Unification of some classical and quantum ideas

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Mottos:

"What lead me more or less directly to the special theory of relativity was the conviction that the electromotive force acting on a body in motion in a magnetic field was nothing else but an electric field." Letter to the Michelson Commemorative Meeting of the Cleveland Physics Society (1952), as quoted by R.S.Shankland, Am J Phys 32, 16 (1964), p35, republished in A P French, Special Relativity,
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"One creates from nothing. If you try to create from something you're just changing something. So in order to create something you first have to be able to create nothing. " – Werner Erhar
"Rather than being restrictions on the behavior of matter, the laws of physics are restrictions on the behavior of physicists."–V.J. Stenger

Abstract

The free Fock space with corresponding - information creation and anihilation operators - supplies a kind of extended language in which equations for n-point information (n-pi) of classical and quantum physics are described.

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In this description the space and time are treated in a similar manner and even different reference systems are treated in a more democratic way. The information vacuum vectors in both the classical and quantum case are introduced. Restrictions upon n-pi leading to complete equations are derived.

The paper also draws attention to the fact that averaging or smoothing of the original quantities (filtration) is not only consistent with the experimental capabilities of people, but it is also an important tool to understand the reality.

Contents

1 Introduction

Motto:

"A theory of everything (TOE) is a putative theory of theoretical physics that fully explains and links together

all known physical phenomena, and predicts the outcome
of any experiment that could be carried out in principle.",
([17]).

In presented papar we would like to show that classical and quantum physics in many ways implement - not in such an ambitious maner - although perhaps more generally, the *unification philosophy* which consists in acknowledging certain *relationships* between concepts and entities previously treated in a separate way. By this we mean that such relationships take place not only for these disciplines separately, but it takes place between them. Let me give you one of a more formal definitions of unification taken from computer science:

Given two input terms s and t, *unification* is the process which attempts to find a substitution that structurally identifies s and t. If such a substitutin exists, we call this substitution a *unifier of s and t*. It is possible to exist **infinitely many unifiers**.

I give you a few examples of my understanding of the idea of unification in which unifiers are given by the same equation or space or notion and so on:

We know very well that a resignation from excess of information called *filtration* is often associated with emerging in the sea of elements, atoms, agents, - constituting the system - some new, often surprising phenomena as the emergence of certain structures, patterns and so on. It also often corresponds to an only possible, global characteristics of the system. It looks that giving up the unnecessary details, we obtain additional knowledge about the system. In this case we are dealing in fact with a **unification** of the macroscopic and the microscopic description of the same discipline with filters or projectors as ***unifiers***. It is worth noting that the unification of micro and macro description of the system is also carried out here using the same linear equations, with appropriate additional conditions.

Agreeing to the loss of information, classical and quantum physics can be described in a linear manner with linear equations as unifiers. It turns out that linear equations which can describe classical and quantum systems can be considered in the free Fock space (FFS). The Fock space is an algebraic system used in quantum mechanics to describe quantum states with a variable or unknown number of particles. It also appears that classical states with incomplete in-

formation about initial and boundary conditions (systems with loss of information) can and are described in linear way in such a space. This means, for example, that the supperposition principle takes place even for classical physics and that locally smoothed exact solutions can be represented by means of supperpositions of nonlocally smoothed solutions.

In FFS, classical and quantum systems which have the same action integral (Lagrangian or Hamiltonian) can be described by n-point information (n-pi) satisfying also identical equations. Moreover, the basic vector $|0>$ of FFS can be modified in such a way, $|0> \rightarrow |0>_{info}$, that the operators appearing in the equations for the generating vector $|V>$ of n-pi, were right invertible operators, see (8). This modification has an impact on n-pi only if there are external forces acting on the system. Guided by the analogy with quantum theories, we interpret vector $|0>_{info}$ as a vector describing the vacuum. Since the vector $|0>_{info}$ does not satisfy any known equation of classical or quantum physics, and because by means of vector $|0>_{info}$ can be build all the available local information about the system, we assume that it describes the local information vacuum, see Eq.8. See also Werner Erhard's statement from the initial mottos.

1.1 Free Fock space. Operators that create and annihilate (local) information

Motto:

"Information is whatever constrains our beliefs." ([14], [27]; page 63).

Free, or, full, or supper - Fock space (FFS) are synonyms used to describes space of vectors

$$|V> = \sum_{n=1} \int d\tilde{x}_{(n)} V(\tilde{x}_{(n)}) \hat{\eta}^{\star}(\tilde{x}_1)...\hat{\eta}^{\star}(\tilde{x}_n)|0> + V_0|0> \qquad (1)$$

in which classical and quantum physics are described. In fact, we mean the classical physics with varies averaging and smoothing operations also called filtrations - like moving averages.

We use here the following denotations: $V(\tilde{x}_{(n)})$- components of the vector $|V>$ - are n-point functions ((n-pfs), that we will call

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n-point information (n-pi)), [3]. They descibe some local properties of a considered classical or quantum system. n-pi (n-pf) $V(\tilde{x}_{(n)})$ may be related to the averages or expectation values of products of fields as well as matrices at points $\tilde{x}_{(n)}$. They depend on n vectors $\tilde{x}_i; i = 1, ..., n$ with space-time and other components to reduce the number of additional indices: $\tilde{x}_i \in S$ a set. We will assume that all components of the vectors $\tilde{x}_i$ are discrete quantities. In this way, we consider discrete and discretized continuous physical systems. In fact, we could assume that vectors $\tilde{x}_i$ are matrices and this would allow their multiplication and methods of non commutative geometry could be applied but now it would lead to premature complications.

$\hat{\eta}^{\star}(\tilde{x})$ are operators in FFS (not in S) indexed by values of the vector $\tilde{x} \in S$, and $|0>$ - a vector with 0-pi component - V_0. In total, in FFS, the products $\hat{\eta}^{\star}(\tilde{x}_1)...\hat{\eta}^{\star}(\tilde{x}_n)$ of operators acting on the vector $|0>$, $\hat{\eta}^{\star}(\tilde{x}_1)...\hat{\eta}^{\star}(\tilde{x}_n)|0>$, create independent base that becomes the orthonormal base when we assume Cuntz (co)relations

$$\hat{\eta}(\tilde{x})\hat{\eta}^{\star}(\tilde{y}) = \delta(\tilde{x} - \tilde{y}) \cdot \hat{I} \tag{2}$$

where operator $\hat{\eta}^{\star}(\tilde{y})$ is adjoint operator to $\hat{\eta}(\tilde{y})$, $\hat{I}$- the unit operator and δ- the Dirac's or rather Kronecker's delta. For Fock spaces in which other relations are used, see, e.g., [25]. We must also assume that the following equalities are satisfied:

$$\hat{\eta}(\tilde{x})|0>=0, \quad <0|\hat{\eta}^{\star}(\tilde{x}) = 0 \tag{3}$$

for all values of $\tilde{x}$.

By analogy to similar terms in QFT, we will call corresponding operators as *(local) information creating* $(\hat{\eta}^{\star}(\tilde{x}))$ *and (local) information annihilating* $(\hat{\eta}(\tilde{x}))$ *operators at the point* $\tilde{x}$. Local information created at the points $\tilde{x}_1, ..., \tilde{x}_n$ is described by the function $V(\tilde{x}_{(n)})$. We can say that the operator $\hat{\eta}^{\star}(\tilde{x})$ is related in some way to a measurement at the "point" $\tilde{x}$. The vector $|0>$ whose structure, at accepted assumtions, we do not need to know, describes the *local information vacuum*. In fact it may contain some aggregated (*nonlocal information*).

In other words, n-pfs V , for n=1.2...., describe properties of the system which are related in some way to points $\tilde{x}_{(n)} \equiv (\tilde{x}_1, ..., \tilde{x}_n)$ like moving averages or averages of products of the unique "field" $\varphi[\tilde{x}_1; \alpha] \cdots \varphi[\tilde{x}_n; \alpha]$, see [1], [3], with respect to initial and bound-

ary conditions represented here by the symbol α. For this reason, the n-pfs V are denoted in Statistical Field Theory (SFT) as $< \varphi(\tilde{x}_1) \ldots \varphi(\tilde{x}_n) >$,or, in Quantum Field Theory (QFT), where fields are operator-valued functions, as $< \Psi|\hat{\varphi}(\tilde{x}_1) \ldots \hat{\varphi}(\tilde{x}_n)|\Psi >$ and are called expectation values of products $\hat{\varphi}(\tilde{x}_1) \ldots \hat{\varphi}(\tilde{x}_n)$.

Use yet vectors (1) instead of linear functional series, ([2]; App.A), to generate these n-pi, more closely resembles the canonical formulation of classical and quantum theories. In addition, we avoid assumptions about the formalities of the generating functional series.

We can say that that a main objective of work is a better understanding of the linear equations for the n-pi V described in a vector form in FFS as:

$$\hat{A}|V >= |\Phi > \qquad (4)$$

where we will assume that the source vector $|\Phi >$ creates (local) information about the system described by the vector $|$V$>$. From Eq.8 results that the vector $|\Phi >$ is proportional to the vacuum vector $|0 >$. This is not a surprising result because the isolated system can be treated as if it was contained in a vacuum. In a more detailed way we could say that the vacuum, which is described by the global (agregated) information related to the system, see (8), is simultaneously responsible for local information about the system. Naturally, in this way of thinking - the Mach philosophy is manifested!

The work, in some sense, extends or rather trims the previous author's papers like [2], [3], although it may be read independently.

2 Restrictions on n-point information (n-point functions) leading to complete equations

We would like to make the process of averaging or smoothing (filtrations) to be independent of the choice of points. This is expressed by the equalities:

$$< \varphi^k(\tilde{x}_1)\varphi(\tilde{x}_{k+1}) \cdots \varphi(\tilde{x}_n) >=$$
$$< \varphi(\tilde{x}_1) \cdots \varphi(\tilde{x}_k)\varphi(\tilde{x}_{k+1}) \cdots \varphi(\tilde{x}_n) > |_{\tilde{x}_1=\ldots=\tilde{x}_k} \qquad (5)$$

which mean that when in the n-point information (n-pi) we substitute field $\varphi[\tilde{x}_1; \alpha]$ by $\varphi^k[\tilde{x}_1; \alpha]$ we should get the same result as if

we replaced in the (k+n)-pi - k first variables by $\tilde{x}_1$. In this way, you can get equations for n-pi which **do not depend explicitly** on the choice of averaging or smoothing. The same remark applies to a theory with a more general nonlinear terms leading to the n-pi like $< N[\tilde{x}_1; \varphi]\varphi(\tilde{x}_2) \cdots \varphi(\tilde{x}_n) >$ with local functional N expanded in the Volterra power series, [6]. The problem arises when the theory has nonanalitic nonlinearities, although using the functional calculus, you can make some progress, [3]. Another important restrictions imposed on n-pi (correlation functions) are nonnegative conditions:

$$< \varphi(\tilde{x}) \ldots \varphi(\tilde{x}) >=< \varphi^k(\tilde{x}) >\geq 0 \qquad (6)$$

where the equality represents the case $\varphi = 0$. In fact, for the correlation functions, we postulate more general conditions:

$$< \varphi(\tilde{x}_1) \ldots \varphi(\tilde{x}_n) >\geq 0, \ if \ \{\varphi(\tilde{x}_1; \alpha) \ldots \varphi(\tilde{x}_n; \alpha)\} \geq 0, \ for \ all \ \alpha \qquad (7)$$

where α represents initial and boundary conditions, for Eq.12, under which the chosen averaging or smoothing process is taken. In the case of points $(\tilde{x}_1, ..., \tilde{x}_n)$ among which you can not find a pair of points which are not "close", like in the case (6), the conditions (7) should almost always be satisfied. Derogate from these conditions is evidenced by the large oscillations of the small "distances".

It is important that restrictions like (5) lead to complete equations for n-pi generated by the generating vector $|V >$. In fact this is achieved through escape to infinity: the infinite set of equations for an infinite amount of n-pi. Hence, the closure problem arises considered in many papers, among others in the papers of the author:

[1, 2, 3].

3   Equations for n-pi of classical physics with (local) information vacuum. Quantum Mach's principle?

Motto:

> "I love talking about nothing. It is the only thing I know anything about." – Oscar Wilde.

"Apart from the omniscience there is nothing else." –Z. Jacyna-Onyszkiewicz

We postulate the following equations for the n-pi $< \varphi(\tilde{x}_1) \cdots (\tilde{x}_n) >$ which by means of the generating vector |V> can be described in the following way:

$$(\hat{L} + \lambda\hat{N} + \hat{G})|V >= \hat{P}_0|V > +\lambda\hat{P}_0\hat{N}|V >\equiv |0 >_{info} \qquad (8)$$

with linear operators acting in FFS:

$$\hat{L} = \int \hat{\eta}^\star(\tilde{x})L[\tilde{x}; \hat{\eta}]d\tilde{x} + |0 >< 0| =$$
$$\int \hat{\eta}^\star(\tilde{x})L(\tilde{x}, \tilde{y})\hat{\eta}(\tilde{y})d\tilde{x}d\tilde{y} + \hat{P}_0 \qquad (9)$$

$$\hat{N} = \int \hat{\eta}^\star(\tilde{z})N[\tilde{z}; \hat{\eta}]d\tilde{z} + \hat{P}_0\hat{N} \qquad (10)$$

and

$$\hat{G} = \int \hat{\eta}^\star(\tilde{x})G(\tilde{x}) \qquad (11)$$

The above operators $\hat{L}, \hat{N}, \hat{G}$, are expressed by operators $\hat{\eta}^\star, \hat{\eta}$ which satisfy the Cuntz (co)relations (2).

Eq.8 results immediately from the following dicrete version of original integro-differential equation, for the field φ:

$$L[\tilde{x}; \varphi] + \lambda N[\tilde{x}; \varphi] + G(\tilde{x}) = 0 \qquad (12)$$

which we apply to one (first) general solution appearing in the n-pi$< \varphi(\tilde{x}_1) \ldots \varphi(\tilde{x}_n) >$ and from (2) - (3). Here L and N are given linear and nonlinear functionals and G a given function. Equations (12) describe the subtle (fine graining) structure of the system under consideration. However, Eq.8 describes the averaged (coarse grained) or smooth characteristics. In both these equations - space and time variables - are treated in a similar way and this feature of description can be considered as the *space-time unification*. A unifier in this case is the definition of n-pi (use of multi-time or rather multi-point information). Other approach to the space-time variables, with the time variable t distinguished, is presented in Sec.4.3.

We assume that

$$L[\tilde{x}; < \varphi(\bullet)\varphi(\tilde{x}_2)\dots\varphi(\tilde{x}_n) >] = < L[\tilde{x}; \varphi(\bullet)]\varphi(\tilde{x}_2)\dots\varphi(\tilde{x}_n) >$$
(13)

In fact, this equality can be regarded as a restriction on the linear operator (fuctional) L and/or averaging (smoothing) process $<\dots>$. Now, with the help of Cuntz relations (2) and Eq.12 it is easy to see that Eq.8takes place.

A small modification of the r.h.s. of Eq.8, compared with similar equations given in almost all previous works, is connected with a demand of right invertability of the operators $\hat{L}$ and $\hat{N}$ what force us to add terms $\hat{P}_0$ and $\lambda\hat{P}_0\hat{N}$ to corresponding operators, see (9) and (10). Without such modifications we can only look for a right inverse operation satisfying, e.g., equation

$$\hat{N}\hat{N}_R^{-1} = \hat{I} - \hat{P}_0$$
(14)

which in not literally a right inverse operation satisfying equation:

$$\hat{N}\hat{N}_R^{-1} = \hat{I}$$
(15)

And just this last equality leads to the emergence in the right-hand side of Eq.(8) - the vector $|0>_{ph}$. The amazing thing is that vector $|0>_{info}\sim |0>$, called the *local information vacuum vector* have to be used only for $\hat{G} \neq 0$ (operator describing external field in which the system is immersed). In order not to confuse this vector with the vector describing the quantum vacuum, we replaced the notation used in previous work ([3]): $|0>_{ph}\Rightarrow |0>_{info}$.

Since this possibility was caused by the transition from the detailed (fine-grained) to the less detailed (coarse-grained) description, we can talk about the (local) information vacuum vector as the *phenomenon of emergence*. The above observations also give us some insight into the human intellectual condition: If something is hard to imagine (no theory, no subconscious assumptions), we treat it like a vacuum!

For $\hat{G} = 0$, we get all perturbation formulas for n-pi, for n=1,2,..., from projected Eq.8:

$$(\hat{I} - \hat{P}_0)(\hat{L} + \lambda\hat{N})|V >= 0$$
(16)

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in which vector $|0>_{info}\sim |0>$ is absent - what we treat as an additional indication to treat this vector as a vacuum (describing vacuum).

In order to deepen our knowledge about vacuum, see [24], and for a conceptual development of the vacuum in physics, see, e.g., [5].

By introducing projectors $\hat{P}_n$ projecting on the consecutive terms of the expansion (1), see (24), we can express the projection properties of operators (9) - (11) as follows:

$$\hat{P}_n\hat{L} = \hat{L}\hat{P}_n \tag{17}$$

(diagonal operator), where n=0,1,2,...,

$$\hat{P}_n\hat{N} = \sum_{n<m} \hat{P}_n\hat{N}\hat{P}_m \tag{18}$$

(upper triangular), where n=0,1,2,..., and

$$\hat{P}_n\hat{G} = \hat{G}\hat{P}_{n-1} \tag{19}$$

(lower triangular operator), where n=1,2,.... The operator values function $\hat{N}$ can be a polynomial functional or a more general Volterra functional power series depending on the vector variable $\tilde{z}$ and the operator variables $\hat{\eta}(\tilde{y})$ indexed by the vector variable $\tilde{y}$. The operator $\hat{N}$

$$\hat{N} = \int d\tilde{z}\hat{\eta}^\star(\tilde{z})N[\tilde{z};\hat{\eta}] + \hat{P}_0\hat{N} =$$
$$\sum_m \int d\tilde{z}d\tilde{y}_{(m)}N(\tilde{z};\tilde{y}_{(m)})\hat{\eta}^\star(\tilde{z})\hat{\eta}(\tilde{y}_1)\cdots\hat{\eta}(\tilde{y}_m) + \hat{P}_0\hat{N} \tag{20}$$

where m+1-pfs $N(\tilde{z};\tilde{y}_{(m)})$ describe usually nonlinear interaction among constituens of the system.

We have similar relation for the operator

$$\hat{L} = \int d\tilde{z}\hat{\eta}^\star(\tilde{z})L[\tilde{z};\hat{\eta}] + \hat{P}_0 =$$
$$\int \hat{\eta}^\star(\tilde{x})L(\tilde{x},\tilde{y})\hat{\eta}(\tilde{y})d\tilde{x}d\tilde{y} + \hat{P}_0 \tag{21}$$

As we said, the operator $\hat{N}$ is related to a nonlinear part of the strong (not averaged) formulation of theory (the original differential equations, (12)). An extension of the operator $\hat{N}$ is described by the operator $\hat{P}_0\hat{N}$ which we propose to choose as follows:

$$\hat{P}_0 \hat{N} = \sum_m \hat{P}_0 \int d\tilde{z} d\tilde{y}_{(m)} N_0(\tilde{z}; \tilde{y}_{(m)}) \hat{\eta}(\tilde{y}_2) \cdots \hat{\eta}(\tilde{y}_m) \qquad (22)$$

with undetermined functions $N_0(\tilde{z}; \tilde{y}_{(m)})$. This choice of the operator $\hat{N}$ is dictated by the demand (15) to be a right invertible operatore. Further constraints on this operator may be derived from requests to computation convergence and its simplicity.

The operator $\hat{G}$ describes a source term with a function $G(\tilde{x})$ correponding to the external forces, for example. It is symtomatic that diagonal and upper triangular operators, $\hat{L}, \hat{N}$, describe an interaction or self-interaction of the constituents of the system and that lower triangular operator, $\hat{G}$, describes an interaction with the external world.

As we will see in the Sec.4, the quantum properties of systems are also describe by the lower traingular operators. Does this mean that the quantum properties of systems are the result of their interaction with the rest of the world? In other words we would have here kind of quantum Mach's principle claiming that "Local physical laws are determined by the large-scale structure of the universe."

The simplest diagonal operator is the unit operator

$$\hat{I} = |0 ><0| + \int \hat{\eta}^\star(\tilde{x}) \hat{\eta}(\tilde{x}) d\tilde{x} \qquad (23)$$

Other diagonal operators are the projectors used in formulas (17) - (19) and constructed by means of the kind of tensor product of bra and ket vectors (outer products):

$$\hat{P}_n = \int \hat{\eta}^\star(\tilde{x}_1) \cdots \hat{\eta}^\star(\tilde{x}_n) |0 ><0| \hat{\eta}(\tilde{x}_n) \cdots \hat{\eta}(\tilde{x}_1) d\tilde{x}_{(n)} =$$
$$\int \hat{\eta}^\star(\tilde{x}_1) \cdots \hat{\eta}^\star(\tilde{x}_n) \left(\hat{I} - \int \hat{\eta}^\star(\tilde{x}) \hat{\eta}(\tilde{x}) d\tilde{x} \right) \hat{\eta}(\tilde{x}_n) \cdots \hat{\eta}(\tilde{x}_1) d\tilde{x}_{(n)} \; (24)$$

for n=0,1,2,..., where $\hat{P}_0 = |0 ><0|$.

The simplest upper trangular, local operator of the type (20) is the local operator

$$\hat{N}_1 = \int d\tilde{x} \hat{\eta}^\star(\tilde{x}) \cdot \hat{\eta}^2(\tilde{x}) + \hat{P}_0 \int d\tilde{x} \hat{\eta}(\tilde{x}) \qquad (25)$$

through which, by the exponentiation, one can build other type of local operators

$$\hat{N}_n = \hat{N}_1^n = \int d\tilde{x} \hat{\eta}^\star(\tilde{x}) \cdot \hat{\eta}^{n+1}(\tilde{x}) + \dots \qquad (26)$$

and further

$$\hat{N} \equiv \hat{N}_{loc} = \sum_n \lambda_n \hat{N}_n = f(\hat{N}_1) + \dots \qquad (27)$$

Projectors (24) form a complete set of orthogonal projectors:

$$\sum_{n=0} \hat{P}_n = \hat{I}, \quad and \ \hat{P}_m \hat{P}_n = \hat{P}_n \delta_{mn} \qquad (28)$$

We can say that projections $\hat{P}_n | V >$, for n=1,2,..., provide n-point information about the local nature of the system but the projection $\hat{P}_0 | V >$ provides rather global, agregated information.

4 Comparison with quantum field theory (QFT) and a few loose remarks

4.1 Wightman functions and operations of averaging and smooting

In the case of a system representing the Universe, or for isolated systems, the r.hs. of Eq.8 can be interpreted as a vacuum, see [3] and the end of Sec.1.1. From the foregoing discussion results that the (classical) vacuum contains the global information about the Universe. Like in Quantum Field Theory (QFT) a non-trivial structure of the vacuum ($|0>_{ph} \neq |0>$) arises only through the nonlinear theory. On the other hand, the vacuum in QFT is defined as a state of minimum energy and is described by a corresponding eigenvector $|\Psi_0 >$ of the Hamilton operator. So these two vectors can differ from one another because they belong to different languages, but the physical meaning can be the same if we realize that the lack of instruments that provide local information about the system is equivalent to the absence of any material bodies, which may correspond to a vacuum. We can illustrate the the above correspondence as follows:

$$|0>_{info} \Longleftrightarrow \{vacuum\} \Longleftrightarrow |\Psi_0 > \qquad (29)$$

In QFT identical equations as (8) take place, for vacuum expectation values of products of the field operator $\hat{\varphi}(\tilde{x})$ (Wightman functions):

$$< \Psi_0|\hat{\varphi}(\tilde{x}_1)...\hat{\varphi}(\tilde{x}_n)|\Psi_0 > \tag{30}$$

where the field operator $\hat{\varphi}(\tilde{x})$ satisfies exactly the same equations as the field φ :

$$L[\tilde{x};\hat{\varphi}] + \lambda N[\tilde{x};\hat{\varphi}] + G(\tilde{x}) = 0 \tag{31}$$

see (12).

In this case however, $n - pfs \equiv n - pi$ are not permutationally symmetric because

$$[\hat{\varphi}(\tilde{x}_1), \hat{\varphi}(\tilde{x}_2)] \neq 0 \tag{32}$$

for almost all $\tilde{x}_1 and \tilde{x}_2$. Nevertheless, the generating vector

$$|V> = \sum_{n=1} \int d\tilde{x}_{(n)} < \Psi_0|\hat{\varphi}(\tilde{x}_1)...\hat{\varphi}(\tilde{x}_n)|\Psi_0 > \hat{\eta}^\star(\tilde{x}_1)...\hat{\eta}^\star(\tilde{x}_n)|0 > \\ +V_0|0> \tag{33}$$

generating (local) n-pi $< \Psi_0|\hat{\varphi}(\tilde{x}_1)...\hat{\varphi}(\tilde{x}_n)|\Psi_0 >$ satisfies identical Eq.8 like in the case of classical, permutational symmetric n-pi $< \varphi(\tilde{x}_1)\ldots\varphi(\tilde{x}_n) >$. This could be interpreted as the real unification of classical and quantum physics with identical form of Eq.8 as an unifier, if the same method of solving this equation could be applied in both cases. It is not inconceivable that this last sentence is a *certain understanding of the definition of unification* stated in the Introduction.

The fact that equations are identical in the cases of classical and quantum theory - leads us to the question: Is it possible a classical "averaging", which would lead to non-symmetric n-pi? The answer is - yes. but ... Let us consider the non-symmetric n-pi:

$$< \varphi(\tilde{x}_1)\ldots\varphi(\tilde{x}_n) >= \int d\alpha_{(n)}\varphi[\tilde{x}_1;\alpha_1]\cdots\varphi[\tilde{x}_n;\alpha_n]W[\alpha_{(n)}] \tag{34}$$

where $W[\alpha_{(n)}] = W[\alpha_1, ..., \alpha_n]$, is a non-symmetric *probability density* or a *smearing functional* by means of which n-pi are defined. Here α_i, i=1,...,n represent "n" initial or/and boundary conditions

or symmetry parameters of the same system described in classical case by the field φ and in quantum case by the operator $\hat{\varphi}$. For non-symmetric W we get non-symmetric n-pi $< \varphi(\tilde{x}_1) \ldots \varphi(\tilde{x}_n) >$. It can not be excluded that there is a W, for which there is

$$< \varphi(\tilde{x}_1) \ldots \varphi(\tilde{x}_n) > = < \Psi_0|\hat{\varphi}(\tilde{x}_1)...\hat{\varphi}(\tilde{x}_n)|\Psi_0 > \qquad (35)$$

but the situation becomes more complicated. Instead of one ensemble, common for any n, we have n, and, it is possible, that these ensemble are different for each n. Canonical case

$$W = \delta[\alpha_1 - \alpha_2]...\delta[\alpha_1 - \alpha_n]W[\alpha_1] \qquad (36)$$

corresponds to symmetric n-pi which have nothing in commence with quantum n-pi $< \Psi_0|\hat{\varphi}(\tilde{x}_1)...\hat{\varphi}(\tilde{x}_n)|\Psi_0 >$. In the latter case we should rather expect the formulas:

$$< \Psi_0|\hat{\varphi}(\tilde{x}_1)...\hat{\varphi}(\tilde{x}_n)|\Psi_0 > = \int d\hat{\alpha} \hat{\varphi}[\tilde{x}_1;\hat{\alpha}] \cdots \hat{\varphi}[\tilde{x}_n;\hat{\alpha}]\hat{W}_{\Psi_0}[\hat{\alpha}] \quad (37)$$

for n=1, 2,... in which $\hat{\varphi}[\tilde{x}_1;\hat{\alpha}] \cdots \hat{\varphi}[\tilde{x}_n;\hat{\alpha}]$ means product of operators.

4.2   Green's functions and nonsingular operators $\hat{L}$

Green's functions are another collection of n-pi used in QFT, which are less mathematically correct but they are more convenient in the computation and interpretation, [6], [7]. These properties are due mainly to their direct relation to the condition of causality and unitarity and the fact that they are, in contrast to the Wightman's functions, permutation symmetrical, [6], [7]. The equation for the generating vector |V> for the Green's functions $G(\tilde{x}_{(n)})$ can be similarilly written as (8)

$$(\hat{L} + \lambda\hat{N} + \hat{C})|V > = \hat{P}_0\hat{L}|V > +\lambda\hat{P}_0\hat{N}|V > \equiv |0 >_{info} \qquad (38)$$

with vector $|0 >_{info}$ defined as in Eq.8. The operators $\hat{L}, \hat{N}$ have the same projective properties as in classical case and the operator $\hat{C}$, resulting from the canonical commutation relations, is again the lower triangular operator with the following projection properties:

$$\hat{P}_n\hat{C} = \hat{C}\hat{P}_{n-2} \qquad (39)$$

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for n=2,3,...and its projections are equal to zero for $n \in \{0, 1\}$, see [10], Sec.7. From mathematical point of view Eq.38 expresses the fact that $|V >$ is a characteristic vector (functional) of complex probability density functional or, more colloquially, it is a functional Fourier transform of a certain functional (exponential function of the action integral multiplied by the purely imaginary number i: $(exp\{iS[\alpha]\})$), [6], [7].

The Green's functions $G(\tilde{x}_{(n)})$ can be obtained from the Wightman functions (30) by means of permutations of their arguments and preservation only these functions with time-orderings. To get complete Eq.38, we have to use in addition the cannonical commutation relations imposed on the operator field $\hat{\varphi}$ which do not change the dynamical equation (33). Because of operators can also form a vector space it is worth noting that quantization provides an interesting example of the dynamics with constraints without reaction forces. Could it be an expression of extraordinary subtlety of microcosm?

Let us assume that operator $\hat{L}$ is a non singular operator (quantum theory case) and we can transfor Eq.38 as

$$(\hat{I} + \lambda \hat{L}^{-1}\hat{N} + \hat{L}^{-1}\hat{C})|V >= \hat{L}^{-1}|0 >_{info}= |0 >_{info} \qquad (40)$$

This equation leads to nontrivial perturbative solutions due to the operator $\hat{C}$. We see it by transformation of Eq.40 into equation:

$$\left[\hat{I} + \lambda \left(\hat{I} + \hat{L}^{-1}\hat{C}\right)^{-1} \hat{L}^{-1}\hat{N}\right] |V >= \left(\hat{I} + \hat{L}^{-1}\hat{C}\right)^{-1} |0 >_{info}$$
$$(41)$$

Its solution can be formally presented in the form:

$$|V >= \left[\hat{I} + \lambda \left(\hat{I} + \hat{L}^{-1}\hat{C}\right)^{-1} \hat{L}^{-1}\hat{N}\right]^{-1} \left(\hat{I} + \hat{L}^{-1}\hat{C}\right)^{-1} |0 >_{info}$$
$$(42)$$

Thus, assuming the legitimacy of a perturbation series or Neumann series for the first inverse appearing in the above formula, it is easy to see that

$$\hat{C} = 0 \qquad (43)$$

leads to the trivial solution

$$|V> = |0>_{info} \qquad (44)$$

In other words, in quantum theories non trivial perturbation solutions to Eq.38 comes from the lower triangular operator $\hat{C} \neq 0$. In classical theories, when $\hat{C} \equiv 0$, to get non-trivial perturbative solutions, we have to assume that operator $\hat{L}$ is a right invertible. In this case the formulas (40) - (42) do not occur and have to be substituted by the formulas below.

In physics, a situation which corresponds to the non-singular operators $\hat{L}$ (due to ε-prescription or restrictions imposed on class of possible n-pi) is usually associated with general conditions such as causality and unitarity conditions. Sometimes, however, even in the QFT, the operators $\hat{L}$ are such singular that any ε- prescription is not able to remove this defect. It takes place when we have too much symmetry, such as gauge symmetry. In such cases to solve Eq.38 we proceed differently: we assume that operator $\hat{L}$ is a right invertible operator. It means that a one side inverse operator exists, $\hat{L}_R^{-1}$, such that

$$\hat{L}\hat{L}_R^{-1} = \hat{I} \qquad (45)$$

With the help of this operator, Eq.38 can be converted in an equivalent manner as follows:

$$\left\{\hat{I} + \hat{L}_R^{-1}\left[\lambda\hat{N} + \hat{C}\right]\right\}|V> = \hat{P}_L|V> + \hat{L}_R^{-1}|0>_{info} \qquad (46)$$

where projector $\hat{P}_L = \hat{I} - \hat{L}_R\hat{L}$. Further transformations may look similar, with the difference that the operator $\hat{L}$ is substituted by $\hat{L}_R^{-1}$. We get, for example,

$$\left[\hat{I} + \lambda\left(\hat{I} + \hat{L}_R^{-1}\hat{C})\right)^{-1}\hat{L}_R^{-1}\hat{N})\right]|V> =$$
$$\left(\hat{I} + \hat{L}_R^{-1}\hat{C})\right)^{-1}\left(\hat{P}_L|V> + \hat{L}_R^{-1}|0>_{info}\right) \qquad (47)$$

To find the projection $\hat{P}_L|V>$ we can use the perturbation principle, [2], which means that undetermined element of Eq.47 is identified with the linear part of original theory:

$$\hat{P}_L|V> = \hat{P}_L|V>^{(0)} \qquad (48)$$

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As a consequence, the first order approximation to vector |V> is

$$|V>^{(0)} = \left(\hat{I} + \hat{L}_R^{-1}\hat{C}\right)^{-1}\left(\hat{P}_L|V>^{(0)} + \hat{L}_R^{-1}|0>_{info}^{(0)}\right) \qquad (49)$$

with the vector $\hat{P}_L|V>^{(0)}$ chosen according to classical or quantum physics with $\lambda = 0$. Of course, in case of classical physics we should have $\hat{C} = \hat{G}$, or $\hat{C} = 0$ with $\hat{L}_R^{-1}$ instead of $\hat{L}^{-1}$.

4.3 One-time n-pi (n-point information)

To be more specific let as assume that functions

$$\alpha = (\alpha_i, \alpha_o) \qquad (50)$$

describe initial and other conditions respectively, for Eq.12. Then, introducing notation: $\tilde{x} \equiv (t, \tilde{\vec{x}})$, we have

$$\varphi(\tilde{x}) \equiv \varphi[\tilde{x}; \alpha] \to \varphi[\tilde{x}; \alpha]|_{t=0} \equiv \varphi[0, \tilde{\vec{x}}; \alpha] = \alpha_i(\tilde{\vec{x}}) \qquad (51)$$

where $\tilde{\vec{x}}$ contains indexes related to different filelds and space components without time t. Hence we have the last equality in Eq.51. Of course, (50), (51) do not describe the most general case. For example, α_o may depend on the time t as in case of non-stationary boudary conditions which are changing over time. Then equations for n-pi, for ensemble with such different boundary conditions, are not so simple. Of course, still we can use moving averages with respect to the time! Hence, perhaps, the popularity of this type of averages.

Let us introduce the generating functional (not vector)

$$V[\eta; t] = \int \delta\alpha_i \delta\alpha_o W[\alpha_i, \alpha_o] exp\left\{i \int d\tilde{\vec{x}} \varphi[t, \tilde{\vec{x}}; \alpha]\eta(\tilde{\vec{x}})\right\} \qquad (52)$$

for the one-time n-pi $< \varphi(t, \tilde{\vec{x}}_1)...\varphi(t, \tilde{\vec{x}}_n) >$. Here and elsewhere the symbol $\int$ represents a summation rather than integration (discrete space). η - without hat, means a function, not an operator as in the case $\hat{\eta}$. But square brackets express the functional dependence of corresponding quantities, [6].

It satisfies the Hopf's evolution equation, [12]:

$$i\frac{\partial}{\partial t}V[\eta;t] + H[\eta, i\frac{\delta}{\delta\eta}]V[\eta;t] = 0 \qquad (53)$$

where the operator H linearly depends on the function η. To get this equation we have to describe Eq.12 in a form

$$\frac{\partial}{\partial t}\varphi(\tilde{x}) + L'[\tilde{x};\varphi] + \lambda N[\tilde{x};\varphi] + G(\tilde{x}) = 0 \qquad (54)$$

and take into account the formula (52). To get a first-order evolution equation (54) we must increase the number of components of the vector $\tilde{x}$.

For the initial time $t = 0$, and from (51) and from (52) we get

$$V[\eta;0] = \int \delta\alpha_i\delta\alpha_o W[\alpha_i,\alpha_o]exp\left\{i\int d\tilde{\vec{x}}\varphi[0,\tilde{\vec{x}};\alpha]\eta(\tilde{\vec{x}})\right\} =$$
$$\int \delta\alpha_i\delta\alpha_o W[\alpha_i,\alpha_o]exp\left\{i\int d\tilde{\vec{x}}\alpha_i(\tilde{\vec{x}})\eta(\tilde{\vec{x}})\right\} \equiv$$
$$\int \delta\alpha_i W[\alpha_i]exp\left\{i\int d\tilde{\vec{x}}\alpha_i(\tilde{\vec{x}})\eta(\tilde{\vec{x}})\right\} \qquad (55)$$

Thus we see that the generating functional $V[\eta;0]$ has a form of fuctional Fourier transform of the *marginal* functional (distribution) $W[\alpha_i] \equiv \int \delta\alpha_o W[\alpha_i,\alpha_o]$. In other words, the effect of other conditions, for example, the stationary boundary conditions, on the initial generating functional and, via the Hopf's evolution equation, on the generating functional $V[\eta;t]$, is reduced to the calculation of this integral. In the case when other conditions and initial conditions are independent quantities:

$$W[\alpha_i,\alpha_o] = W[\alpha_i]W[\alpha_o] \qquad (56)$$

the above integration leads to identity.

If the smearing functional $W[\alpha_i]$ is presented in the form

$$W[\alpha_i] = exp\left\{\int d\tilde{\vec{x}}S(\alpha_i(\tilde{\vec{x}}))\right\} \qquad (57)$$

with a *quasi-local* functional S (S can depend as well on derivatives), which reflects subsystem *quasi-independence*, [14], then it satisfies Schwinger equation, [6]. Its vector description has the form (38). So we get a surprising result: **The functional $V[\eta;0]$ describing the initial conditions for the Hopf's equation satisfies the**

Schwinger's type equation of quantum physics considered in the space of one dimension less, but evolution of equal times n-pi is described by the generating functional $V[\eta; t]$ of classical statistical physics satisfying Hopf's evolution equation. If, for the functional S, the action integral is chosen, then a gauge symmetry can be introduced.

Formally, a solution to the Hopf's equation (53} can be presented as

$$V[\eta; t] = exp\left\{itH[\eta, i\frac{\delta}{\delta\eta}]\right\} V[\eta; 0] \tag{58}$$

where H is the Hopf's operator. This formula is apparently different in nature from the formula (42) with the vacuum vector $|0>_{info}$ in the right hand side. But we must remember that the functional (vector) $V[\eta; 0]$ representing the initial state of the system is simultaneously a function of the rest of the universe and can be represented in the form (42). In other words, even in classical case the initial vector of a system representing also the rest of the world has a quantum character. It is also possible that the impact of the Universe on a isolated system is a beyond time, because the functional V depends on functions defined in the D-1 space.

4.4 Stationary solutions

In this case

$$V[\eta; t] = V[\eta; 0] \tag{59}$$

for all $t > 0$. In result the evolutionary equation like (58) loses its meaning. The problem reduces to calculating the functional integral (55). However, the nature itself saves the value of the evolutionary equations. It turns out that systems pushed out of equilibrium tend to equilibrium by themselves - like in the case of shaken vessel with liquid. This means that we can use Eq.58 with simpler initial conditions described, for example, by Gaussian functionals, [6, 7], and get a stationary state in the process of solving evolutionary equations with $t \to \infty$. Sometimes people say that computers like evolutionary equations, [22].

Moreover, if the dimension of the vectors $\tilde{x}$ is increased by one, by introducing so called the fictitiouse time s, then by means of Eq.58

one can also describe Quantum Field Theory, [10], which further reduces the differences between classical and quantum theories. This allows you to look at quantum system as a classical system with the lack of detailed data responsible for the uniqueness of the solutions. Of course, we cannot forget that mentioned above of lack of detailed data is obtained by integration with a complex measure.

So things are in spacetime with one extra time, which perhaps is wrongly called the fictitious time. In fact, we should call it the hidden variable or rather the *hidden time*!. For comparison, see [21]. To reveal to us our world - starting with a big bang until the present day, with physical laws allowing us to predict the future and the past, we have to go with the hidden time up to infinity.

Addition to the hidden time there is the *hidden probability* which is a complex valued function giving the usual probability by calculating the square of its module.

One can also use Eq.8 with the whole benefit of the possibilities supplied by the free Fock space.

5   Final remarks

"In physics, a unified field theory (occasionally referred to as a "uniform" field theory[1]) is a type of field theory that allows all that is usually thought of as fundamental forces and elementary particles to be written in terms of a single field. There is no accepted unified field theory. It remains an open line of research. The term was coined by Einstein, who attempted to unify the general theory of relativity with electromagnetism, hoping to recover an approximation for quantum theory. A "theory of everything" is closely related to unified field theory, but differs by not requiring the basis of nature to be fields, and also attempts to explain all physical constants of nature.";
[http://en.wikipedia.org/wiki/Unified_field_theory].

From the above equations and formulas - vector $|0>_{info}$, which should not contain any information about considered systems,[2], - in fact it contains such information (global) and this is true in classical as well as in quantum case. It is possible that this is a manifestation of a physical inability to create a situation which we might call absolute nothingness. We must note, however, that by

nothingness we have here in mind rather *information vacuum* about the system which we do not identify with the absence of that system. It is not excluded that if the system is the whole Universe then information vacuum about the Universe - due to lack of any measuring instruments outside of the system - can be identified with the physical vacuum describing nothingness!

Presented and previous studies had added to the *eigenvalues and eigenvectors philosophy of physics* a new approach in which creation, annihilation operators and the "vacuum" vectors still appear but are rather used for creation and annihilation of information contained in fields.

As an interesting issue would be an explanation of why only the presence of the external field represented by the operator $\hat{G}$ or the presence of the canonical commutation relations represented by the operator $\hat{C}$ lead to the impact of information vacuum, $|0>_{info}$, on the n-pi. Would it be a real manifestation of the true nature of the vacuum?

The multitimes formalism considered mainly here and other author papers, and of course by other peoples, [28], [15], allows better aquaint ourselves with real role of the time in description of the Nature and choose right description in particular cases. In my opinion the multitime formalism not only casts a new perspective on equations for the n-pi, but also shows opportunity to formulate a theory in the form in which temporal and spatial variables plays a similar role. In this sense we can speak about of a *unification of space and time*, even in the Newtonian theories. In many cases, as additional advantage of the above unification, is a possibility to derive the same equations for n-pfs $V(\tilde{x}_{(n)})$ in the two types of averages: like in the case of (34) - (36) and in a more practical case of averaging with respect to variables $\tilde{x}$, see [1], [4], among which are averages to which ergodic hypothesis can be postulated, [16].

Similar remark can be made for the initial conditions for the one-time Hopf's equation, which satisfy similar equations as the vectors |V> generating n-pi in the D-1 dimension space. Was it was the unification of dynamics and additional conditions? See [13], for a similar idea. This picture is even deeper if as smearing functional the action integral is used in exponential function, 56, which has the same symmetry as the dynamical equations in D-1 dimension. It is worth noting that in the description of the one-time evolution,

where time is treated differently than spatial variables, in the initial conditions - the local information vacuum appears. As an additional evidence that an unification of dynamics and initial conditions takes place is that the algorithmic information content of the final state is not much greater than that of the initial state, [19].

Due to many similarities in the description of classical and quantum physics in the full Fock space, we can consider this space as their unifier or - to put it simply - as an arena of their unification.

We would like to mention the unification called the spacetimematter unification, see W.M. Stuckey's pappers about relational blockworld, and the unification called p-q duality, see [29].

The covariant formulation of a theory can be treated as some kind of unification of different reference frames particularly recomended for description of large scale systems. We add that covariant formulation means symmetrical formulation, where by this we understand only formal distinction, [26]. From that point of view it is interesting that quantum physics can be obtained from classical physics by reducing the symmetry (n-pi are not permutation symmetrical, see Sec.4.1). In other words, contrary to popular belief, classical world is more symmetrical than the quantum!

The loss of information can be used perhaps to understand the role of covariant formulation of theory used by Einstein requiring that there be no preferred reference frames and further: 'The laws of physics must be of such a nature that they apply to systems of reference in any kind of motion" (1916); [20],[23]. We can hope that in the case of a more symmetrical theories the moving averages are more smooth and can be used in the case of less precise measurements possible only in large scale systems.

Appendix1:

"In modern theoretical physics particle interactions are described by gauge theories. These theories are constructed by demanding that symmetries in the laws of physics should be local, rather than global, in character. "–Anthony Lasenby, Chris Doran, and Stephen Gull

Appendix2:

"The *free algebra on n indeterminates* $X_1, ..., X_n$ (the construction works also for any countable set S of "indeterminates"), is the algebra spanned by all linear combinations

$$\sum \Pi^{i_1...i_n} X_{i_1}...X_{i_n} \qquad (60)$$

of formal products of the generators X_i , with coefficients $\Pi^{i_1...i_n} \in K$. This algebra is denoted by $K < X_i >$and is said to be freely generated by the X's. "–X.Bekaert (Internet). We gave this definition to note a similar structure in FFS formed by vectors (1). In this case, the indeterminates are represented by operators $\hat{\eta}^\star(\tilde{x})$ with indexes $\tilde{x}$ instead of subindex i.

Appendix3:

General messages are defined as

$$A^+ \doteq \sum_{n=0}^{\infty} \mathcal{A}^{\mathrm{n}} \qquad (61)$$

where $\mathcal{A}^n$are n-component words: $x_1 \cdots x_n$ with letters $x_i \in \mathcal{A}$, where the set $\mathcal{A}$ is called the alphabet. It follows that the book of nature can be described both with finite and infinite alphabets. In physics, as letters can be used distinguished particles or rather states of particles. In case of Fock space constituated by means of vectors (1) the letters are operators $\hat{\eta}*$ at particular points $\tilde{x}$, see also [30].

The following formula is also used:

$$\mathcal{H}^{\oplus} = \bigoplus_{n=0}^{\infty} \mathcal{H}^{\otimes n} = \mathcal{H}^{\otimes 0} \oplus \mathcal{H}^{\otimes} \oplus \mathcal{H}^{\otimes 2} \oplus \cdots \qquad (62)$$

with symbols $\otimes, \oplus$denoting the tensor product and direct sum. $\mathcal{H}^{\oplus}$is a general message space, with the Hilbert, alphabet space $\mathcal{H}$. [30].

Appendix4:

"If something is systematically absent, as if as a rule it is a "non-given", then in order to express this state in natural language, willy-nilly, we say that it does not exist." (from Tadeusz Bartoś, *Koniec Prawdy Absolutnej* "The end of absolute truth", page 169, my translation). Can we say this also about a vacuum??

References

[1]   Hanckowiak, J. 2008. *Some Insight into Many Constituent Dynamics. http://arxiv.org/abs/0807.1489v1*

[2]   Hanckowiak, J. 2010. *Models of the "Universe" and a closure principle. http://arxiv.org/abs/1010.3352*

[3]   Hanckowiak, J. 2010. *Free Fock space and functional calculus approach to the n-point information about "Universe". arXiv:1011.3250v1 [physics.gen-ph]*

[4]   Hanckowiak, J. 2007. *Reynolds' dream? A description of random field theory within a framework of algebraic analysis and classical mechanics.* Nonlinear Dyn. 50. 191-211. http://arxiv.org/abs/physics/0511225

[5]   Zeiger, B.F. and M. Bischof. 1998. *The Quantum Vacuum in Biology.* Internet

[6]   Rzewuski, J. 1969. *Field Theory, Part II.* Ilife Books LTE., London

[7]   Vasiliev, A.H. 1976. *Functional Methods in Quantum Field Theory and Statistics.* Leningrad University, Leningrad

[8]   Sevilla, A.L.C. 2003. *Negative Energy and Empty Space. The Metaphysics of the Vacuum Fluctuation Theory.* Internet

[9]   de Muynck, W.M. 2009. *Von Neumann-Luders projection, and its applicability to EPR experiments.* Internet

[10]   Hanckowiak, J. 1992. *In search of physical solutions in quantum and statistical field theory.* J. Math. Phys. 33, 1132-1140.

[11]   Poulin, D.E. *Toy Model for a Relational Formulation of Quantum Theory.* arXiv:quant-ph/0505081v2. 2008

[12]   Hopf, E. J. Rat. Mech. Anal. 1

[13]   Nielsen, H. B. and M. Ninomiya. 2008. *Search for Effect of Influence From Future in Large Hadron Collider.* arXiv:07071919v3

Caticha, A.Q. 2006. *Updating Probabilities.* arXiv:physics/0608185v1

[15] Monin, A.S. and A.M. Jaglom. 1967. Staistical Hydromechanics. vol. 2 MIR Publishers, Moscow

[16] Toda, M., Kubo R. and Saito N. 1983, 1985. Statistical Physics I: Equilibrium Statistical Mechanics and Statistical Physics II: Nonequilibrium Statistical Mechanics. Berin Heidelberg New York Tokyo

[17] Internet. 2011. *Theory of everything.* http://en.wikipedia.org/wiki/Theory_of_everything

[18] Imternet. 2010. *Unified field theory.* http://en.wikipedia.org/wiki/Unified_field_theory

[19] Tegmark, M. Does the Universe in Fact Contain Almost no Information? arXiv:quant-ph/9603008v1. 1997

[20] Brading, K. and E. Castellani. 2005. *Symmetries and invariances in classical physics.* Internet

[21] Khrennikov, A. *On the problem of hidden variables for quantum field theory.* arXiv:hep-th/0604163v1. 2006

[22] Na. T.Y. 1979. *Computational Methods in Engineering Boundaryvalue Problems.* Academic Press, New York, San Francisco

[23] Stenger,V. *Where do the laws of Physics come from?* http://www.colorado.edu/philosophy/vstenger/. 2007

[24] Stenger, V. *Why is There Something Rather Than Nothing?* Skeptical Briefs • June 2006 (JN1100)

Turbiner, A. 1997. *Lie Algebras in Fock Space.* http://arXiv.org/abs/q-alg/9710012v1

[26]   Wilczek, F. 2008. *The Lightness of Being. Mass, Ether, and the Unification of Forces.* Prószyński Media Sp. z.o.o. Warsaw

[27]   Heller, M. 2011. Philosophy of Science. Introduction. PETRUS Publishers. Kracow (in Polish)

[28]   Kraichnan, R.H. and R.M. Lewis. 1962. Comm. Pure App. Math., No. 15, 397-411

[29]   Faraggi, A.E. and M. Matone. 1999. *The Equivalence Postulate of Quantum Mechanics.* arXiv:hep-th/9809127

[30]   Bostroem, K. and T. Felbinger. 2006. *Lossless quantum data compression.* University of Potsdam, Germany. Internet