation direction: the currents annihilate each other; the transfer of the correlation back to space time results in products of the commutator which annihilate each other. In fig.1b the same currents have in the path of the photons different circulation directions, the residual currents related to negative circulation direction (clockwise) results on space time in a positive commutator. In figures 1(c) and (1d) two O-X-photons are compared: in fig.1c the photons O and X have properties of the photons with deactivated virtual action and in fig.1d the photons O and X have real action in the O-photon with negative action (negative residual currents) and in the X-photon with positive residual currents. The photon in fig.1d form a

graviton. As can be seen by comparing the fig.1c and fig.1d, the structures and the current signs are identical; in detail they differ in the propagation of the currents through the cubes (fig.1a and fig.1b). Booth photons of fig.1c and of fig.1d overlap and form the Maxwell vacuum. While the photons with deactivated virtual action in fig.1c are the environment on which all interactions occur, the photons in fig.1d are transporting action and are the basis of gravitation. This will be discussed in the following sections.

4 Oscillators of Charges and Matter

The static photons of charges and of gravitons are interacting with matter oscillators. As an example two oscillation states of the $\mu = 0$ oscillator for a particle with particle properties are depicted in the following relations

$\mu = 0$ oscillator, state Z1(1)

O1: Z1-LS RS

$_{-}\Phi$	$\Leftarrow -$	$_{+}\varphi^{\dagger}$	$_{+}\Phi^{\dagger}$	$+ \Rightarrow$	$_{+}\varphi$
$\uparrow$	$\mu 1$	$\downarrow$	$\downarrow$	$\mu 1$	$\uparrow$
$_{+}\varphi^{\dagger}$	$- \Rightarrow$	$_{+}\Phi$	$_{+}\varphi$	$\Leftarrow +$	$_{-}\Phi^{\dagger}$
G	$X(0/3)$			$X(1/2)$	
$_{-}\varphi$	$\Leftarrow +$	$_{-}\Phi^{\dagger}$	$_{-}\varphi^{\dagger}$	$- \Rightarrow$	$_{+}\Phi$
$\uparrow$	$\mu 2$	$\downarrow$	$\downarrow$	$\mu 2$	$\uparrow$
$_{+}\Phi$	$+ \Rightarrow$	$_{-}\varphi$	$_{-}\Phi$	$\Leftarrow -$	$_{-}\varphi^{\dagger}$
o **B**	O(1/2)			O(0/3)	

Z1(1) = O(−)-X(+)

O2: Z1-LS RS

$_{-}\varphi^{\dagger}$	$- \Rightarrow$	$_{+}\Phi$	$_{+}\varphi$	$\Leftarrow +$	$_{+}\Phi^{\dagger}$
$\downarrow$	$\mu 1$	$\uparrow$	$\uparrow$	$\mu 1$	$\downarrow$
$_{+}\Phi$	$\Leftarrow -$	$_{+}\varphi^{\dagger}$	$_{+}\Phi^{\dagger}$	$+ \Rightarrow$	$_{-}\varphi$
E	$X(0/3)$			$X(1/2)$	
$_{-}\Phi^{\dagger}$	$+ \Rightarrow$	$_{-}\varphi$	$_{-}\Phi$	$\Leftarrow -$	$_{+}\varphi^{\dagger}$
$\downarrow$	$\mu 2$	$\uparrow$	$\uparrow$	$\mu 2$	$\downarrow$
$_{+}\varphi$	$\Leftarrow +$	$_{-}\Phi^{\dagger}$	$_{-}\varphi^{\dagger}$	$- \Rightarrow$	$_{-}\Phi$
D	O(1/2)			O(0/3)	

Z1(1) = O(+)-X(−)

$\mu = 0$ oscillator, state Z2(1)

O1: Z2-LS RS

$_{-}\varphi^{\dagger}$	$- \Rightarrow$	$_{+}\Phi$	$_{+}\varphi$	$\Leftarrow +$	$_{+}\Phi^{\dagger}$
$\downarrow$	$\mu 1$	$\uparrow$	$\uparrow$	$\mu 1$	$\downarrow$
$_{+}\Phi$	$\Leftarrow -$	$_{+}\varphi^{\dagger}$	$_{+}\Phi^{\dagger}$	$+ \Rightarrow$	$_{-}\varphi$
G	$X(0/3)$			$X(1/2)$	
$_{-}\Phi^{\dagger}$	$+ \Rightarrow$	$_{-}\varphi$	$_{-}\Phi$	$\Leftarrow -$	$_{+}\varphi^{\dagger}$
$\downarrow$	$\mu 2$	$\uparrow$	$\uparrow$	$\mu 2$	$\downarrow$
$_{+}\varphi$	$\Leftarrow +$	$_{-}\Phi^{\dagger}$	$_{-}\varphi^{\dagger}$	$- \Rightarrow$	$_{-}\Phi$
o **B**	O(1/2)			O(0/3)	

Z2(1) = O(+)-X(−)

O2: Z2-LS RS

$_{-}\Phi$	$\Leftarrow -$	$_{+}\varphi^{\dagger}$	$_{+}\Phi^{\dagger}$	$+ \Rightarrow$	$_{+}\varphi$
$\uparrow$	$\mu 1$	$\downarrow$	$\downarrow$	$\mu 1$	$\uparrow$
$_{+}\varphi^{\dagger}$	$- \Rightarrow$	$_{+}\Phi$	$_{+}\varphi$	$\Leftarrow +$	$_{-}\Phi^{\dagger}$
E	$X(0/3)$			$X(1/2)$	
$_{-}\varphi$	$\Leftarrow +$	$_{-}\Phi^{\dagger}$	$_{-}\varphi^{\dagger}$	$- \Rightarrow$	$_{+}\Phi$
$\uparrow$	$\mu 2$	$\downarrow$	$\downarrow$	$\mu 2$	$\uparrow$
$_{+}\Phi$	$+ \Rightarrow$	$_{-}\varphi$	$_{-}\Phi$	$\Leftarrow -$	$_{-}\varphi^{\dagger}$
D	O(1/2)			O(0/3)	

Z2(1) = O(−)-X(+)

In the scalar oscillators the currents of the O and X photons with their two parts (1/2) and (0/3) already are introduced. Each scalar oscillators O1 and O2 consists of the two scalar field- field products $\varphi^{\dagger}\varphi$ and $\varphi\varphi^{\dagger}$ and of an O-X-photon with ac-

tivated virtual action. For an interaction with the photons of static Maxwell fields or with gravitons the currents of the photons and of the scalar oscillators must be equally directed. Photons and gravitons are connected with the scalar oscillators under conditions of minimization of action with their $\mu = 0$ oscillators. The oscillators for charges and for matter are the same; they differ in their four dimensional structure and in their formation of objects.

5 Formation of Gravitons and Interaction with Mass Oscillators

The gravitons are formed from photons of static Maxwell fields. In photons of charges the $\mu = 0$ oscillator leads to positive action in oscillation state Z1 and to negative action in oscillation state Z2. Gravitons consisting of O- and X-photons can be formed from photons of static Maxwell fields, if action and circulation directions of currents are opposite in the contributing photons O and X. To form all combinations of O-X-photons with these properties, the $\mu = 0$ oscillator must oscillate also between a negative action value in oscillation state Z1 and a positive value in state Z2.

The interaction of masses with gravitons in gravitation occurs in similar way as the interaction between two charges: matter objects contain oscillators of charges and of masses. The charge oscillators consists of a photon cloud and the additional masses consists of gravitons in a "graviton cloud". The mass-oscillators are interacting with the gravitons of the vacuum, similar as the photons of static Maxwell fields are interacting with the oscillators of charges. After a description of the formation of gravitons the interaction of the gravitons with the photons of the photon cloud will be discussed. The interaction between gravitons of masses and gravitons of the gravitational field occur in a similar way, [10].

5.0.1 Formation of gravitons from photons of static Maxwell fields

Particle and anti-particle oscillate in two oscillation states. The state in which action is absorbed from the photon cloud into the scalar oscillator is called the exchange state (state in which information is exchanged) and the state in which the absorbed information is processed by the scalar oscillators is called the particle state (particle state, because this state is only active in particle and not in wave properties). The static photons of particle and anti-particle have the following properties in the longitudinal oscillators:

particle state:

particle Z2 $\mu = 0$: O$\downarrow(-)$-X$\uparrow(-)$, $\mu = 3$: O$\downarrow(+)$-X$\uparrow(+)$
anti-particle: Z1, $\mu = 0$: O$\uparrow(+)$-X$\downarrow(+)$, $\mu = 3$: O$\uparrow(-)$-X$\downarrow(-)$

exchange state:

particle: Z1: $\mu = 0$: O$\uparrow(+)$-X$\downarrow(+)$, $\mu = 3$: O$\uparrow(+)$-X$\downarrow(+)$
anti-particle: Z2: $\mu = 0$: O$\downarrow(-)$-X$\uparrow(-)$, $\mu = 3$: O$\downarrow(-)$-X$\uparrow(-)$

The signs in brackets are the signs of action in the μ-oscillator and the arrow up is the positive and arrow down the negative circulation direction in the (1/2) part of the photons. With these two properties the μ-oscillator is characterized. From particle and anti-particle directly gravitons cannot be formed, because the two photons O and X in gravitons must have different signs of action and different circulation directions.

For an interaction between the gravitons and the mass oscillators the gravitons must have in the two longitudinal oscillators the same circulation direction but different signs of action and in the O and X photons the sign of action must be different. They oscillate in two states changing sign of action and circulation direction. For a realisation of this properties the signs of the $\mu = 0$ and $\mu = 3$ oscillators must be modified in relation to the photons of positive and negative charges.

The gravitons can be formed in following interactions between particle and anti-particles in the two oscillation states:

In state Z2 of
particle Z2 $\mu = 0$: O$\downarrow(-)$-X$\uparrow(-)$, $\mu = 3$: O$\downarrow(+)$-X$\uparrow(+)$
anti-particle: Z2: $\mu = 0$: O$\downarrow(+)$-X$\uparrow(+)$, $\mu = 3$: O$\downarrow(-)$-X$\uparrow(-)$
or in state Z1
anti-particle: Z1, $\mu = 0$: O$\uparrow(+)$-X$\downarrow(+)$, $\mu = 3$: O$\uparrow(-)$-X$\downarrow(-)$
particle: Z1: $\mu = 0$: O$\uparrow(-)$-X$\downarrow(-)$, $\mu = 3$: O$\uparrow(+)$-X$\downarrow(+)$

The results of this interaction are the gravitons with the following properties in longitudinal oscillators in four oscillation states :

Z1.1: $\mu = 0$: O$\uparrow(+)$-X$\downarrow(-)$, $\mu = 3$: O$\uparrow(-)$-X$\downarrow(+)$
Z2.1: $\mu = 0$: O$\downarrow(-)$-X$\uparrow(+)$, $\mu = 3$: O$\downarrow(+)$-X$\uparrow(-)$
Z1.2: $\mu = 0$: O$\uparrow(-)$-X$\downarrow(+)$, $\mu = 3$: O$\uparrow(+)$-X$\downarrow(-)$
Z2.2: $\mu = 0$: O$\downarrow(+)$-X$\uparrow(-)$, $\mu = 3$: O$\downarrow(-)$-X$\uparrow(+)$

For a generation of gravitons the $\mu = 0$ oscillator must change in halve of the photons the properties from state Z1 being positive and in state Z2 being negative

characteristic for charges, to state Z1 being negative and state Z2 being positive in gravitons. With this is connected a change of properties of the $\mu = 3$ oscillator, which has in the active phase the same circulation direction and different signs of action, in comparison to the $\mu = 0$ oscillator.

5.0.2 Interaction of photons with gravitons

The interaction of a gravitation field and a mass object occurs between the gravitons of the field and the gravitons of the mass-oscillators and between the gravitons of the field and the photons of the "photon cloud" of the object. In table 1 the interaction of gravitons of the graviton field and the photons of an anti-particle are depicted at the example of the $\mu = 0$ oscillator of the photons O(−)-X(−) of negative charges. In the upper part of table 1 the O(−) photon of the charge is interacting with the graviton OZ1(−)-XZ2(+) and in the lower part the photon X(−) is interacting with the graviton OZ2(+)-XZ1(−). The interaction occurs always by an overlap of equally directed currents under conditions of minimization of action. If the currents are equally directed the minimization of action causes the interaction of the photons with different signs of action. The O(−)-photon is interacting with the graviton part XZ2(+) and the X(−) photon with the graviton part OZ2(+). The other parts of the gravitons OZ1(−) and XZ1(−) are interacting simultaneously with the photons O(+)-X(+) of a particle. As follows from table 1 in one interaction step both photons O and X in the O-X-photon are changed by the properties of the graviton.

5.0.3 Interaction of Mass Oscillators in a Gradient of Gravitation

In this section it is shown that the object moving in a gradient of gravitation is in a rest frame. This follows from the simultaneous absorption of virtual (of positive and negative) action and is the condition for the validity of the principle of equivalence, [10].

In a gradient of gravitation only those gravitons, which have the common direction with the gradient will interact with the oscillators of the mass. Because anti-particle is interacting in a gradient with Z1 Δ:O$\uparrow$(+)-X$\downarrow$(+) and particle is interacting with Z2 Δ:O$\downarrow$(−)-X$\uparrow$(−) and for mass oscillators the direction of circulation in a gradient must be the same in particle and in anti-particle, it must be assumed that in a gradient gravitons in all four states Z1.1, Z1.2, Z2.1 and Z2.2 will interact with mass oscillators. The states Z1.1 and Z1.2 (and similar the states Z2.1 and Z2.2) have the same circulation direction and are distinguished by the sign of action. The interaction of the gravitons with O-X-photons is schematically depicted in fig.2.

Table 1: The interaction of gravitons with O(−)-X(−) photons in oscillation state Z1 of an anti-particle. Anti-particle part of graviton, state Z1 (particle state); active real negative

O(−)-photon

$$\begin{array}{ccccc} & & {}_{-}A_0 & & \\ & OZ1 & \Downarrow & & \\ {}_{-}\mathbf{A}_2 & \rightarrow & \partial A_0 & \Rightarrow & {}_{+}\mathbf{A}_0 \\ & 1/2 & \downarrow & & \\ & - & {}_{+}A_1 & & \end{array} \qquad \begin{array}{ccccc} & & {}_{-}A_3 & & \\ & OZ1 & \downarrow & & \\ {}_{-}\mathbf{A}_0 & \Rightarrow & \partial A_0 & \rightarrow & {}_{+}\mathbf{A}_3 \\ & 0/3 & \Downarrow & & \\ & - & {}_{+}A_0 & & \end{array}$$

Gravitons:

$$\begin{array}{ccccc} & & {}_{-}A_0 & & \\ & OZ1 & \Downarrow & & \\ {}_{-}\mathbf{A}_2 & \rightarrow & \partial A_0 & \Rightarrow & {}_{+}\mathbf{A}_0 \\ & 1/2 & \downarrow & & \\ & - & {}_{+}A_1 & & \\ & & {}_{-}\mathbf{A}_0 & & \\ & XZ2 & \Downarrow & & \\ {}_{-}A_2 & \rightarrow & \partial A_0 & \Rightarrow & {}_{+}A_0 \\ & 1/2 & \downarrow & & \\ & + & {}_{+}\mathbf{A}_1 & & \end{array} \qquad \begin{array}{ccccc} & & {}_{-}A_3 & & \\ & OZ1 & \downarrow & & \\ {}_{-}\mathbf{A}_0 & \Rightarrow & \partial A_0 & \rightarrow & {}_{+}\mathbf{A}_3 \\ & 0/3 & \Downarrow & & \\ & - & {}_{+}A_0 & & \\ & & {}_{-}\mathbf{A}_3 & & \\ & XZ2 & \downarrow & & \\ {}_{-}A_0 & \Rightarrow & \partial A_0 & \rightarrow & {}_{+}A_3 \\ & 0/3 & \Downarrow & & \\ & + & {}_{+}\mathbf{A}_0 & & \end{array}$$

anti-particle

particle

O(−)-photon: + Δ_g(+OZ1−XZ2); (1/2)/(0/3) = (−+)/(+−)+(++)/(−−)

X(−)-photon

$$\begin{array}{ccccc} & & {}_{+}A_0 & & \\ & XZ1 & \Uparrow & & \\ {}_{+}\mathbf{A}_2 & \leftarrow & \partial A_0 & \Leftarrow & {}_{-}\mathbf{A}_0 \\ & 1/2 & \uparrow & & \\ & - & {}_{-}A_1 & & \end{array} \qquad \begin{array}{ccccc} & & {}_{+}A_3 & & \\ & XZ1 & \uparrow & & \\ {}_{+}\mathbf{A}_0 & \Leftarrow & \partial A_0 & \leftarrow & {}_{-}\mathbf{A}_3 \\ & 0/3 & \Uparrow & & \\ & - & {}_{-}A_0 & & \end{array}$$

Gravitons:

$$\begin{array}{ccccc} & & {}_{+}A_0 & & \\ & XZ1 & \Uparrow & & \\ {}_{+}\mathbf{A}_2 & \leftarrow & \partial A_0 & \Leftarrow & {}_{-}\mathbf{A}_0 \\ & 1/2 & \uparrow & & \\ & - & {}_{-}A_1 & & \\ & & {}_{+}\mathbf{A}_0 & & \\ & OZ2 & \Uparrow & & \\ {}_{+}A_2 & \leftarrow & \partial A_0 & \Leftarrow & {}_{-}A_0 \\ & 1/2 & \uparrow & & \\ & + & {}_{-}\mathbf{A}_1 & & \end{array} \qquad \begin{array}{ccccc} & & {}_{+}A_3 & & \\ & XZ1 & \uparrow & & \\ {}_{+}\mathbf{A}_0 & \Leftarrow & \partial A_0 & \leftarrow & {}_{-}\mathbf{A}_3 \\ & 0/3 & \Uparrow & & \\ & - & {}_{-}A_0 & & \\ & & {}_{+}\mathbf{A}_3 & & \\ & OZ2 & \uparrow & & \\ {}_{+}A_0 & \Leftarrow & \partial A_0 & \leftarrow & {}_{-}A_3 \\ & 0/3 & \Uparrow & & \\ & + & {}_{-}\mathbf{A}_0 & & \end{array}$$

anti-particle

particle

X(+)-photon: + Δ_g(+XZ1−OZ2); (1/2)/(0/3) = (+−)/(−+)+(−−)/(++)

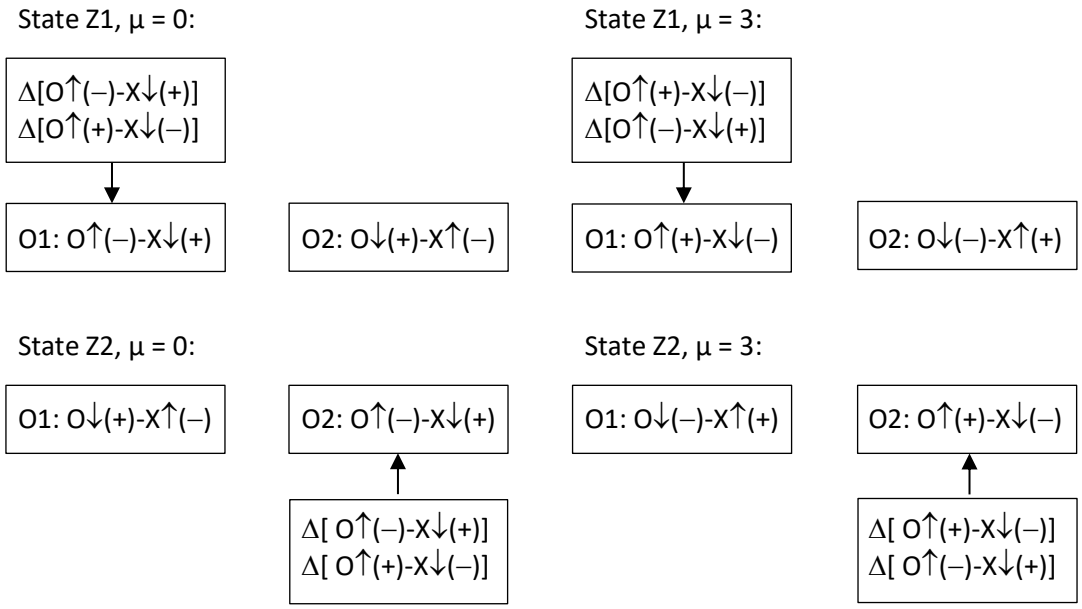


Figure 2: Schematic representation of interaction of the $\mu = 0$ and the $\mu = 3$ oscillator of a particle in states Z1 and Z2 with the gravitons O↑(−)-X↓(+) and O↑(+)-X↓(−)

Fig.2 describes the interaction of the scalar longitudinal oscillators O1&O2 in the two oscillation states Z1 and Z2 with two gravitons of the oscillation states Z1.1 and Z1.2. These are the gravitons: O↑(−)-X↓(+) and O↑(+)-X↓(−) for $\mu = 0$ and O↑(−)-X↓(+) and O↑(−)-X↓(+) for $\mu = 3$ oscillator in state Z1.1 and with opposite sign of action and the opposite circulation direction in state Z2. The gravitons in the vacuum are marked by a delta; the delta describe the change of action due to the absorption of action from the gravitational field. In a homogeneous gradient of gravitation in both oscillation states Z1 and Z2 of a particle the two deltas with opposite sign of action (and the same circulation direction) are absorbed: in state Z1 in the O1 oscillator and in state Z2 in the O2 oscillator. In both oscillation states the action of both photons of Z1.1 and Z1.2 together is virtual.

Details of interaction between gravitons in a gravitational gradient are described in [10]. From the results of fig.2 follows that during propagation of an object in a gradient of gravitation in each interaction step the action always is stored in form of virtual action. As shown in [10] this means that the object moving in a gradient of gravitation is in a rest frame (Conditions of the principle of Hamilton are fulfilled.).

6 Application of Physical Information to Cosmology

In following some aspects in cosmology will be discussed under application of the physical information, [11].

6.0.1 Positive kinetic- and negative potential- energy

In classic physics the potential energy in a gravitational field is negative. An object accelerated in a gradient of gravitation gets positive kinetic energy, [11]. In PIT the gradient of gravitation consists of gravitons, which concentration increases with an approach of the abject to the source of the gravitation. During movement of the object in a gravitational field, an interaction between the gravitons of the field and the gravitons present in the photon cloud of the object take place. In this interaction action from the gradient is absorbed by the oscillators of the object; the increase of action in oscillators of the object is the cause for the acceleration of the object. The gravitons consist of photons O and X of positive and negative action and are different to the photons of the charges, which have either positive in particles or negative action in anti-particles. In an interaction between gravitons and photons of charges, according to the condition of minimization of

action, always the part of gravitons O or X with positive action is in interaction with the photons of anti-particles and the part of gravitons with negative action X or O is interacting with photons of the particle. This is in similarity to the perception of classic physics that potential energy in gravitation is negative. This property of gravitation has consequences for the behaviour of objects in a gradient of gravitation and in cosmology.

6.0.2 Action determines the relative speed

The amount of action stored in the scalar oscillators determines the relative speed, a change of the amount of speed due to an interaction depends only from the amount of action, not from the sign of the delta of action, because in the scalar oscillators O1&O2 the same positive and negative parts of the O and X photons in both circulation directions are present. Below the not-relativistic limit action is added to the absorbed O and X photons, above the not-relativistic limit action is in addition stored in the field-field correlations of the scalar oscillators and causes an increase of the relativistic mass, [9].

6.0.3 Cosmological constant

According to the PIT the cosmological constant describes in the equations of Einstein the action of gravitons in the surrounding vacuum under the conditions of a rest frame in which the action of gravitons of the object must be equal to the action of the gravitons in the surrounding vacuum. These are the conditions of a static universe. As described in section 4, the condition of a rest frame is also fulfilled, however, when the object is embedded in a homogeneous gradient of gravitation, [9]. The cosmological constant can therefore describe a value, in which the concentration of action is lower or larger as the constant describing the static universe. Especially the "cosmological constant" can also depend from time, provided that the change of time is small in relation to the interaction frequency between the gravitation of the vacuum and the oscillators of the object.

The interpretation of a negative pressure causing the accelerated movement of galaxies is in presented formalism explained by the properties of the gravitons, which always react with the photons of matter under reduction of action in the photon cloud and under attracting acceleration. The energy and the pressure cannot be directly observed in space time, because action is vanishing in gravitons.

6.0.4 Formation of the universe from nothingness

In the present cosmology the formation of the universe from nothingness is explained by the simultaneous formation of positive matter/energy and negative

gravitation, [12]. In the PIT the formation of the universe occurs from activated virtual action, which consists in equal shares from positive and negative action. Because of condition of minimization of action, action will always form activated virtual action that is gravitons. This kind of action is also the content of matter, radiation and vacuum. The charge is real action of positive and negative sign and is also in equal parts contained in the cosmos.

The basic law in nature is the principle of Hamilton operating on action embedded in a four dimensional correlation space, connected to the space time. The principle of Hamilton and action were existent already before the big bang.

6.0.5 Model of prenatal conditions for the universe

In PIT a model for the time before the beginning of the big bang can be proposed in which the deactivated vacuum still existed. On the deactivated vacuum superimposed was activated virtual vacuum. A high coincidental concentration of activated virtual action formed on deactivated virtual vacuum was the cause for the formation of matter and radiation. In an interaction between matter and radiation the space time was formed with a high concentration of matter, radiation and activated virtual action. The space time is expanding into the already existing deactivated virtual action of the vacuum. The universe is under conditions of minimization of action homogeneous and isotropic. The expansion of the universe is forced by the spread out of the activated virtual action and of the electromagnetic structures of photons of light into the deactivated virtual action of the original vacuum. The origin of the CMB radiation is the activated virtual action.

6.0.6 The three phases of the development of the universe

In present cosmology three consecutive phases of the development of the cosmos are discussed: the phase of radiation, the phase of matter and the phase of vacuum, [11]. The phase of the matter causes a deceleration of the cosmos expansion due to the gravitation of the matter and the phase of vacuum a new acceleration of space time. In PIT the driving force in the development of the universe is the density of activated virtual action in the vacuum: in the vacuum the three components determining the density of activated virtual action are: the component formed during the big bang, the component being part of the matter and the component of the high speed in matter. The new accelerated phase of the universe is formed after the contribution of high speed was lower as the two other contributions.

6.0.7 The beginning of universe with high order of action

From the beginning of the universe in space time, [13], the direction of propagation of photons and gravitons must have been occurred into a radial direction in space-time. In photons and gravitons this is the direction from the creator plane to the annihilator plane. If it is assumed that the formation of space time occurs from the high density of virtual action on correlation space, one has to expect that this direction was also present on correlation space. That means that there was not only a high concentration of action, but this action was also of high order. Structures of high order can be expected on correlation space also under conditions of minimization of action. This implies that also the vacuum of deactivated action has been in a structure of high order. In contradiction to the present speculations in cosmology, according which the false vacuum has generated different universe with different physical properties, in the PIT there is only one law and one physical quantity – the action – which determine also the conditions of prenatal properties of the universe.

6.0.8 High speed in inflation

If the beginning of the universe occurs first only on the correlation space and after that after a short time also on space time, the accelerated inflation occurring with a higher speed as the propagation of light, this can be explained in the PIT by an application of the tunnel effect. In an explanation of the PIT for the tunnel effect, [1], the propagation of information can occur by a higher speed as the speed of light, if the propagating information has the same structure and the same action, as the structure and the action of the medium, in which the information is propagating. Such a condition could also exist in the early phase of the formation of the universe.

During the formation of the beginning of the universe the high density of activated virtual action is in local time equilibrium with the masses. This high concentration of action causes the high speed of the mass-elements. Due to the gravitational interaction during the expansion of the universe this speed is with higher speed gradual reduced, in comparison to the reduction of the density of the activated action of gravitational vacuum.

6.0.9 Formation of matter and radiation from activated virtual action

The false vacuum is in the PIT the high concentration of activated virtual action. From the activated virtual action in interactions matter is formed according to the formation of components without generation of space time:$-A_0 \rightleftharpoons +A_0$, as well as with the formation of space time:$-A_0 \rightleftharpoons \partial A_0 \rightleftharpoons +A_0$. The false vacuum

of cosmology will be form the real action of charges, when the concentration of activated virtual action will be equal to the concentration of activated virtual action of gravitons generated by the masses.

6.0.10 Higgs-field and gravitation

The Higgs-field is a scalar field. It is comparable with the gravitation, defined in the PIT, because the gravitons are forming also scalar fields: their activity depends only from the content of active virtual action. Similar to the Higgs-field the gravitons, defined in the PIT, are interacting with matter (and radiation). In this context the agglomeration of mass-oscillators are the Higgs-particles (and comparable with dark matter). There are different gravitons in PIT, which may be formed in different concentrations during different expansion periods by the photons O(+)-X(−) and O(−)-X(+), which has some similarities to the different minima of the potential different from zero in the Higgs-field.

The four forces: strong and weak nuclear forces, the electromagnetic force and gravitational force, were created during the reduction of the temperature after the big bang. This is considered to happen by a break of symmetry in the original force. In PIT it is assumed that the four forces are controlled by the principle of Hamilton and the bosons which mediate these forces are different: in electromagnetic interactions these are the photons of static Maxwell fields and in gravitation the gravitons. The bosons of the nuclear forces are also carriers of action, but have an up to now an unknown structure. In conclusion of this, the original force before and after the big bang, which still is the law of all interactions, is the principle of Hamilton.

The break of symmetry caused by the Higgs-field can be also considered in the PIT: the presents of active virtual action is under the minimization of action the basic precondition for the formation of matter; matter consists of oscillators formed from virtual action and from gravitons interacting with the oscillators of matter. This is similar as charges are consisting of oscillators formed from action interacting with photons of the photon cloud, belonging to the oscillators of the charges.

6.0.11 Accelerated expansion

The accelerated expansion of galaxies indicates that the action of the vacuum is larger, as the action of the gravitons generated by the matter: there is an increase of action in the vacuum in relation to the action in the gravitons, generated by matter. From view of the PIT this is the reason for the acceleration of the galaxies in relation to the original behaviour before the 5 Milliard years. The action

of the vacuum generated by activated virtual action of gravitons was high at the beginning of the universe and is decreasing during the expansion of the cosmos. The action of the matter consists of action of the matter-oscillators included in the field -field correlations and of the action resulting from acceleration at the beginning of the big-bang. While the action of the matter and the action of the deactivated vacuum remain constant during expansion of the universe, the action of the activated vacuum and the action of the original acceleration are decreasing. If the action of the original acceleration is faster decreasing in comparison to the action of the activated vacuum, a space time position will be reached at which the sum of action of the activated vacuum will be larger as the action generated by the matter oscillators and the galaxies will be accelerated.

If the density of activated virtual action (action of gravitons) in future still will be decreasing with the expansion of the universe, a position in space time will again be reached, where the density of action of gravitons will not any more increase in relation to the action in gravitons of matter oscillators and after that time action in the universe will be smaller in relation to the density of action in the gravitons of matter. From this space time position in future the action of gravitation will be the only cause of interaction between the galaxies. This will be the situation described by the solution of Friedmann for the future of the universe, [14, 15].

6.0.12 Euclidean orthogonal geometry of space time

The Euclidean orthogonal geometry of space time follows from the conditions of minimization of action. The elements of the Maxwell vacuum – the photons of light, the photons of static Maxwell field and the related photons of vacuum – are formed under conditions of minimization of action. Especially this means that for example the gravitons with their structure O(+)-X(−) and O(−)-X(+) contain equal amounts of positive and negative action. As a consequence of this the unity cubes are formed with correlations of equal lengths. Because the correlation structure of the cubes is related to the three direction of the space, the space must be orthogonal. The Euclidean geometry of space is a consequence of the minimization of action (the principle of Hamilton).

6.0.13 Network formation of gravitons

In fig.3 the B_3 cube of a photon of static Maxwell fields in oscillation state Z1 is shown. As seen in the relations (1) the B_3 cubes are placed at the outside corner of the static O-X-photons. The currents in the active B_3 cube connect the inside of the photon with the outside. In fig.3 these are the currents depicted by the continuous and by the discontinuous arrows. These currents connect the

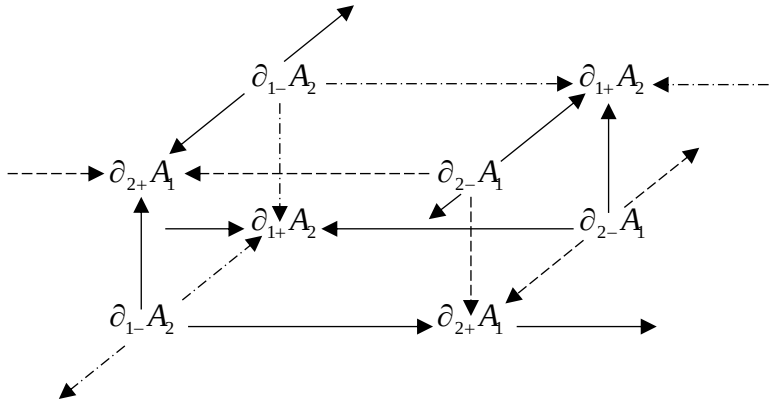


Figure 3: B_3 cube of the X-photon in state Z1 connecting with its currents marked by continuous and discontinuous arrows the neighbour photons.

considered photon with the neighbour photons. Such currents are active for both B_3 and E_3 fields. The static photons of Maxwell fields are able to form networks.

6.0.14 Curvature of space and density of action

The curvature of space in general relativity is in the PIT interpreted as variation of the content of action. Gravitons are present in vacuum and matter has, similar to the photon cloud of charges, a "graviton cloud". The gravitons of the vacuum are interacting with the photons of the photons cloud of charges and with the gravitons of the "graviton cloud". Instead of considering the curvature of space the content of action in gravitons of the vacuum is considered. Curvature of space and density of action in vacuum are equivalent, when we assume that the content of action in the photons of vacuum is influencing the structure of the gravitons. All effects caused by the curvature of space are in PIT interpreted by the density of action in the photons of vacuum. Interpreting the action as two currents in unity cubes the interaction between the vacuum and the elementary objects can be interpreted by an overlap of currents under conditions of action minimization.

6.0.15 Cosmic Microwave Radiation

For a discussion of the cosmic microwave background radiation (CMB) in PIT there is a problem of interpretation. As discussed in [10], the microwave radiation has a different structure in comparison to the photons of light. The question is:

is the present observed CMB a result of originally formed high energy light kind radiation, or is the CMB structure the same as the structure occurring in static photons, originally formed after the big-bang. In the last case the origin of the CMB follows from properties of the Maxwell vacuum and not from the structure of the photons of light.

The spatial distribution of energy in the CMB is in PIT interpreted as a spatial distribution of action in the vacuum. It can be also interpreted as fluctuation between the photons with activated virtual action and photons of real action of vacuum. The origin of this fluctuation can be of intrinsic nature, or caused by early interactions.

6.0.16 Structure of space time

In interpretation of the present cosmology the expansion of the universe, observed by the increasing distances between the galaxies, is an expansion of the space, [16, 17]. If we use the interpretation of the PIT, the space consists of the Maxwell vacuum that is of structures of O-X-photons with activated and deactivated action. There is some evidence that the deactivated vacuum was existing before the big-bang and that the activated virtual action was created during the big-bang. In this context the expansion of the universe is the propagation of the active virtual action on the structure of the already existing deactivated vacuum, while the formation of the space time is a consequence of formation of real action during interactions. If the expansion of the universe is the propagation of activated virtual action into the deactivated vacuum, the space will expand by the speed of light and the accelerated expansion of space between galaxies is the change of the content of activated virtual action in vacuum.

For the propagation of the activated virtual action under induction and the PSCO, the deactivated virtual action is needed. The formation of a horizon occurs at the border formed by the propagation of activated virtual action with the speed of light.

6.0.17 A-symmetry of matter and anti-matter

Protons consists of two up quarks, each of which is of two positive 1/3 charges, which results in four positive 1/3 charges and of one down quark with one negative 1/3 charge; together they form one positive charge of the proton. Neutrons consist of one up quark with two positive 1/3 charges and of two down quarks, each with one negative 1/3 charge, which results in zero charge. Together protons and neutrons, as forming the nucleons, have one positive charge. The neutralization of

matter occurs by the negative charge of the electron. In anti-matter the neutralization occurs similar between negative nucleons and positive anti-electrons. The a-symmetry between matter and anti-matter follows from difference of charges related to mass carrying nucleons and of the charges of the low masses of electron and anti-electron. The masses of the nucleons are for protons 9,1 MeV/c^2, for neutrons 11,6 MeV/c^2 and for electrons with 0,511 MeV/c^2. The masses of nucleons forming together atom nucleons are 20 times larger as the masses of electrons.

In the presented formalism the origin of the universe is considered to form from a high concentration of activated virtual action generated on the vacuum consisting of deactivated virtual action. The origin of the universe is the high concentration of activated virtual action, which leads to an interaction under formation of positive and negative real action. The real action is interacting under formation of up quarks, down quarks and electrons/anti-electrons and the formation of space time. The space time is expanding in space in radial directions and in the space time the parts of matter are moving in radial direction. With the expansion of the universe the density of activated virtual action is exponentially decreasing.

The photons of activated virtual action (similar as the photons of deactivated virtual action) are a-symmetric. The a-symmetry consists in the different oscillation mechanism for positive and negative static photons: the positive photons have their active oscillation state in state Z2 with positive $\mu = 3$ and negative $\mu = 0$ oscillator and the negative photons in oscillation state Z1 with negative $\mu = 3$ oscillator and positive $\mu = 0$ oscillator.

The expansion of the universe occurs in only one direction: in positive or in negative $\mu = 3$ direction. If it is assumed that the expansion occurs in positive direction the photons with positive action in the $\mu = 3$ oscillator will interact preferentially with the active virtual action of the surrounding vacuum under formation of up and down quarks. Gravitons of mass oscillators and photons of activated virtual action have the same direction and overlap under addition of currents under formation of matter. At early time, in high density of activated virtual action, mostly positive nucleons of the matter will form. After a depletion of positive charges under formation of nucleons, a surplus of negative charge remain in an environment of diluted active virtual action under formation of negative electrons.

Parallel to the formation of matter dark matter is formed from activated virtual action without forming charges. The formation of matter and dark matter occurs during formation of space time. The a-symmetry between matter and anti-matter follows from the properties of the structure of the space time – the photons of

static Maxwell fields – during the process of space time formation.

6.0.18 Orthogonality of space time follows from the Hamilton principle

If it is assumed that the condition of minimization of action creates the orthogonality of space time, from which follows that the space time must be homogeneous and isotropic and that the instabilities formed by fluctuation are undone by the minimization of action, this statements are equivalent to the demand that the density of the universe must be equal to the critical density of the universe, [18]. The universe is in homogeneity and isotropy for each space time history self-stabilizing by the Hamilton principle.

The formation of structures in the history of the universe is forced by the minimization of action. This shows that besides the fluctuations the interaction under formation of structures is forced by the properties of action and the conditions of the principle of Hamilton. Only strong vicinity of elementary objects, which is connected with an overlap of their fields, is enough for the formation of structures, which can also occur without presence of fluctuations.

6.0.19 Four dimensions of correlation space

The objects of the PIT are furthermore dot-like in space time, but they have a four dimensional structure on the correlation space. If interaction between elementary objects is described on correlation space, no infinite curvatures and infinite energies are created. This implies that the interactions occur on space time and on correlation space.

The description of the space time under application of the correlation space is unique: it is existing only one four dimensional correlation space, which is connected with the space time by events, [19].

In the PIT the fluctuations of the vacuum are described by the changes of the deactivated vacuum into activated vacuum and between the activated vacuum and the real vacuum. There are no virtual particle existing in the vacuum, the vacuum is formed only from the Maxwell vacuum.

6.0.20 Transport of action in gravitation

Effects of gravitation move with the speed of light. This says in the PIT that the effects of gravitation are caused by a transport of action. In frame of the presented formalism the propagation of action occurs in gravitation similar as the propagation of action in light: under formation of correlation structures of gravitons in

vacuum and under conditions of the PSCO, the flow of currents forming action occurs with the speed of light between the oscillation states. Pure structure information without a transport of action can occur under the only conditions of the PSCO and is not underlying the conditions of the special relativity.

6.0.21 Time dilation in gravitation

Under conditions of action minimization, action of the gravitons is always subtracted from the photons of the photon cloud of objects. The gravitons consist of O-X-photons with positive and negative action, so that action is annihilated in gravitons. In an interaction with matter (and with structures of light) the positive part in the O-X-gravitons is interacting with the photons of negative charge and the negative part of action in gravitons is interacting with the photons of positive charge. This reduces the oscillation frequency of the photons in the photon cloud of objects (and of light), and the objects are accelerated by absorbing the deltas of action in the scalar oscillators. The reduction of oscillation frequency is connected with a red shift in photons of light.

6.0.22 Light in gravitation of a black hole

In a photon moving into the direction of a black hole the red shift will be increasing and the action will be reduced to zero at the event horizon. Similar for an object moving in direction of a black hole the action in the oscillators of the photons of the photon cloud will be reduced, which is connected with a time dilation; at the event horizon the oscillation frequency is reduced to zero. The object moving in direction of the black hole is accelerated, because action is increased in the scalar oscillators; the acceleration is independent from the sign of the delta of action acquired during oscillation, [20].

At the event horizon the action of the object is vanishing in the photon cloud, because the addition of gravitons with opposite sign of action reduces the action of the gravitons in the "graviton cloud". This is not influencing the action stored in the mass oscillators of the object.

It is the interaction between the photons of the photon cloud and the absorbed photons which causes the time dilation. At the event horizon the interaction between the object and the gravitation field is reduced to zero; at the event horizon there are no events and with vanishing of events the space time does not exist.

6.0.23 Information mechanism of a black hole

In frame of the presented formalism the mechanism of the black hole can be interpreted by an exchange of activated virtual action between the black hole and the vacuum. Matter, charge, radiation and vacuum consists in different forms of action. The activated virtual action forms a gradient with increasing virtual action in the direction of the black hole. Masses are accelerated into the direction of the black hole and are transferred inside the black hole, under conditions of high pressure and high temperature, into their constituents that is into activated virtual action, which is emitted by the black hole and contributes to the strong gravitation of the black hole. The information of the masses, consisting of virtual action, are transferred by the black hole to the information of the gravitation, consisting of virtual action. Information of masses, charges or radiation, described by action in Maxwell fields, is conserved.

6.0.24 Dark Matter and Dark Energy

The dark matter can be described, in analogy to the conventional matter, as consisting of mass oscillators generating a "graviton cloud", which is interacting with the gravitons of the vacuum and submitting the change of action to the scalar oscillators of the matter-objects. Contrary to the conventional matter the dark matter has no charge oscillators. The dark energy, [21], is the Maxwell vacuum, consisting of photons with deactivated and activated action. In the present scenario the vacuum was already consisting of photons of deactivated action before the big bang, while the formation of a high concentration of activated vacuum was the first step in the development of the universe, comparable to the considerations in the cosmology, according to which the Higgs-field was a first actuator at the beginning of the cosmos.

7 Summary and Discussion

For the description of properties and interactions of elementary objects by an exchange of information a physical information theory was developed, which contrary to the classic physics and quantum mechanics, considers the Lagrange density and the covariant commutators of communication relations of quantum mechanics as a whole defining the elementary objects. This leads to the formation of three dimensional correlation structures with four dimensional fields for the description of elementary objects that is masses, charges, radiation and vacuum. The mass and charge objects are described by scalar fields and the photons of Maxwell fields and the Maxwell vacuum by the vector potential. The four dimensional commutators

embedded in photons of Maxwell fields describe in the presented formalism physical information, which main part the action is, generated by the $\mu = 0$ oscillator. All properties and interactions are described under the conditions of the principle of Hamilton.

Gravitation is described in the presented formalism similar as the interaction between charges: the masses consists of gravitons and of field-field correlations which can also be represented by action not oscillating in space time. The scalar oscillators of the masses are interacting with a "graviton cloud" and the gravitons of the "graviton cloud" interact with the gravitons of the vacuum by an overlap under formation of deltas of action. In addition the photons of the photon cloud of charges are interaction with the gravitons of the vacuum. The change of action resulting from an interaction in the "graviton/photon cloud" leads in the mass oscillators to a change of the content of virtual action and a change of canonical momenta.

From the interaction of the masses in the gradient of gravitation follows that the objects are accelerated while they are in a rest frame, because the absorbed action occurs in form of deltas of virtual action, [10]. The description of the interaction of masses in a gravitation gradient allows some contributions to the present discussions in cosmology. The main aspects are the properties of the action generated physical information, being part of all elementary objects and acting always under conditions of minimization of action (the principle of Hamilton). Under application of action the origin of the universe can be postulated to be the active virtual action, submitted onto the already existent vacuum with deactivated virtual action, both being a part of the correlation space. Due to a separation of activated virtual action into positive and negative action under formation of space time, the cosmos begin to exists. Using the formalism of the physical information theory, which foundations are the physical information, the conditions of the minimization of action acting on a four dimensional vector potential, all up to now not understood quantum mechanical effects can be interpreted, [9] and in cosmology on the basis of the gravitation, such as the formation of the universe, the red shift of spectral lines under different conditions of gravitation, the formation of the orthogonal homogeneous and isotropic space time, the formation of Maxwell vacuum, the process of high speed inflation at the beginning of the universe, and the increase of acceleration due to the behaviour of the virtual action in vacuum can be explained.

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