Bulgarian Journal of Agricultural Science, 17 (No 1) 2011, 1-10
Agricultural Academy

THEORETICAL FIELD ANALYSIS OF THE CONCRETE QUANTUM FIELD SYSTEM WITH AN IMPULSE EFFECT IN THE ELEMENTARY LIVING CELLS

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Abstract

TSVETKOV, Ts. D., G. PETROV and A. HADZHY, 2011. Theoretical field analysis of the concrete quantum field system with AN impulse effect in the elementary living cells.
Bulg. J. Agric. Sci., 17: 1-10

The question above the possibility to find the complicate appearances connected with the existence of the life and the living systems his place in the mathematical frame of any one concrete quantum field theory by the contemporary state of the theoretical biological and nanophysics problems is open by the consideration of high topographical complementarities by the London- and Casimir forces involved importantly in the highly specific and strong but purely physical thermodynamically complexing of elementary living cells by enzymes with substrates, of antigens with antibodies, etc. From the new results by the contributions of the environmental freezing-drying and vacuum sublimation (Zwetkow, 1985; Tsvetkov and Belous, 1986; Tsvetkov et al., 1989; Tsvetkov et al., 2004 – 2009) it is hopped that by the great form expressed e.g. by the automodality (scaling) behaviour of the invariant entities described the elementary living cells and systems will be possibly to describe the biological expressions at the standpoint of the nanophysics by means of the behaviour of the concrete quantum field system, e.g. sea scalar particles, in the physical vacuum too.

It is possibly that in this processes in the theory will be introduced an elements of the non locality (similar to the Coulomb forces in the Quantum electrodynamics and the Casimir force by the interaction of the quantum electromagnetic field with the classical objects e.g. classical boundary conditions or the so called string objects in the Quantum chromo dynamics). On essential result of the perturbation theory in the relativistic quantum fields is the importance of the non local operators expansion on the light cone describing by the Quantum chromo dynamics (in the sense of electrodynamics) with the concept of the automodality. This can be understood by means of the consideration of the micro causality conditions for the invariance entities in the sense of the S-matrix theory in the deep inelastic scattering of the lepton hadrons scattering without model consideration (Bogolubov et al., 1976).

At the molecular level (Mitter and Robaschik, 1999) the thermodynamics behaviour is considered by any concrete quantum field system with additional boundaries as by the Casimir effect between the two parallel, perfectly conducting square plates (side L, distance d, L > d), embedded in a large cube (side L) with one of the plates at face.

Key words: Casimir effect, elementary living cells by cryobiological lyophilization, nanophysics

Introduction

The study of the automodality by verification in selfcontrolling of the conformal processes by the DNA and damage produced by freezing-drying and/or low temperature and low contents water is important in a variety fields (Zwetkow, 1985; Tsvetkov and Belous, 1986) and there the very full references to this problem; (Tsvetkov et al., 1989; Tsvetkov et al., 2004 - 2009), of which here are some examples: In medicine, surgeons would like to be able to cryopreserve organs for transplants. To date, however, the cryopreservation of large organs (except blood) has a very poor success rate. Blood and sex cells are routinely frozen and thawed for later use but even then, in many cases, the cellular survival rates are unacceptably low. Cryopreservation is also important in maintaing germplasm for important or endangered species. Frost damage is an important agronomic concern: if farmers can get a crop into the ground before the last frost, then they have a longer growing season and a greater yield. Damage in seeds during drying and dehydration may also be agronomical and ecologically important. Because of the impact of temperature on all reactions of the elementary living cells, adaptation to fluctuations in temperature is possibly the most common response researched. Drying and freezing are also important in the nanophysics by the food industries, by the cryo-electronic, microscopy, and quantum field theory of the vacuum and so on.

For simplicity here we have considered a domain of space-time containing any one massless scalar field $\varphi(x)$ defined at the material point of the coordinate Minkowski space-time at the fixed time t on the domain $S_{(t-2(n-j/2),\, t2(n-j/2)]}$ from the Minkowski space-time, following from the condition of the primitive microcausality. Further a concrete massless field $\varphi(t, \ y)$ is considered as a Banach valued vector state of the so called Schwartz space obeying the impulse wave equation in a local concave Banach space (Fresche space), defined over the space $\Omega_t^3 \subset M$ at the time $t = t_0$ in the Minkowski space-time. By imposing suitable boundary conditions for any one quantum field system as we considered any one relativistic quantum field $\varphi(x)$ fulfilled the Klein-Gordon equation, the total fields energy in any domain at the point $(ct, \ x)$ from the Minkowski space-time can be written as a sum of the mode energy for $t \in (t_{-2(n - ½ j)}, t_{2(n - ½ j)}]$, $n = 0,1,2, \ldots$, $j = 0,1,2, \ldots,2n$ and $x^3 \in (0, d_0)$ or $x^3 \in (d_0, L)$, $n = 0,1,2, \ldots$, $j = 0,1,2, \ldots,2n$ so that $| \ x_\perp | \leq. ((ct)^2 - (x^3)^2)^{½}$ is fulfilled and the ground state of this concrete quantum field system must be conformed by this suitable boundaries and so we can modelled the interaction of the concrete quantum field system to the external classical field in the elementary living cells by means of this suitable boundaries.

Our interest is concerned to the vacuum and especially the physical vacuum conformed by the suitable boundary conditions.

Nevertheless, the idea - that the vacuum is like a virtual ground state of any one concrete fundamental quantum field system - is enormously fruitful for the biological elementary living cells and systems in the cellular cryobiology and nanophysics too.

To day now we are faced with an unpleasant fact; the vacuum energy density for the virtual state of the quantum field system is infinite. It is, of course the total zero point energy (z.p.e.) density of the quantum field system. This is not what can be to wish but every one must be done and for the Casimir energy calculation we have to taken the difference between the energy of the vacuum without boundary and with boundary conditions and this can be plus or minus finite quantity.

As yet, no completely satisfactory resolution of this difficulty exists. We shall press on, retaining the z.p.e. concept for its physical usefulness, then the finite differences of z.p.e. can account for significant measurable effects: it plays an important role, for example, in the kinetic transition anyone thermodynamically systems, and try to cope as well as we can with the mathematical troubles. The concept can certainly prompt us to consider the possibility of interesting physical phenomenon, analogous to the Casimir effect of anyone concrete relativistic quantum field system interacting with classical external fields considered as a relativistic quantum system with additional boundary conditions which modified the classical external fields and considered this as a non equilibrium thermodynamically system.

Main Result

At the first we take the mirror reflecting points in the Minkowski space $y^{\mu}_{-2(n-½(j-1))}$, $y^{\mu}_{-2(n-½j)}$, $y^{\mu}_{2(n-½j)}$, $y^{\mu}_{2(n-½(j+1))}$, and the point $x^{\mu} = (ct,\ x)$ and $y^{\mu}_0 = (ct_0,\ y)$ between the plates so that

$$t \in (t_{-2(n-½j)}, t_{2(n-½j)}],\ n = 0,1,2,\ldots,\ j = 0,1,2,\ldots,2n \text{ for } x^3 \in (0, d_0), \text{ or } x^3 \in (d_0, L),$$

where $\mu = 0,1,2,3$, and n is the reflecting number of the see point y^{μ}_0 from the Minkowski space-time at the time $t = t_0$ between the not moved and the moved plate with the constant velocity v so that

$$y_{-2(n-½(j-1))}^{\;2} = y_{-2(n-½j)}^{\;2} = y_{2(n-½j)}^{\;2} = y_{2(n-½(j+1))}^{\;2} =$$

$$y_0^{\;2} = (ct_0)^2 - \bar{y}^2 = (ct_0)^2 - \bar{y}_{\perp}^{\;2} - y_0^{3\,2} \neq 0,$$

$$y_0^{\;3} \in (0, d_0],\ y_0^{\;3} \in (d_0, L)$$

$t_{-2(n-½j)} = t_{2(n-½(j+1))}$, $y^3_{-2(n-½j)} = -y^3_{2(n-½(j+1))}$, $t_{-2(n-½(j-1))} = t_{2(n-½j)}$, $y^3_{-2(n-½(j-1))} = -y^3_{2(n-½j)}$. Also we have a so called lexicographic order for $y^{\mu}_{-2(n-½(j-1))}$ and $y^{\mu}_{2(n-½j)};\ y^{\mu}_{-2(n-½j)}$ and $y^{\mu}_{2(n-½(j+1))}$.then we change not the $y_{\perp}$ by the reflections and the hyperbolically turns. Further we can defined by the distinguishing marks "l" = left and "r" = right the following relations between the point x between the plates and the reflecting see points

$${}^{l}\tilde{x}^{\mu} = x^{\mu} + (y^{\mu}_{2(n-½j)}/y_0^{\;2})((xy_{2(n-½j)})^2 - x^2y_0^{\;2})^{½} -$$

$$(xy_{2(n-½j)})\, y^{\mu}_{2(n-½j)}/y_0^{\;2} =$$

$$x^{\mu} + y^{\mu}_{2(n-½j)}((xy_{2(n-½j)})/y_0^{\;2})((1 - x^2y_0^{\;2}/(xy_{2(n-½j)})^2)^{½} - 1) =$$

$$x^{\mu} + y^{\mu}_{-2(n-½j)}\, f \text{ for } t \in (t_{-2(n-½j)}, t_{2(n-½j)}] \text{ and}$$

$${}^{r}\tilde{x}^{\mu} = x^{\mu} + (y^{\mu}_{-2(n-½j)}/y_0^{\;2})((xy_{-2(n-½j)})^2 - x^2y_0^{\;2})^{½} -$$

$$(xy_{-2(n-½j)})\, y^{\mu}_{-2(n-½j)}/y_0^{\;2} =$$

$$x^{\mu} + y^{\mu}_{-2(n-½j)}((xy_{-2(n-½j)})/y_0^{\;2})((1 - x^2y_0^{\;2}/(xy_{-2(n-½j)})^2)^{½} - 1) =$$

$x^{\mu} + y^{\mu}_{-2(n-½j)}\, f$ for $t \in (t_{-2(n-½(j+1))}, t_{2(n-½(j+1))}]$, $n = 0,1,2,\ldots,\ j = 0,1,2,\ldots,2n$,

as a light like Minkowski space vector and $y^{\mu}_{2(n-½j)}$ and $y^{\mu}_{-2(n-½j)}$ are fixed Minkowski space-time vectors.

Further we define by the following relations

$$\kappa' x^{\mu} = \tau_j{}^{r}\tilde{x}^{\mu} + ½\,(x + \tau_j{}^{r}\tilde{x})^{\mu} f_{\kappa'} \text{ with } f_{\kappa'} = ½ y_0^{-2}(x\,\tau_j{}^{r}\tilde{x})((1 + 4\kappa'^2x^2y_0^{\;2}/(x\,\tau_j{}^{r}\tilde{x})^2)^{½} - 1)$$

$$\text{for } y_{-2(n-½j)}^{\;2} = ½\,(x + \tau_j{}^{r}\tilde{x})^2,\ t \in (t_{-2(n-½j)}, t_{2(n-½j)}],$$

$$n = 0,1,2,\ldots,\ j = 0,1,2,\ldots,2n,$$

$$\kappa x^{\mu} = \tau_j{}^{l}\tilde{x}^{\mu} + ½\,(x + \tau_j{}^{l}\tilde{x})^{\mu} f_{\kappa} \text{ with } f_{\kappa} = y_0^{-2}½(x\,\tau_j{}^{l}\tilde{x})((1 + 4\kappa^2x^2y_0^{\;2}/(x\,\tau_j{}^{l}\tilde{x})^2)^{½} - 1)$$

$$\text{for } y_{2(n-½j)}^{\;2} = ½\,(x + \tau_j{}^{l}\tilde{x})^2,\ t \in (t_{2(n-½j)}, t_{-2(n-½(j-2))}],\ n = 0,1,2,\ldots,\ j = 0,1,2,\ldots,2n,$$

$$\kappa x^{\mu} = \tau_{2n-1}{}^{l}\tilde{x}^{\mu} + ½\,(x + \tau_{2n-1}{}^{l}\tilde{x})^{\mu} f_{\kappa} \text{ with}$$

$f_{\kappa} = y_0^{-2}½(x\,\tau_{2n-1}{}^{l}\tilde{x})\,((1+4\,\kappa^2x^2y_0^{\;2}/(x\,\tau_{2n-1}{}^{l}\tilde{x})^2)^{½} - 1)$ for $y_1^{\;2} = ½\,(x + \tau_{2n-1}{}^{l}x)^2$, $t \in (t_1, t_{-3}]$, so that the following bounded open domains of double cons are defined

${}^{l}D = {}^{l}D_{\kappa x,\,\tau j\,{}^{l}\tilde{x}} = V^{+}_{\tau j\,{}^{l}\tilde{x}} \cap V^{-}_{\kappa x}$ with the basis $S_{\kappa x,\,\tau j\,{}^{l}\tilde{x}}$

and the axis $[\kappa x^\mu, \tau_j{}^l\tilde{x}^\mu] = y_{2(n-\frac{1}{2}j)}{}^\mu f_\kappa$,

$^rD = {}^rD_{\kappa' x, \tau j}{}^{r\tilde{}}{}_x = V^+{}_{\tau j}{}^{r\tilde{}}{}_x \cap \bar{V}_{\kappa' x}$ with the basis

$S_{\kappa' x, \tau j}{}^{r\tilde{}}{}_x$ and the axis $[\kappa' x^\mu, \tau_j{}^r\tilde{x}^\mu] = y_{-2(n-\frac{1}{2}j)}{}^\mu f_{\kappa'}$.

Further we can define for the impulse Minkowski space by means of the following relation and fixed impulse four vector k^μ as by the Bogolubov et al. (1976).

$$q_\kappa{}^\mu = {}^l\tilde{q}^\mu + k^\mu f_\kappa \text{ with } f_\kappa = k^{-2}(k^l\tilde{q})((1+\kappa^2 q^2 k^2/(k^l\tilde{q})^2)^{\frac{1}{2}} - 1),$$

$$q_{\kappa'}{}^\mu = {}^r\tilde{q}^\mu + k^\mu f_{\kappa'} \text{ with } f_{\kappa'} = k^{-2}(k^r\tilde{q})((1+\kappa'^2 q^2 k^2/(k^r\tilde{q})^2)^{\frac{1}{2}} - 1) \text{ and}$$

$$q^\mu = \tfrac{1}{2}(q_\kappa{}^\mu + q_{\kappa'}{}^\mu),\ k^\mu = \tfrac{1}{2}(q_\kappa{}^\mu - q_{\kappa'}{}^\mu),\ {}^l\tilde{q}^2 = {}^r\tilde{q}^2 = 0,\ q_\kappa{}^2 = \kappa^2 q^2,\ q_{\kappa'}{}^2 = \kappa'^2 q^2.$$

From $q_\kappa{}^2 q_{\kappa'}{}^2 = \kappa^2\kappa'^2 q^4$ it is easy to be seeing that for $\kappa', \kappa \to 00$, we have a local case considered by the deep inelastic scattering of leptons and hadrons in the forward and non forward direction.

So also we have $(\kappa' x)^2 = \kappa'^2 x^2$, $(\kappa x)^2 = \kappa^2 x^2$, so that $(\tau_j{}^l\tilde{x})^2 = (\tau_j{}^r\tilde{x})^2 = 0$.

Further we can define the $\Psi_{\alpha\kappa}(\varphi_t, t)$ ψ-functional as functional from the non local field defined on the Schwartz functional space by the help of the following formal integration following the theorem of Luzino and the distributions belonging local for $\Omega_t{}^3 \in M$ and if the anyone distributions belongs to the Hilbert space so that

$$\int_{\Omega_t^3} d\bar{x}\,|\alpha| \le \int d\bar{x}\,(\varphi_t)^2, \text{ the volume of } \Omega_t{}^3$$

and that is from very great importance for the following definition

$$\Psi_{\alpha\kappa}(\varphi_t, t) = \int D\varphi_t \int D\alpha_\kappa\, \delta(\alpha_\kappa{}^2 - \|\varphi_t\|^2)\langle\alpha_\kappa|(D, \varphi_t)(\tau_j{}^l\tilde{x})\rangle = \int D\varphi_t\,[\psi_t(\|\varphi_t\|,\varphi_t) + \psi_t(-\|\varphi_t\|,\varphi_t)]/2\|\varphi_t\|,$$

where $|\alpha_\kappa| = \|\varphi_t\|$, $\psi_t(\alpha_\kappa,\varphi_t) = \langle\alpha_\kappa|(D, \varphi_t)\rangle$, and

$D\varphi_t = \Pi_{(t,x)} d\varphi_t(\tau_j{}^l\tilde{x})$ is the functional measure, the δ-functional $\delta(\alpha_\kappa{}^2 - \|\varphi_t\|^2) = (\delta(\alpha_\kappa - \|\varphi\|) + \delta(\alpha_\kappa + \|\varphi_t\|)/2\|\varphi_t\|$ for $\|\varphi_t\| \ne 0$ is the Dirac's functional.

The functional states vector $|(D, \varphi_t)\rangle = (D, \varphi_t)(\tau_j{}^l\tilde{x}^0, \bar{x}\tilde{})|0\rangle$ is a functional defined by the help of the non local field $\varphi_t(\tau_j\tilde{x})$ in the following formal way of integrating of the distribution

$$(D,\varphi_t)(\tau_j\tilde{x}^0, \bar{x}\tilde{}) = \int_{\Omega_t^3} d\bar{x}\tilde{} \int d\tau_j\tilde{x}^0\, \delta((\tau_j\tilde{x}^0)^2 - \|\bar{x}\tilde{}\|^2)\varphi_t(\tau_j\tilde{x}^0, \bar{x}\tilde{}) =$$

$$\int_{\Omega_t^3} d\bar{x}\tilde{}\,(\varphi_t(\|\bar{x}\tilde{}\|, {}^l\bar{x}\tilde{}) + \varphi_t(-\|\bar{x}\tilde{}\|, \bar{x}\tilde{}))/2\|\bar{x}\tilde{}\| \text{ for } |\tau_j\tilde{x}^0| = \|\bar{x}\tilde{}\|, \text{ and}$$

$$\|\bar{x}\tilde{}\| = (\bar{x}\tilde{}^2)^{\frac{1}{2}},$$

$$\varphi_t(\tau_j\tilde{x}^0, \bar{x}\tilde{}) \in C_0{}^\infty(\Omega_t{}^3) \text{ and } \Omega_t{}^3 \in {}^lD \cup {}^rD$$

$\delta((\tau_j\tilde{x}^0)^2 - \|\bar{x}\tilde{}\|^2) = \delta(\tau_j\tilde{x}^0 - \|\bar{x}\tilde{}\|) + \delta(\tau_j\tilde{x}^0 - \|\bar{x}\tilde{}\|)/2\|\bar{x}\tilde{}\|$, for $\|\bar{x}\tilde{}\| \ne 0$, is the Dirac's function, defined on the light cone, so that the distribution

$$(D,\varphi_t)(\tau_j\tilde{x}^0, \bar{x}\tilde{}) = 0$$

if the domain of the temperierte distribution $\varphi_t(\tau_j\tilde{x}^0, \bar{x}\tilde{})$ intersect not the domain of the light cone.

For $f = -1$ we can obtain the field $\varphi_t(\tau_j\tilde{x}^0, \bar{x}\tilde{})$ as a distribution from the equality relations

$$\delta((x - y_{-2(n-\frac{1}{2}j)})^2) = \delta((x - \tfrac{1}{2}(x + \tau_j{}^r\tilde{x}))^2) =$$

$$\delta(y_0{}^2 - (x\tau_j{}^r\tilde{x})) = \delta(c^2 t_0{}^2 - \bar{y}_\perp{}^2 - y_3{}^2 - (x\tau_j{}^r\tilde{x})),$$

what is easy to obtain by the help of the article (Bordag et al. 1984, Petrov, 1985, 1989) and the relation for the massless Green's function

$D(x - y_{-2(n-½j)}) = \int d^4\tilde{q} \exp[-i\tilde{q}(x - y_{-2(n-½j)})]$

$/(q^{\sim 2} - i\varepsilon) = - i/4\pi^2 (x - y_{-2(n-½j)})^2,$

in the following way if we define the convolution

$(\theta(u + a^2)\delta(u)*\delta(u - a^2))(y_0) = \varepsilon(ct_0)\delta(c^2t_0^2 - a^2) = Q_n$, for $a = \bar{y}_\perp - y^3 - (x\tau_j{}^r x)$ is fixed, considered as a impulse operator.

If $Q^\sim{}_n(q)$ is distribution with slowly growth at the infinity also causal then $Q_n(x - y_{-2(n-½j)})$ as a Fourier transform from this distribution is a Banach valued functional in Minkowski space and is zero for

$(x - y_{-2(n-½j)})^2 < 0$ so that is possible to defined the following temperierte distribution in Banach space

$$Q^T{}_n(ct_0) = \int_{-\infty}^{\infty} d\bar{y}_\perp Q_n(x - y_{-2(n-½j)})T(\bar{y})$$

where $T(\bar{y}) \in C_0^\infty(R^3)$, and this can be integrated by definition

$$\int d\bar{y} \int_{-\infty}^{\infty} dct_0 Q_n(x - y_{-2(n-½j)})T(\bar{y})\varphi(ct_0)$$

$$= \int_{\Omega_t^3} d\bar{y} \int_{-\infty}^{\infty} dct_0 Q_n(x - y_{-2(n-½j)})\varphi(ct_0, \bar{y})$$

if $T(\bar{y})\varphi(ct_0)$ is understanding as a standing wave equal to $\varphi(ct_0, \bar{y})$, where

$\varphi(ct_0, \bar{y}) \in C_0^\infty(\Omega_t^3)$ is a solution of Klein-Gordon equation at the time $t = t_0$,

and formal we can defined the non local field by the help of the impulse operator

$$\varphi_t(\tau_j{}^r\tilde{x}^0, {}^r x^\sim) = \int_{\Omega_t^3} d\bar{y} \int_{-\infty}^{\infty} dct_0$$

$$((\theta(u + a^2)\delta(u)* \delta(u - a^2))(y_0)\varphi(ct_0, \bar{y})) =$$

$$\int_{\Omega_t^3} d\bar{y} \int_{-\infty}^{\infty} dt_0 \int_{-\infty}^{\infty} du\, \theta(u + \bar{y}^2 + x\tau_j{}^r\tilde{x})$$

$$\delta(u)\,\delta(c^2t_0^2 - \bar{y}^2 - (x\tau_j{}^r\tilde{x}) - u)\,\varphi(t_0, \bar{y}) =$$

$$\int_{\Omega_t^3} d\bar{y} \int_{-(\bar{y}^2 + x\tau_j{}^r\tilde{x})}^{\infty} du\delta(u)[\varphi$$

$$((u + \bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}, \bar{y}) +$$

$$\varphi(-(u + \bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}, \bar{y})] /2(u + \bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}] =$$

$$\int_{\Omega_t^3} d\bar{y} \int_{-\infty}^{\infty} du\, \theta(u + \bar{y}^2 + x\tau_j{}^r\tilde{x})\delta(u)[\varphi$$

$$((u + \bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}, \bar{y}) +$$

$$\varphi(-(u + \bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}, \bar{y})] /2(u + \bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}] =$$

$$\int_{\Omega_t^3} d\bar{y}\theta(\bar{y}^2 + x\tau_j{}^r\tilde{x}) [\varphi((\bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}, \bar{y})$$

$$+\varphi(-(\bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}, \bar{y})] /2(\bar{y}^2 + x\tau_j{}^r\tilde{x})^{½}]$$

where the Banach valued field vector $\varphi(ct_0, \bar{y}) \in C_0^\infty(\Omega_t^3)$ with $\Omega_t^3 \in {}^r D$ is a solution of the wave Klein-Gordon equation taken in the nodes or the minima or the maxima of the quantum field system in 4-point $(ct_0, \bar{y})$ of the Minkowski space. Of the same way it is to be given the field $\varphi_t(\tau_j{}^l\tilde{x})$ by fixed x-point of the S hyperplan.

It is from great importance to give the norm $||\varphi_t||$ by the following way based of the small wave amplitudes of the scalar's particles which is concerned with the first of the possibilities, might be called the linearized exact theory, since it can be obtained from the exact theory simply by linearizing the free surface conditions at the S plane on the assumptions that the wave motions studied constitute, e.g. scalar's systems, a small derivation from a constant flow with a horizontal free surface. Since we deal only with irrotational flows, the result is a theory based on the determination of velocity potential in the space variables (containing the time as a parameter, however) as a solution of the Laplace equation satisfying linear boundary and initial conditions. This linear theory thus belongs, generally speaking, to potential theory.

At the first we obtain the limes

$\lim x\tau_j\tilde{x}/2||\bar{y}_\perp|| = \text{const} \in [-1, 1]$

for $||\bar{y}_\perp|| \to \infty$ and $\tau_j\tilde{x}^0 \to \infty$,

where $||\bar{y}_\perp|| = ((\bar{y}_\perp)^2)^{½}$

so that

$||\varphi_t|| = \{\int_{\Omega_t^3} d\bar{y}\, ([\varphi(||\bar{y}_\perp|| + \text{const}, \bar{y}) + \varphi(-$

$(\|\bar{y}_\perp\| + \text{const}), \bar{y})] /2(\|\bar{y}_\perp\| + \text{const}))^2\}^{1/2}$

and for standing waves it is to obtain

$$\|\varphi_t\| = \{_{\Omega_t}{}^3\int d\bar{y} ([\varphi(\|\bar{y}_\perp\| + \text{const}, \bar{y})$$

$$+\varphi(-(\|\bar{y}_\perp\| + \text{const}), \bar{y})] /2(\|\bar{y}_\perp\|$$

$$+ \text{const}))^2 \varphi^2(\bar{y})\}^{1/2}$$

The norm is the same for both left and right cases.

For the further considerations is to remark that it is possible to take the following way of the consideration of the scalar mass field.

$$\varphi_{m\tau}(\bar{x}, t) = (\varphi_t(\tau_j\tilde{x})^*\delta(\tau_j\tilde{x} - {}^{1/2}(x - \tau_j\tilde{x}))\,(\bar{\xi}, \xi^0),$$

$$\varphi_{m\tau}(\bar{\xi}, \xi^0)) = {}_{-\infty}\int^{\infty} d\tau_j\, \tilde{x}^0{}_{\xi^0 = t}\int d\bar{x}^{\sim}{}_{-\infty}\int^{\infty} d\bar{\xi}\, \varphi_t$$

$$(\tau_j x^0, x^{\sim})\, \delta(\xi^0 - {}^{1/2}(t - \tau_j x^0) - \tau_j x^0)$$

$$\delta(\bar{\xi} - {}^{1/2}(\bar{x} - \tilde{\bar{x}}) - \bar{x}^{\sim})\, \varphi_{m\tau}(\xi^0, \bar{\xi}) =$$

$$\int d\bar{x}^{\sim}{}_{-\infty}\int^{\infty} d\bar{\xi}\, \varphi_t(t_{-2(n - 1/2 j)}, \bar{x}^{\sim})\, \delta(\bar{\xi} -$$

$${}^{1/2}(\bar{x} - \bar{x}^{\sim}) - \bar{x}^{\sim})\; \varphi(\xi^0, \bar{\xi}) =$$

$$\int d\bar{x}^{\sim}\, \varphi_t(t_{-2(n - 1/2 j)}, \bar{x}^{\sim})\varphi_{m\tau}(\xi^0, {}^{1/2}(\bar{x} + \bar{x}^{\sim})),$$

where $(\partial_t^2 - c^2(d_0/c)\Delta + m_\tau^2 c^4(d_0/c))\varphi_{m\tau}(\bar{\xi}, \xi^0) = 0$ is for the great importance for the nanophysics and d_0/c has a time dimension

$c(d_0/c) = gd_0/c + i\, F_c\, d_0^2 / m_\tau c$

$c^*(d_0/c) = gd_0/c - i\, F_c\, d_0^2/ m_\tau c$

thus $c^*c = g^2 d_0^2/c^2 + F_c^2 d_0^2/m_\tau^2 c^2$

where g is the ground states acceleration of the earth gravitation and F_c the so called Casimir force for the scalar's field in the vacuum, c is the light speed and the $c(d_0/c)$ is the virtual sound speed in the vacuum and the m_τ is the mass of the virtual scalars particles so that the $c(d_0/c) \le$ or $>$ c.

Further we can defined the probability for the non equilibrium thermodynamically systems and also the thermodynamic behaviour for the case of the so called kinetic transition by the vacuum functional $\Psi_{\alpha\kappa}(\varphi_t, t)$ and the impulse operator $Q_{\kappa',\kappa}(\kappa' x, \kappa x)$ described the evolution of the fundamental quantum scalar field in the Banach space with impulse effect.

Let us consider the vacuum described by the Schrödinger wave $\Psi_{\alpha\kappa}(\varphi_t, t)$ ψ-functional, defined on the set of the non local wave field $\varphi_t(\tau_j\tilde{x})$ of the called sea scalars particles on the environment of the double light cones union $\Omega_t^3 \in {}^lD \cup {}^rD$, so that we can define for the any observable in the "middle" values of the norm $|\alpha| = \|\varphi_t(\tau_j\tilde{x})\|$ in the Hilbert space of the considered quantum field subsystem remained on the conformed vacuum characterized by the α-norm of field $\varphi_t(\tau_j\tilde{x})$ for the fixed time t

$$\langle\alpha_\kappa|\Psi^*_{\alpha\kappa'}(\varphi_t, t)|\alpha_{\kappa'}\rangle = \int D\varphi\, \langle\alpha_\kappa|\psi^*_{\alpha\kappa'}(\varphi_t, t)$$

$$|\varphi\rangle\Psi^*_{\alpha\kappa'}(\varphi, t) =$$

$$\int D\varphi\, \langle(D,\varphi_t(\kappa x))|\varphi\rangle\Psi^*_{\alpha\kappa'}(\varphi, t) = \Psi^*_{\alpha\kappa}(\varphi_t, t),$$

where $\langle(D,\varphi_t(\kappa x))| = \delta_{\alpha\kappa', \alpha\kappa}\langle\alpha_\kappa|(D,\varphi_t(\kappa x))$

$$= \delta_{\alpha\kappa',\alpha\kappa}\langle\alpha_\kappa|\psi^*_{\alpha\kappa'}(\varphi_t, t)$$

and $\Psi^*_{\alpha\kappa'}(\varphi, t) = \langle\varphi|\alpha_{\kappa'}\rangle$ ψ-functional is a solution of the impulse Schroedinger wave equation for the local φ(x) function. The operator ψ* acts as the interweaves operators between the interacted field subsystems (so called coherent sectors in the vacuum), $\langle\varphi_t(\kappa x)|\varphi\rangle = \delta(\varphi_t(\kappa x) - \varphi(x))$ is the Dirac δ-function ψ-functional and $|\varphi\rangle$, $|\alpha_\kappa\rangle$ are the Dirac's bracket eigen state vectors. It is possible further to write for the probability to find the observable

$W_{\alpha\kappa} = \int D\varphi_t\, \Psi^*_{\alpha\kappa}(\varphi_t, t)\, \Psi_{\alpha\kappa}(\varphi_t, t) = \text{const} \int dE_{\alpha\kappa'} \exp[S'(E_{\alpha\kappa'})]\, \delta(E_{\alpha\kappa'} + E_{\alpha\kappa} - E_c)/\Delta E_{\alpha\kappa'} =$

const $\exp[S'(E_{\alpha\kappa'})/\Delta E_{\alpha\kappa'}]_{E\alpha_{\kappa'} = Ec - E\alpha_\kappa}$ and the α-norm of the non local field $|\alpha_\kappa| = \|\varphi_t\|$, give the number of the states of the quantum field subsystems so that the $S'(E_c - E_{\alpha\kappa}) = S'(E_c) - E_{\alpha\kappa}dS'(E_c)/dE_c = S'(E_c) - E_{\alpha\kappa}/\kappa_B T$ for $\Delta E_{\alpha\kappa'}$ is not changed significantly and we obtain $W_{\alpha\kappa} = A\exp[-E_{\alpha\kappa}/\kappa_B T]$ or the so called distribution of Gibbs or the canonical distribution obtained for the classical statistic in 1901 from J.W. Gibbs and

$$A = \sum_{\alpha\kappa} \exp[-E_{\alpha\kappa}/\kappa_B T] \qquad (1)$$

and further for the transition probility

$$R_{\alpha\kappa', \alpha\kappa} \exp[i\gamma_{\alpha\kappa', \alpha\kappa}] = \int D\varphi_t\, \Psi^*_{\alpha\kappa}(\varphi_t, t)$$

$$\Psi_{\alpha\kappa'}(\varphi_t, t) = \text{complex number.} \qquad (2)$$

We can obtain the probability that the observable value α_κ characterize as a α-norm of the non local field the number of the states of the conformed vacuum of the fundamental quantum field subsystem in the any one coherent sector in the vacuum state of the quantum scalar field remained on this vacuum, health below the observable values of the α-norms of the normal energetic modes of the Schrödinger wave functional on the conformed vacuum, when it is known, that the Schrödinger wave functional is to be found on the conformed vacuum, characterized by the value $\alpha_{\kappa'}$ of the α_κ-norm of the non local field

$$P_{\alpha\kappa', \alpha\kappa} = R^2_{\alpha\kappa', \alpha\kappa}. \qquad (3)$$

Every one Schrödinger wave functional on the conformed vacuum can be described by the linear superposition in the one coherent sector of the vacuum state of the ψ-functional in the environment of the light cone for the domain $\Omega_t^3 \in {}^lD \cup {}^rD$ of the following way

$$\Psi^*_\pi(\varphi_t, t) = \langle \pi | \pi_\pi(\partial_t\varphi_t, t) | \pi^+ \rangle =$$

$$\int D\pi^+ \langle \pi(\tau_j{}^r\tilde{x}) | \pi^+ \rangle\, \Psi^*{}_\pi{}^+(\varphi_t, t) \text{ and}$$

$$\Psi_\pi(\varphi_t, t) = \langle \pi^+ | \pi_\pi(\partial_t\varphi_t, t) | \pi\, \rangle = \int D\pi^+ \langle \pi(\tau_j{}^r\tilde{x}))$$

$$|\pi^+\rangle^*\, \Psi_\pi{}^+(\varphi_t, t), \text{ for}$$

$$t \in (t_{-2(n - ½j)}, t_{2(n - ½j)}],\ n = 0,1,2, ...,$$

$$j = 0,1,2, ..,2n$$

$$\Psi^+{}_\pi{}^+(\varphi_t) = \langle \pi | \pi^+{}_\pi(\partial_t\varphi_t) | \pi^+ \rangle^* \text{ and}$$

$$\Psi^{*+}{}_\pi{}^+(\varphi_t) = \langle \pi^+ | \pi^+{}_\pi(\partial_t\varphi_t) | \pi \rangle, \text{ for } t = t_{-2(n - ½j)}+0,$$

$$n = 0,1,2, ..., j = 0,1,2, ..,2n,$$

corresponding to the functional eigen states of the Schrödinger wave functional with defined c-number observable values $\pi(\tau_j{}^r\tilde{x}) = \partial_t\varphi_t(\tau_j{}^r\tilde{x})$ for $t \in (t_{-2(n - ½j)}, t_{2(n - ½j)}]$,

$$\pi^+(\tau_j{}^r\tilde{x}) = \partial_t\varphi_t(\tau_j{}^l\tilde{x}) + v_{2(n - ½(j+1))}\, \partial_z\varphi_t(\tau_j{}^l\tilde{x}) =$$

$$\pi(\tau_j{}^l\tilde{x}) + v_{2(n - ½(j+1))}\partial_z\varphi_t(\tau_j{}^l\tilde{x})$$

for the time $t = t_{-2(n - ½j)}+0$, $n = 0,1,2, ..., j = 0,1,2, ..,2n$ and $\pi(\tau_j{}^l\tilde{x}) = \partial_t\varphi_t(\tau_j{}^l\tilde{x})$

for $t = t_{2(n - ½(j+1)}$, $n = 0,1,2, ..., j = 0,1,2, ..,2n$ and

$$\pi(\tau_j{}^l\tilde{x}) = \partial_t\varphi_t(\tau_j{}^l\tilde{x}) \text{ for } t \in (t_{2(n - ½j)}, t_{-2(n - ½(j-2))}],$$

$$\pi^+(\tau_j{}^l\tilde{x}) = \partial_t\varphi_t(\tau_j{}^r\tilde{x}) + v_{-2(n - ½(j-2))}\, \partial_z\varphi_t(\tau_j{}^r\tilde{x}) =$$

$$\pi(\tau_j{}^r\tilde{x}) + v_{-2(n - ½(j-2))}\partial_z\varphi_t(\tau_j{}^r\tilde{x})$$

for the time $t = t_{2(n - ½j)}+0$, $n = 0,1,2, ..., j = 0,1,2, ..,2n$ and $\pi(\tau_j{}^r\tilde{x}) = \partial_t\varphi_t(\tau_j{}^r\tilde{x})$
for $t = t_{2(n - ½j)}$, $n = 0,1,2, ..., j = 0,1,2, ..,2n$ of the impulse wave below the impulse observable values of the Schrödinger wave functional on the vacuum,

$$\Psi_{\alpha\kappa}(\varphi_t, t) = \int D\pi C_\pi(\alpha_\kappa)\Psi_\pi(\varphi_t, t) =$$

$$\int D\pi^+\, C_\pi{}^+(\alpha_\kappa, t)\Psi^+{}_\pi{}^+(\varphi_t),$$

$$t \in (t_{2(n - ½j)}, t_{-2(n - ½(j-2))}],$$

$$\Psi_{\alpha\kappa'}(\varphi_t, t) = \int D\pi C_\pi(\alpha_{\kappa'})\Psi_\pi(\varphi_t, t) =$$

$\int D\pi^{+} C_{\pi^{+}}(\alpha_{\kappa'}, t)\, \Psi^{+}_{\pi^{+}}(\varphi_t)$,

$t \in (t_{-2(n-\frac{1}{2}j)}, t_{2(n-\frac{1}{2}j)}]$, $n = 0,1,2, \ldots,$

$j = 0,1,2, \ldots, 2n$ (3)

$\Psi^{+}_{\alpha\kappa}(\varphi_t) = \int D\pi^{+} C^{+}_{\pi^{+}}(\alpha_\kappa) \Psi^{+}_{\pi^{+}}(\varphi_t)$

for $t = t_{2(n-\frac{1}{2}j)}+0$, $n = 0,1,2, \ldots$, $j = 0,1,2, \ldots, 2n$

$\Psi^{+}_{\alpha\kappa'}(\varphi_t) = \int D\pi^{+} C^{+}_{\pi^{+}}(\alpha_{\kappa'}) \Psi^{+}_{\pi^{+}}(\varphi_t)$,

for $t = t_{-2(n-\frac{1}{2}j)}+0$, $n = 0,1,2, \ldots$, $j = 0,1,2, \ldots, 2n$ (4)

The over introduced values in (1) and (2) can be given by the coefficients of this expansion

$W_{\alpha\kappa} = \int D\pi |C_\pi(\alpha_\kappa)|^2 = \int D\pi^{+} |C_{\pi^{+}}(\alpha_\kappa, t)|^2$,

and

$R_{\alpha\kappa', \alpha\kappa} \exp[i\gamma_{\alpha\kappa', \alpha\kappa}] = \int D\pi C^*_\pi(\alpha_\kappa)\, C_\pi(\alpha_{\kappa'})$

$= \int D\pi^{+}\, C^*_{\pi^{+}}(\alpha_\kappa, t)\, C_{\pi^{+}}(\alpha_{\kappa'}, t) = C_{\alpha\kappa', \alpha\kappa}(t)$ (5)

where $D\pi = \Pi_{(x)}\, d\pi(\tau_j{}^r x^{\sim})$ and $D\pi^{+} = \Pi_{(x)}\, d\pi^{+}(\tau_j{}^r x^{\sim})$ are the functional measures.

It is obvious that from the equation for the probability
$i\partial_t (C^*_{\pi^{+}}(\alpha_\kappa, t)\, C_{\pi^{+}}(\alpha_{\kappa'}, t)) = i\partial_t C_{\alpha\kappa', \alpha\kappa}(t) = (E_{\alpha\kappa} - E_{\alpha\kappa'})\, (C^*_{\pi^{+}}(\alpha_\kappa, t)\, C_{\pi^{+}}(\alpha_{\kappa'}, t))$ it is following that $\gamma_{\alpha\kappa',\alpha\kappa} f_\kappa = (E_{\alpha\kappa} - E_{\alpha\kappa'})$, and in this way is the z.p.e. taken a way by the subtraction of the two energetic levels between two coherent sectors in the vacuum, but for the further consideration that is very important result, when we define the degenerate vacuum state as the conformed vacuum with a given coherent sectors.

Further we can obtain a so called impulse operator $Q_{\kappa', \kappa}$ in the non local sense for any concrete fundamental quantum field system at the fixed time t (Ts. D. Tsvetkov, G. Petrov, 2004, Ts.D. Tsvetkov, G. Petrov, P. Tsvetkova, 2005 - 2009). This quantity is determined by means of the concrete quantum field theory, e.g. for the deep inelastic scattering that is the non local operator expansion of the current product in the Quantum Chromo Dynamic on the light cone, so we have obtained

$Q_{\kappa', \kappa}(\kappa' x, \kappa x) = (\Psi^*_{\alpha\kappa'}(\varphi_t, t), \Psi_{\alpha\kappa}(\varphi_t, t)) =$

$[\Psi^{0*}_{\alpha\kappa}(\varphi_t, t) \exp[-ig \int_{\kappa'} d\tau\, \tilde{x}^\mu A_\mu(\tau\tilde{x})] \Psi^0_{\alpha\kappa'}$

$(\varphi, t_0)] =$

$[\Psi^{0*}_{\alpha\kappa}(\varphi_t, t)[1 + \int_{\kappa'}^{\kappa} d\tau \int_{\kappa'}^{\tau} d\tau_1 \ldots \int_{\kappa'}^{\tau_{2n-1}}$

$d\tau_{2n}\, A(0) \ldots A(2n)] \Psi^0_{\alpha\kappa'}(\varphi_t, t)]$,

where $A(0) = -ig\, \tilde{x}^\mu A_\mu(\tau\tilde{x})$, $A(j) = -ig\, \tilde{x}^\mu A_\mu(\tau_j \tilde{x})$ for

$t = t_{2(n-\frac{1}{2}j)}$, $n = 0,1,2, \ldots$, $j = 0,1,2, \ldots, 2n$ (6)

For further consideration it is to remark that the field $A(j)$ is practically the potential for the field with the wave normal modes by the normal frequency $\tilde{\omega}$,

$H_\alpha \Psi^0_{\alpha\kappa}(\varphi_t, t) = E_{\alpha\kappa} \Psi^0_{\alpha\kappa}(\varphi_t, t)$ for $t = t_{2(n-\frac{1}{2}j)}$,

$n = 0,1,2, \ldots$, $j = 0,1,2, \ldots, 2n$.

$H_\alpha \Psi^0_{\alpha\kappa'}(\varphi_t, t) = E_{\alpha\kappa'} \Psi^0_{\alpha\kappa'}(\varphi_t, t)$ for $t = t_{-2(n-\frac{1}{2}j)}$,

so that we can defined

$\omega_{\alpha\kappa} = \tilde{\omega} + \gamma_{\alpha\kappa, \alpha\kappa'} f_\kappa$ and $\omega_{\alpha\kappa'} = \tilde{\omega} + \gamma_{\alpha\kappa', \alpha\kappa} f_{\kappa'}$.

It easy to understand this as a combination scattering so that
$\tilde{\omega} + E_{\alpha\kappa'} = \omega_{\alpha\kappa'} + E_{\alpha\kappa}$ and $\tilde{\omega} + E_{\alpha\kappa} = \omega_{\alpha\kappa} + E_{\alpha\kappa'}$, and moreover $E_{\alpha\kappa'} < E_{\alpha\kappa}$. In the first case the vacuum state of the concrete quantum system, e.g. the system of the scalars particles, is going to the state with normal energetic mode with more high normal frequency at the expense of the normal

frequency of the quanta with the normal frequency $\tilde{\omega}$ and is occurred a diffused quanta with a lesser normal frequency $\omega_{\alpha\kappa'}$. In the second case the interaction of the quanta with the excited normal mode of the this quantum system lead to appearance of the diffused quanta with more frequency, equal

$$\omega_{\alpha\kappa} = \tilde{\omega} + ½(E_{\alpha\kappa} - E_{\alpha\kappa'})f_{\kappa}.$$

So that the $\Psi_{\alpha\kappa}(\varphi_t, t)$ ψ-functional can describe the quanta of the vacuum state of any concrete quantum system, e.g. the system of the sea scalars, by the help of the impulse operator $Q_{\kappa',\kappa}$ from the following impulse wave functional equation in the Schrödinger picture for the impulse wave functional in the Hilbert space with one remark that in this case the understanding of the operator $Q_{\kappa',\kappa}$ is to understand in the synthetically sense also it is to determine by the help of the kinetic (analytic) transition of the information for any concrete quantum field system, e.g. the system of the sea scalars, at a any one asymptotical stabile centre of the localisation also the functional vacuum state is to considered as a metastabile.

$$i\partial_t\Psi_{\alpha\kappa}(\varphi_t, t) = H(t)\, \Psi_{\alpha\kappa}(\varphi_t, t) = \int d^3xH$$

$$(\varphi_t, -i\delta/\delta\varphi_t)\Psi_{\alpha\kappa}(\varphi_t, t),$$

$$\text{for } t \in (t_{-2(n - ½j)}, t_{2(n - ½j)}],\ n = 0,1,2, ...,$$

$$j = 0,1,2, ..,2n \text{ and } x^3 \in (0, d_0)$$

$$\Psi^{+}_{\alpha\kappa}(\varphi_t) = Q_{\kappa',\kappa}(\kappa' x, \kappa x)\, \Psi_{\alpha\kappa'}(\varphi_t) = {}_{\kappa} \quad {}_{\kappa}$$

$$\int_{\kappa'}^{\tau_{2n-1}} [\Psi^{0*}_{\alpha\kappa}(\varphi_t, t)\, \psi^*(\kappa\tilde{x})[1 + \sum_{n=0}^{\infty} {}_{\kappa'}\!\int d\tau\ {}_{\kappa'}\!\int d\tau_1 \ldots d\tau_{2n} A(0) \ldots A(2n)]\, \psi(\kappa' x)\Psi^{0}_{\alpha\kappa'}$$

$$(\varphi_t, t)]\Psi_{\alpha\kappa'}(\varphi_t)$$

$$\text{for } t = t_{-2(n - ½j)}+0,\ n = 0,1,2, ...,\ j = 1,2, ..,2n \tag{7}$$

and n = 0,1,2, ... is the numbers of the fields subsystems in the any one coherent sector in the vacuum, e.g. the system of the scalars sea particles, at the fixed time t and normal modes of the gage potential $A(j)$ and the Hamiltonian $H(t) = H_{\alpha} + W(t)$.

Its is clear that we can so consider the non equilibrium thermodynamics of the Casimir effect from the point of view of the vacuum impulse Schrödinger wave functional equation in the Hilbert space in adiabatic sense in any one coherent sector in the vacuum. Here we have a relativistic quantum field system with time arrow in the Minkowski space-time, e.g. the system of the observable, sea scalars, and that can be considered as a dynamically problem for the evolution with the time arrow of one small subsystem in the any one coherent sector in the vacuum, e.g. the system of the sea scalars, interacted with a great box defined by the boundary condition for the relativistic quantum field system with vacuum as a ground state conformed to this boundary conditions. So we can see that the vacuum Schrödinger functional and the impulse operator or in this case the black body radiated operator describe a relativistic field configuration e.g. the system of the sea scalars, conformed with the boundary conditions in one total relativistic field system + boundaries on the box with the ground state in the any one coherent sector of the vacuum, the vacuum of this total system conformed with the physical boundaries also we have a model for physical vacuum as a ground state of the concrete relativistic fundamental quantum field system considered as a non equilibrium thermodynamically system, e.g. the system of the sea scalars.

Acknowledgments

The one of the authors A.H. takes pleasure in acknowledging the help and encouragement given to him by prof. S.I. Kostadinov, University "Paisii Hilendarski", Plovdiv, for the fruitful discussions, by International Scientific Fund in general.

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Received June, 14, 2010; accepted for printing December, 2, 2010.