ATOMIC FORCEPS AND SCALPEL FOR NANOTECHNOLOGIES

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I World Championship in Beijing
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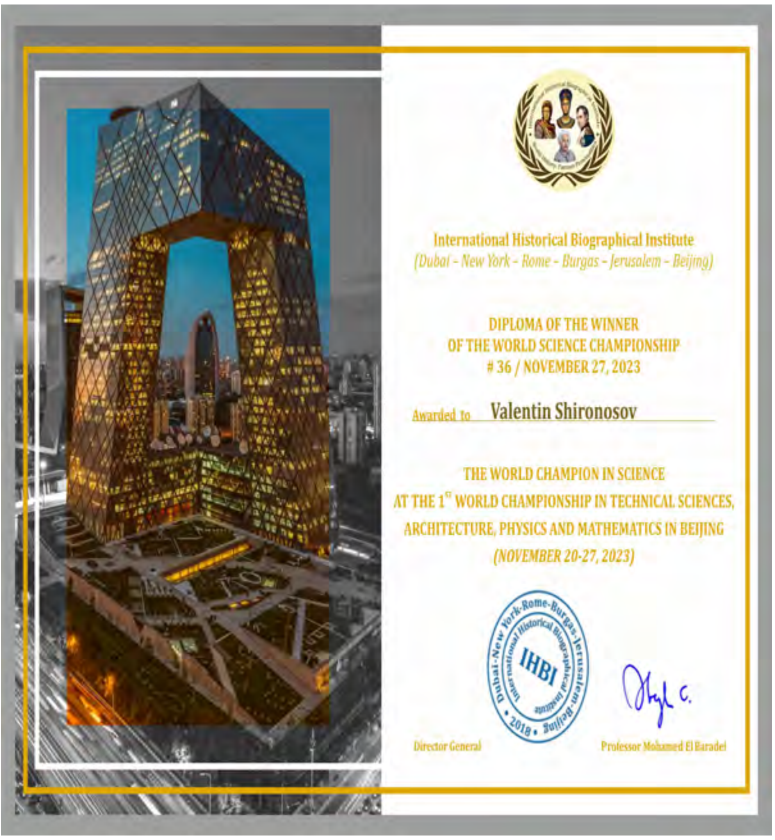

The main obstacle in the way of nanotechnologies is the lack of selective "scalpel and forceps", the instruments to operate with particles of size less than 10-9 meters, particularly with molecules and atoms. For the first time received new scientific and applied results in the sphere of resonance impact of fields on nonlinear physical and biological systems - Atomic forceps and scalpel for nanotechnologies in physics, medicine, chemistry, biology and medicine based on nonlinear parametric resonance:

1. 1974 - theoretically and experimentally (for macrobodies) the possibility of resonance confinement of bodies and particles (from elementary to macro) in nonuniform electromagnetic fields without external feedback was demonstrated.

2. 1988...1990 - was found accurate analytical solution of basic equation for simulation of the most complex nonlinear processes in different spheres of chemistry, biology, medicine, biophysics and physics (mechanics, electrodynamics, plasma physics, etc.) - equations of nonlinear pendulum with vibrating suspension point (Nonlinear ordinary differential equation with 3/2):

$$x'' + \xi_r x' + (\xi_0 + \xi_1 \cos \tau)\sin x - \xi_{-1}\cos(\tau+\varphi)\cos x = 0.$$

In 1988 was found the method which allows analytically with required accuracy to define dynamical stability areas of unstable states of composite multicomponent nonlinear systems of physical nature which don't have explicit small parameter under conditions of resonance and out of them.

***3.** 1984 - "$1/R^3$" problem was solved theoretically. The possibility of resonance microclusters appearance (RM) was proved. Resonance microclusters are stable resonance states of motion in the system consisting of two and more oscillating spin particles (having dipoles) - Spin Isomers (SI), caused by nonlinear parametric resonance and electromagnetic supercoherent radiation (SR) of the PM.*

The main obstacle in the way of nanotechnologies is the lack of selective "scalpel and forceps", the instruments to operate with particles of size less than 10^{-9} meters, particularly with molecules and atoms.

Nanotechnologies were referred to for the first time in a well-known Richard Feynman's speech at the annual meeting of American Physical Society in California Institute of Technology (Caltech), 1959. "There's Plenty of Room at the Bottom". Feynman suggested power moving single atoms and assembling macroobjects with the help of adequate-sized robots. It would allow making these objects many times cheaper. It was only needed to give such nanorobots the requisite amount of molecules and energy and write a suitable assembly program.

The studies to develop this adequate-sized robot - "scalpel and forceps" for nanotechnologies – have been in progress for a long time indeed and have their own respectable history. It is due to the fact, that the problem keeps arising while various applied problems in physics, biology, medicine and technology are being solved. These problems may concern the study of the way cells, organisms and particles move, attempts to hold them fixed and manipulate them with regard to their characteristics - size, ranging from micro- to macro-, charge, mechanical, electric, and magnetic moments in inhomogeneous fields.

The solutions of problems like these involve other serious mathematical and physical problems even in the first approximation.

The main mathematical problem is the absence of general vibration theory and small parameter for nonlinear systems. As a rule, the pendulum with vibrating suspension center was regarded as a "simple" model system with vibrational amplitude as a small parameter. Given approximation gave rise to numerous difficulties in the process of physical and mathematical (analogous, digital, hybrid) simulation of nonlinear dynamics in the sphere of resonance, such as "strange" singularities, attractors and chaos. Finally the authors of found solutions concluded that dynamical stability was impossible in zones of parametric resonance.

The main physical problem is that in a particle weighting region without any field sources (electrical, magnetic or gravitational) only saddle points exist. According to this, in statics and for the saddle points, the particle will be pulled in the weighting region in one direction and out in the other. The problem of stability was considered long ago by Gilbert (1600) and Earnshaw (1842). They discovered unstable equilibrium (static magnetic configuration). In accordance with Earnshaw theorem, stable particle confinement is just impossible in statics.

But what is impossible in statics, may be quite possible in dynamics (in variable fields or while particles move in inhomogeneous fields). In particular, Brownback showed that unstable equilibrium in statics may become stable in dynamics provided that there is a diamagnetic body in the system. Many theoretical and empirical researches have proved that dynamical stability of various physical systems is possible (levitron tasks, atomic traps, Kapitza's and Chelomey's pendulums etc.) outside the zones of parametric resonance. In 1989 N.F. Ramsey, W. Paul and H. Demelt won the Nobel Prize for nonresonant confinement of charged particles in electromagnetic atomic traps without feedback. Later on similar studies on confinement of living systems were carried out on the basis of intravital study of cell dynamics in inhomogeneous electromagnetic fields (1994). By the estimates of foreign experts, this discovery meant a breakthrough in the sphere of fundamental physics, biophysics and nanotechnologies.

For the first time the possibility to manipulate molecules with the help of resonant electromagnetic field was demonstrated theoretically and experimentally by P.N. Lebedev the century before last. In 1890 he brought forward a single program of "nanoworks" on resonant influence of fields on molecules and atoms.

In 1974 A.I. Filatov and V.G. Shironosov provided both theoretical and experimental evidence for resonant confinement of particles (ferromagnetics) in inhomogeneous electromagnetic fields without external feedback.

ATOMIC FORCEPS AND SCALPEL FOR NANOTECHNOLOGIES IN PHYSICS, MEDICINE, CHEMISTRY, BIOLOGY AND MEDICINE BASED ON NONLINEAR PARAMETRIC RESONANCE

Part I. Theoretical background.

The question of the stability of unstable states of dynamical systems that do not explicitly contain a small parameter, chaos and bifurcations in them has attracted attention ever since [1-14]. This is due to the fact that this problem often arises not only in mathematics, but also in various fields of mechanics and physics. In particular, the task of retaining atomic particles in electrodynamic traps has recently become of special interest [14].

As a rule, the solution of such problems is reduced to the study of the model equation pendulum equations with a vibrating suspension point

(1) $$x'' + \varepsilon_r x' + (\varepsilon_o + \varepsilon_1 \cos\tau) \sin x - \varepsilon_{-1} \cos(\tau + \varphi) \cos x = 0,$$

At small deflection angles x and $\varepsilon_{-1} = 0$, the equation (1) is reduced to the well-known Mathieu equation, which admits stability of the unstable state of the inverted pendulum ($\varepsilon_o <0$, $\varepsilon_{-1}\neq 0$) outside the parametric resonance zone [2]. In 1982, the authors [6] found, on the basis of numerical simulation, stable parametrically excited oscillations of the inverted pendulum in the resonance zone. Later [1, 4], the corresponding dependences of the oscillation amplitudes of ε_o, ε_1 were obtained.

In addition to these, many other non-trivial solutions, such as vibrational, vibrational-rotational, the emergence of chaos, etc. [13] were considered. However, the large variety of methods [1-6] and the study (1) with the expansion of sin (x), cos (x) in a series according to a degree of smallness made it difficult to cross-link particular solutions, interpret the results and understand the causes of chaos, bifurcations in systems described by equations of the type (1).

Therefore, taking into account Poincare's two propositions [7, p. 75] that "... the periodic decisions are the only breach through which we could try to penetrate into the region considered to be inaccessible "(1) and that " ... the periodic solution can disappear, only merging with another periodic solution ", i.e. "... the periodic solutions disappear in pairs like the real roots of algebraic equations" (11), we use a generalization of the corresponding methods to find and examine for the stability of periodic solutions (1) with respect to the critical points of the action function [7-12].

To do this, we rewrite equation (1) in the Lagrangian form

(2) $d(\partial L/\partial x)/d\tau - \partial L/\partial x = -\partial F/\partial x$,

wherein

(3) $L=T-U$, $T=x'^2/2$, $F=\varepsilon_r x'^2/2$,

(4) $U= - (\varepsilon_0 +\varepsilon_1 \cos\tau) \cos x - \varepsilon_{-1} \cos(\tau+ \varphi) \sin x$.

In the general case, x can be a vector. We seek a solution of (2) close to a periodic solution at α frequency in the form of a series

(5) $$x=x_0+\sum_{n=1}^{\infty} [x_n \cos(n\alpha\tau)+(y_n/n\alpha) \sin(n\alpha\tau)],$$

wherein x_0, x_n, y_n in the general case $f(\tau)$.

Taking into account the dependence $x = f(x_k, y_k, x_k', y_k')$, one can obtain in the approximation of slowly varying amplitudes x_k, y_k for the period $2\pi/\alpha$ the following abridged equations:

(6) $x_k' \cong -\partial S/\partial y_k - \partial R/\partial x_k, \quad y_k' \cong \partial S/\partial x_k - \partial R/\partial y_k,$

wherein

$y_k = x_0'$, k=1, 2, …, ∞, and

(7) $$S = s - y_0^2, \quad s = \langle L\rangle = (\alpha/2\pi)\int_0^{2\pi/\alpha} L\,d\tau,$$

$$R=(\varepsilon_0/2)\left[\, y_0^2 + (1/2)\sum_{n=0}^{\infty}\left[x_n^2+y_n^2\right]\right].$$

In the conclusion (6), the condition of the extremeness of the action function (2) is taken into account. In the variables amplitude–phase, the equations (6) take the following form:

(8) $\psi_n' \cong (1/nr_n)\,\partial S/\partial r_n, \quad r_n' \cong -(1/nr_n)\,\partial S/\partial \psi_n - \varepsilon_r r_n,$

$$x = x_0 + \sum_{n=1}^{\infty}\left[\, r_n \cos(n\alpha\tau - \psi_n)\right).$$

In the variables action–angle

(9) $\psi_n' \cong \partial S/\partial \chi_n, \quad \chi_n' \cong -\partial S/\partial \psi_n - 2\varepsilon_r\,\chi_n,$

$$x = x_0 + \sum_{n=1}^{\infty}\left[\, (2\chi_n/n)^{1/2}\cos(n\alpha\tau - \psi_n)\right).$$

Returning to equation (1), we will seek a solution in the form (8). Using

the representation $\cos x = \mathrm{Re}[\exp(ix)]$, formulas (8) and [15]

(10) $$\exp[ir_n\cos(n\alpha\tau - \psi_n)] = \sum_{K=-\infty}^{+\infty} Jk_n(r_n)\exp\left[ik_n(n\alpha\tau + \pi/2 - \psi_n)\right],$$

we get

(11) $$S=\sum_{n=1}^{\infty} n^2\alpha^2 r_n^2/4 - y_0^2/2 + (1/2)\bullet \sum_{k_1,k_2,..=-\infty}^{+\infty}\prod_{n=1}^{+\infty} Jk_n(r_n)\bullet \sum_{\beta=-1}^{+1}\varepsilon_\beta\,\delta^{\pm\beta}_{\sum_{N=1}^{\infty}k_n n\alpha}(1+$$

$$+\delta^0_\beta)\bullet\cos\left[x_0 + \sum_{n=1}^{\infty} k_n(\pi/2 - \delta^{\pm1}_\beta\,\psi_n) - \delta^{-1}_\beta(\pi/2 \pm\varphi)\right],$$

wherein $Jk_n(r_n)$ are Bessel functions, and δ^n_β is the Kronecker symbol.

The search for periodic solutions of equations of the type (1), as can be seen from (6), (8), (9) with $\varepsilon_r \cong 0$, is reduced to finding and examining the stability of the critical points (11) with respect to r_n, ψ_n , or χ_n, ψ_n (x_n, y_n) and x_0, y_0.

In the simplest case of a mathematical pendulum, without taking friction and vibrations into account, the results of calculations (8) with respect to S (11) with $n = 1$

(12) $S \cong [\alpha^2 r_1^2/4 + y_0^2/2 + \varepsilon_0 J_0(r_1)\cos x_0]$,

indicate a completely satisfactory accuracy of $\alpha\,(r_1)$, since the series (11) decreases rapidly with increasing index n for a fixed value of the argument r_n.

A relative error of the approximation $\alpha\,(r_1)$ even for angles of deviation of the pendulum $x \sim 160°$ does not exceed 5.5% (see, for example, [5, p. 55]).

The introduction of longitudinal vibration, as follows from expression

(13) $S \cong [\alpha^2 r_1^2/4 - y_0^2/2 + \varepsilon_0 J_0(r_1)\cos x_0 + \varepsilon_1 J_{1/\alpha}(r_1)\cos(x_0+\pi/2\alpha)\cos(\psi_1/\alpha)]$,

and (8), results in two types of critical points. The first ones are the equilibrium positions $x_0=\pm n\pi$, $\psi_1=0, \pm\pi/2$, ($1/\alpha$ are even); the second ones are $x_0 \neq \pm n\pi$, $\psi_1=0, \pm\pi/$, ($1/\alpha$ are uneven), $n = 0, 1, 2, \ldots$ (in particular, $x_0 = \pm(2n + 1)$ for $\varepsilon_0 = 0$). Therefore, taking into account the scenario of "merging" of two periodic solutions according to Poincare (11), due to the presence of the second type of critical points $x_0 \neq \pm n\pi$ (bifurcation of the period $1/\alpha=2 \leftrightarrow 1/\alpha=1$), we seek the solution for the problem of an inverted pendulum ($\varepsilon_0 \cos x_0<0$) outside and in the zone of parametric resonance in the following form:

(14) $x=x_0+r_1\cos(\tau/2 - \psi_1)+r_2\cos(\tau/2 - \psi_2)$.

This representation of (14) leads to the expression S (11) with an accuracy of $n = 2$. When limiting to the terms of the order r_k^4 with the expansion of $J_n(r_k)$ in S (11) and using the variables x_k, y_k (6), we can obtain the corresponding equations to find equilibrium points and the characteristic roots λ_0 for small ε_r, in the analytic form.

In the case $x_1= x_2= y_1= y_2= \sin x_0= y_0=0$

(15) $\{\lambda^2+1/16[(1-4\varepsilon_0^{\pm})^2-4(\varepsilon_1^{\pm})^2]\}\{\lambda^4+\lambda^2(1+\varepsilon_0^{\pm})^2/4+1/8(1-\varepsilon_0^{\pm})[(\varepsilon_1^{\pm})^2+2\varepsilon_0^{\pm}(1-\varepsilon_0^{\pm})]\}$.

wherein $\lambda=\lambda_0+\varepsilon_r$, $\varepsilon_{0,1}^{\pm}=\varepsilon_{0,1}\cos x_0$. From the first bracket (15) we obtain the upper limit evaluation of the stable solution $4(\varepsilon_1^{\pm})^2<(1-4\varepsilon_0^{\pm})^2$, from the second we obtain the lower one $(\varepsilon_1^{\pm})^2>2|\varepsilon_0^{\pm}(1-\varepsilon_0^{\pm})|$ for an inverted pendulum ($\varepsilon_0^{\pm}<0$) outside the parametric resonance.

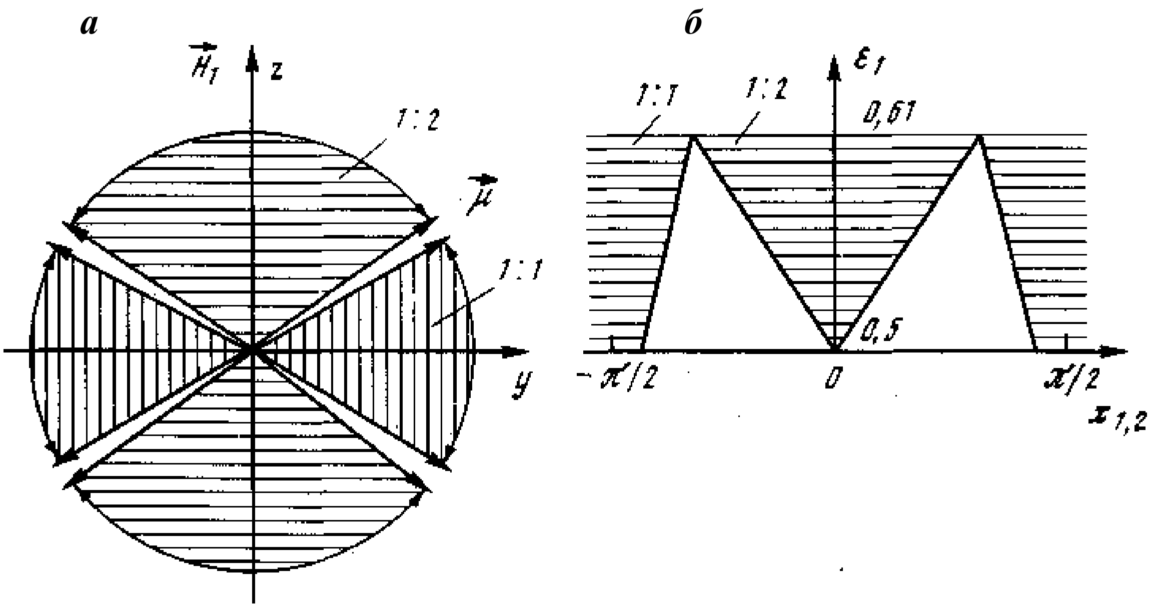

Fig. 1. Scenario for the appearance of a bifurcation for an inverted pendulum according to Poincare with ε_0=0. a) 0,5<ε_1<0,61; dependency graphs of $x_{1,2}(\varepsilon_1)$.

In the case $x_1 \neq 0$, $y_1=0$ ($x_1=0$, $y_1 \neq 0$), from the conditions $\partial S/\partial x_1=0$ ($\partial S/\partial y_1=0$), we can get

(16) $x_1^2=6[(4\varepsilon_0^{\pm}+2\varepsilon_1^{\pm}-1)/(2\varepsilon_1^{\pm}+3\varepsilon_0^{\pm})]$, ($y_1^2=(3/2)(4\varepsilon_0^{\pm}-2\varepsilon_1^{\pm}-1)/(3\varepsilon_0^{\pm}-2\varepsilon_1^{\pm})]$),

(17) $[\lambda^2+(x_1^2/24)[2\varepsilon_0^{\pm}+\varepsilon_1^{\pm}+1)]f_x(\lambda)=0$, ($[\lambda^2-\varepsilon_1^{\pm} y_1^2(2\varepsilon_0^{\pm}-2\varepsilon_1^{\pm}-1)/6]f_y(\lambda)=0$),

wherein $f_y(\lambda)=f(\lambda,\varepsilon_{0,1}^{\pm}, x_1, y_1)$. It results from (17) that there are two stable states of the inverted pendulum ($\varepsilon_0^{\pm}<0$) in the zone of parametric resonance $2\varepsilon_1^{\pm}>4|\varepsilon_0^{\pm}|+1$, $(2|\varepsilon_1^{\pm}|>4|\varepsilon_0^{\pm}|+1)$, differing from each other only in the change of sign in $\varepsilon_1^{\pm}$.

In the simplest case with $\varepsilon_0=0$, the bifurcation point is $1/\alpha=2 \leftrightarrow 1/\alpha=1$ is found from the joint consideration of two periodic solutions under the scenario (11). Carrying out similar calculations near the equilibrium point $x_0 = \pm(2n+1)\pi/2$, $x_1=y_1=y_0=0$, one can obtain solutions with $\alpha^{-1}=1$

(18) $x_2.4(1-(1+3\varepsilon_1^{*2}/2)^{1/2})/3\varepsilon_1^{*}$, $\varepsilon_1^{*}=\varepsilon_1 \sin x_0$, $y_2=0$,

are unstable with respect to x_0, y_0 for $|x_2| = \pi/2$. Solving jointly (16), (18), one can define the corresponding bifurcation point from the condition (see Fig. 1):

(19) $|x_1^{*}(\varepsilon_1 N)| + |x_2^{*}(\varepsilon_1 N)| = \pi/2$,

$x_1^{*}.59\,°$, $x_2^{*}.\,31\,°$, $\varepsilon_1 N\,.\,0.61$.

In this case (with ε_0= 0), the appearance of a bifurcation can simultaneously lead to the emergence of chaos in the system (1) (see Fig. 1). The reason for this may be fluctuations, errors from the macrosystem used in the physical, analog or numerical simulation of the deterministic system described by the equation (1). As a result, cascades of transitions between different types of periodic motions $\varepsilon_1 = \varepsilon$ Ņ (vibrational 1:2, 1:1, rotational 1:1 and others), perceived as chaos, will be observed.

Computer simulation of the equation (1) using the analog computing machinery "Rusalka" and full-scale modeling with a magnetic needle of a compass placed in a magnetic field confirmed the correctness of the results obtained within the limits of simulation errors.

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ATOMIC FORCEPS AND SCALPEL FOR FOR BIOTECHNOLOGY AND MEDICINE

The main obstacle to the implementation of biotechnology is the lack of a selective "scalpel and tweezers" for working with biosystems, microorganisms, microbes, viruses, biomolecules and particles with small sizes, including less than 10^{-9} m.

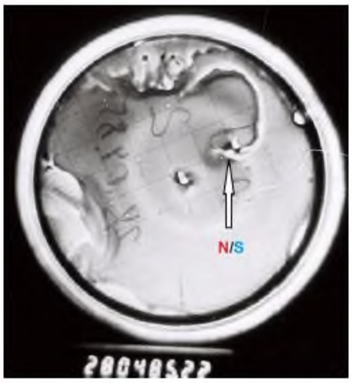
The idea of such a scalpel came to me in 1984. The reason was the painful search for effective methods of treating cancer and other complex diseases based on a synergistic approach. After numerous meetings with V.I. Ozhogin and S.P. Kurdyumov and discussions of the methods of MRI, EHF-therapy and SQUIDs (for MEG), the final solution for such an idea was formed.

The essence of the solution [1] consisted in a resonant spatially selective action in inhomogeneous fields on nuclear and electron spins [2], spin isomers [3-4] due to NMR-EPR [5] in certain spatially localized points-regions of biosystems (in particular, implementation of the idea of spatially selective action on the active points of the brain).

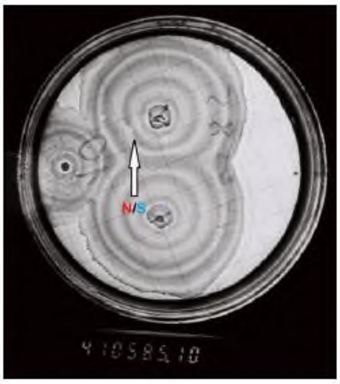
In 1984, the proposed method of selective scalpel was tested on the basis of the growth of colonies of bacteria of the genus Proteus. Assistance in carrying out the experiments was provided by the staff of the Department of Microbiology of the IGMA L.D. Osipov and P.S. Timonov.

The results of the experiments carried out in April-May 1984 are shown in Pic. 1-4.

Pic. 1. Experience scheme.



Pic. 2. Standard inoculation and growth of bacteria of the genus Proteus.



Pic.3. Proteus growth, with synchronization, without microwave.

Pic. 4. Proteus growth, with microwave and synchronized.

Instruments and experimental conditions: generator "LUCH-3" (frequency 2.375 GHz); thermostat TS-80; microwave resonator (H_{101}); SmCo magnet (cylinder, 6*8 mm^2); spot sowing; synchronization - cold (5^o C, 8 h). Features of the results of the experiments: Fig. 3 - weakening of growth at the location of the magnet; Pic. 4 - cessation of growth at the location of the magnet (resonance ~ 2.8 MHz / Oe).

The decision to publish the results of 1984 was made by me after the events that have become known to me and occurred [1-7], including 2019-2020.

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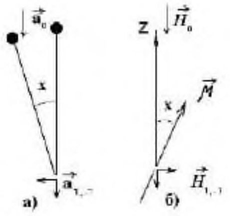
Physics of “anomalous” properties of aqueous solutions

A simple explanation of numerous "anomalous" properties of water in living and nonliving systems based on the principle of least action, classical nonlinear mechanics and electrodynamics is proposed [1]. Such water, as a rule, is in a nonequilibrium thermodynamic state with three-dimensional dissipative structures [2] based on Spin Isomers [3].

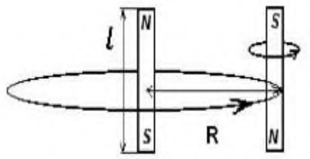
It took centuries (from the 17th to the 21st centuries, Pic. 1-4) before it became clear [1-7] that the linearization of the equations of motion in describing the properties of water is fundamentally wrong, and only the Coulomb, gravitational ~ 1/r and centrifugal terms are taken into account. ~ 1/r2, neglecting ~ 1/r3 (dipole - dipole type) is clearly insufficient.

As a result, scientists, not having solved ordinary differential equations, even for one or two particles taking into account their spins, proceeded to describe the nonlinear world around us based on phenomenological equations.

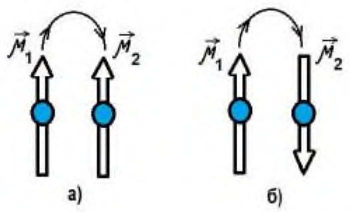
The physics of the processes of "anomalous" properties of water (homeopathy, contactless activation of liquids, LERN-HYC, formation of "ball-light", spin isomers...) in living and nonliving systems is complex, but generally understandable. When activated, dipoles of water molecules and ions form vortices of synchronously oscillating, in antiphase, ensembles of dipoles - spin isomers (a kind of molecular "tuning forks" - resonant microclusters). In statics (Earnshaw's theorem), a system of two dipoles (electric, magnetic, nuclear) is unstable (the effect of collapse or expansion), but in dynamics, at resonance, the effect of dynamic stabilization of unstable states is manifested [1, 4, 6].



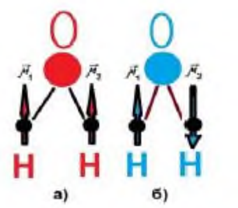
Pic. 1. Dynamic stability of an inverted pendulum and a dipole (H0↓↑**μ**) at resonance [4].



Pic. 2. Dynamic stability in a system of two non-point dipoles [5].



Pic. 3. Dynamic stability in a system of two point dipoles, a) **μ**1↑↑**μ**2, field **H**μ1↑↓**μ**2; b) **μ**1↑↓**μ**2, field **H**μ1↑↑μ2 [6].



Pic. 4. a) **ortho** (**μ**1↑↑**μ**2), b) **pair** (**μ**1↑↓**μ**2) –Spin isomers in water [2].

The alternating electromagnetic field from two resonantly synchronously oscillating dipoles has a narrow frequency spectrum of $\sim 10^{-(13...23)}$ (supercoherent radiation) and decreases $\sim 1/r^n$ (n> 3). As a result, solitary vortices (three-dimensional nonequilibrium dissipative resonance structures) from spin isomers arise in nonequilibrium media [1-3]. The "effective temperature" in such vortices is millions of degrees and their lifetime is tens, hundreds of seconds, minutes, and years, depending on the mode of resonant microclusters. The mechanism of the appearance of solitary vortices in nonequilibrium “activated” liquids at room temperatures [7] is similar to the mechanism of excitation of ball lightning (“ball-light”) in air [1].

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Part III

ATOMIC FORCEPS AND SCALPEL FOR FOR BIOTECHNOLOGY AND MEDICINE

Method of local selective influence of physical fields on biochemical systems or living organisms

Formula of invention:

1. A method of local selective influence of physical fields on biochemical systems or a living organism, characterized by the fact that the influence of fields is carried out on elementary particles, atoms or molecules that are part of biochemical systems and living organisms, having spins and/or magnetic and/or electrical moments, Moreover, the values of the field parameters (strengths, amplitudes, frequencies and gradients) are selected corresponding to the areas of nonlinear parametric resonance.

2. The method according to claim 1, characterized in that before the fields are exposed to biochemical systems or a living organism, the latter are pre-cooled and/or heated to phase transition temperatures.

The invention relates to biochemistry, biotechnology, medicine and can be used to control non-contact, locally and selectively biochemical reactions and living organisms through physical fields.

Further in the description the following terms are used, which, although generally accepted by specialists in this field of technology, however, require clarification in the context of the claimed invention:

BAP – biologically active points,
BSorZhO - biochemical systems or living organisms,
Efficiency – efficiency factor,
NPR – nonlinear parametric resonance,
LF – low frequency,
RM – resonant microclusters,
Microwave – ultra high frequency,
SI - spin isomers,
State of emergency - Petri dish,
EMF – electromagnetic field,
NMR – nuclear magnetic resonance.

Numerous methods and devices for influencing fields on biochemical systems or a living organism are known (RU 2525439, RU 2713375 – locally through embedded magnetic nanoparticles [1]; RU 2164424 – selective effect of LF EMF on BAP [2]; RU 127637 – effect of LF EMF therapy [3];https://www.mbst.de/, RU 2689847 – NMR therapy in uniform fields [4]; Zeldovich Ya.B., Buchachenko A.L., Frankevich E.L. Magnetic spin effects in chemistry and molecular physics - UFN, 1988, v. 155, no. 1, p. 3–45, Buchachenko A.L., Kuznetsov D.A. Nuclear-magnetic control of the synthesis of energy carriers in living organisms - Vestn. RAS. 2008, vol. 78, no. 7, p. 579, Arifullin M.R. Quantum entanglement of spin states of indistinguishable fermions. Dissertation Ph.D. Orenburg. 2014, 111 p. – based on particle spins – spintronics of magnetic phenomena in biochemical reactions [5]).

However, the disadvantages of the known methods and corresponding devices [1-5] for the influence of physical fields on biochemical systems or a living organism are weak localization, selectivity, high energy intensity and dimensions due to the size of the nanoparticles, associates and groups of molecules used.

The proposed invention is aimed at simplifying the technical implementation of the method, increasing its efficiency, localization, selectivity, miniaturization and reducing energy intensity.

This technical result is achieved by the fact that in the proposed method, the effect of physical fields on biochemical systems or a living organism is carried out on the elementary particles, atoms or molecules that are part of the biochemical systems and living organisms, having spins and/or magnetic and/or electrical moments, and the values field parameters (strengths, amplitudes, frequencies and gradients) are selected corresponding to the areas of Nonlinear Parametric Resonance. In addition, before fields influence biochemical systems or a living organism, the latter can be pre-cooled and/or heated to phase transition temperatures.

The impact of physical fields directly on elementary particles, atoms or molecules that are part of biochemical systems and living organisms, having spins and/or magnetic and/or electric moments in the regions of inhomogeneous field parameters corresponding to zones of nonlinear parametric resonance, directly or after their preliminary cooling or heating to phase transition temperatures, allows you to significantly simplify the method, reduce the energy intensity of the process (the efficiency for resonant processes is about 100%) and reduce its cost due to the specific nonlinearity of resonant interaction processes.

Biochemical systems or a living organism are systems containing liquids that are in a nonequilibrium thermodynamic state with resonant microcluster structures, in particular consisting of particles with spins [4, 5] and ortho- and para-Spin Isomers (Pershin S.M. Quantum differences between ortho and para spin isomers of H2O as the physical basis for the anomalous properties of water. Nanostructures. Mathematical physics and modeling, volume 7, no. 2, 103–120 [6])

Mathematical and physical analogues of such systems are dipole systems under conditions of nonlinear parametric resonance: electric and magnetic dipoles under resonance conditions; system of two excited dipoles. The calculation of properties, the behavior of such model systems, and the parameters of the influencing physical fields in the areas of NPR were theoretically first obtained by the author (Shironosov V.G. On the stability of unstable states, bifurcation, chaos of nonlinear dynamic systems. - DAN USSR, 1990, v. 314, No. 2, pp. 316-320 –https://ikar.udm.ru/files/pdf/sb66-5.pdf[7]; Shironosov V.G. The problem of two magnetic dipoles taking into account the equations of motion of their spins. Izv. universities Physics, 1985, v. 28, no. 7, pp. 74-78 – http://ikar.udm.ru/files/pdf/sb66-7.pdf[8] – the emergence of Resonant Microclusters from resonantly oscillating two or more spins – dipoles in antiphase – the solution to the “$1/R^3$” problem.

The impact of physical fields on biochemical systems and living organisms after their preliminary cooling or heating to phase transition temperatures makes it possible to significantly simplify the method, smoothly control, slow down or accelerate processes by changing the concentration of ortho/para Spin Isomers in areas of NPR ([6], Pershin S.M. Quantum nature of the temperature values of special points of water: -80, -42, 4, 19, 36.6, 48, 60 0 C. 3rd All-Russian Conference "Physics of Aqueous Solutions" Moscow, Presidium of the Russian Academy of Sciences, Leninsky pr., 32A, December 14-15, 2020 [9])

These features are absent in known technical solutions, and the properties that they provide to the proposed method are due to the authors discovered and previously unknown patterns of the influence of fields on the dynamics of spin systems, taking into account their dipoles under NPR conditions, and on condensed media - liquids in a nonequilibrium thermodynamic state with a resonant microcluster structure (patent RU 2316374 [10]). This indicates that the proposed method meets the invention criteria of “novelty” and “inventive step”.

The method of local selective influence of physical fields on biochemical systems or a living organism is illustrated by figures, where Fig. 1 shows a diagram of a device containing sources of influencing physical fields (a microwave resonator and a permanent magnet NS with a gradient magnetic field), a thermostat and a Petri dish with biological object; Fig. 2 is a photograph of standard seeding and growth of bacteria of the genus Proteus, without pre-cooling to T = 40C (phase transition points for ortho-para Spin Isomers [9]) and with exposure only to a constant gradient magnetic field NS; in figure 3 – with preliminary cooling to T = 40C, and then heating to T = 36.60C (phase transition points for ortho-para Spin Isomers [9]) and subsequent exposure to only a constant gradient magnetic field NS; in Fig.4 - according to the experimental scheme of Fig.3 with additional exposure to a microwave field in the resonator in the field parameters of the NPR fields.

The proposed method is as follows. A biochemical system or living organism in a state of emergency, in a nonequilibrium thermodynamic state with a resonant microcluster structure, is exposed to physical fields. The influence of fields is carried out on elementary particles, atoms or molecules that are part of biochemical systems and living organisms, possessing spins and/or magnetic and/or electric moments, and the values of field parameters (strengths, amplitudes, frequencies and gradients) correspond to areas of nonlinear parametric resonance. Before fields influence biochemical systems or a living organism, the latter can be pre-cooled and/or heated to phase transition temperatures.

As sources of physical fields, various EMFs can be used - electric and/or magnetic, and their combinations of constant and/or variable with parameters (intensities, amplitudes, frequencies and gradients) corresponding to the areas of scientific research [7, 8].

Under the influence of radiation from sources of inhomogeneous physical fields in BSorZhO, resonant excitation of elementary particles, atoms or molecules with spins and/or magnetic and/or electric moments occurs and their transfer to a state with increased potential energy, with the formation of PM microclusters. Subsequently, accelerated synchronization of microclusters occurs with the formation of larger formations of macroclusters. As a result, local selective influence of fields on the course of biochemical reactions occurs and 100% efficiency is practically achieved, which is typical for resonance in NPR zones.

When using pre-cooling and/or heating of biochemical systems or living organisms to phase transition temperatures, the efficiency of the method significantly increases due to the selectivity of the processes of resonant excitation of certain resonant microclusters based on spin isomers [6, 9].

The effectiveness of the proposed method is confirmed by examples of studies of the growth processes of microorganisms (Fig. 2-4), which are in a nonequilibrium thermodynamic state, under the influence of radiation from physical fields in the area of the NPR on the device (Fig. 1).

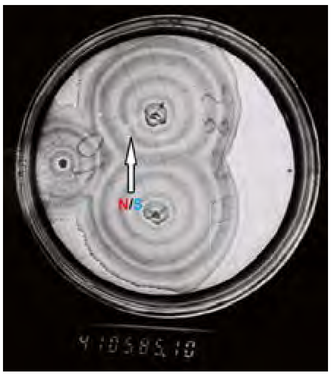
Bacteria of the genus Proteus were selected as the initial BSorLHOs, seeded using the pinpoint method on a standard nutrient medium in a Petri dish. The following sources of physical fields were chosen: the “LUCH-3” generator (frequency 2.375 GHz), SmCo magnet (cylinder with a diameter of 6 mm and a height of 8 mm). The Petri dish with bacteria was placed in a microwave resonator (with wave type H101), and the resonator was placed in a TS-80 thermostat (Fig. 1).

The research results are shown in Fig. 2-4. Fig. 2 – continuous growth is observed with weakening growth at the location of the NS magnet and at a temperature of 36.6°C. Fig. 3 – sowing of Proteus with three punctures; then, after preliminary synchronization of bacteria with cold at 4°C (for 8 hours), growth in rings is observed with weakening of growth at the location of the NS magnet and at a temperature of 36.6°C. Fig. 4 – seeding of Proteus with a point prick; further, after preliminary synchronization of bacteria with cold at 4°C (for 8 hours), growth in rings is observed in the microwave resonator with the “LUCH-3” generator turned on and a localized selective cessation of growth at the location of the magnet (NPR resonance conditions ~ 2.8 MHz/Oe) and at a temperature of 36.6°C. Synchronization with cold (4°C, 8 hours) led to synchronization of colony growth times (an analogue of the effect - Lobanov A.I., Pashkov R.A., Petrov I.B., Polezhaev A.A. Formation of spatial structures by chemotactile bacteria Escherichia coli, Mat. Modeling, 2002, volume 14, number 10, 17–26 [11]).

Thus, physical fields in the NPR region can be used for spatially selective non-thermal effects on biological systems and living organisms due to resonance with minimal energy consumption and for controlling biochemical processes.

Pic.1

Pic.2



Pic.3

Pic.4